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# Effect of Concurrent Exercise program on Pregnancy-Related Lumbo-pelvic Pain: A Prospective Randomized Controlled Trial

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## Abstract:
**Background:** Half of pregnant women frequently complain of lumpo-pelvic pain (LPP). It could have a detrimental impact on sleep, work capacity, physical, social, and psychological health that contribute to physical inactivity. The benefits of LPP prevention or remedy for pregnant women through specific exercises should therefore be further investigated. Thus, this trial **aimed** to evaluate the effect of a concurrent exercise program on pregnancy-related lumbo-pelvic pain. **Methods:** A randomized, controlled trial was conducted at the family health centers affiliated to Mansoura district as well as the antenatal clinics of Mansoura University hospital in El Dakahlia Governorate. A total sample size of 144 pregnant women was selected using a randomized sampling technique. Data collection tools were five: a structured interview schedule for assessing pregnant women's characteristics; the Numeric Rating Scale (NRS); the Roland-Morris Disability Questionnaire (RMDQ); an Arabic version of the Hospital Anxiety and Depression Scale (HADS); and an Arabic version of the Pittsburgh Sleep Quality Index (PSQI). **Results:** Before the exercise program, 70.8% of the pregnant women in study groups reported moderate pain level, while 58.3% of the pregnant women in control groups reported sever pain level. Compared to two-months after the program, this higher pain level improved in the study group to mild pain among 52.8%, but remained the severe pain level among 55.6% of the control group. **Conclusion and recommendations:** The concurrent exercises reduce the severity of lumbo-pelvic pain and its related symptoms in pregnant women. So, the researchers recommend including concurrent exercises in regular prenatal care as a viable therapeutic option for pregnancy-related LPP.

***Keywords: Concurrent Exercise, Lumbo-pelvic Pain & Pregnancy.***

## Introduction:
Lower back pain (LBP) is described as pain between the 12th rib and the gluteal fold, whereas pelvic girdle pain (PGP) is defined as "pain experienced between the posterior iliac crest and the gluteal fold." When pregnant women experience both forms of pain (LBP and PGP), it is referred to as lumbo-pelvic pain (LPP). Indeed, there appears to be agreement (despite differences in definition) that the term LPP is used when no distinction is established between LBP and PGP **(Daneau et al., 2022**).

Based on the data from **Yıldırım, et al., (2023),** Lumbo-pelvic pain (LPP) is a notable musculoskeletal problem affecting nearly two-thirds of pregnant women, with a frequency up to 76%, and it is a highly prevalent risk factor of disability during the middle and last trimesters of pregnancy and 25% of them still experience pain one year after giving birth. A cohort study of **Hu et al. (2020),** concluded "up to 11 years after childbirth, 10% of women who suffered LPP during pregnancy still have serious repercussions."

The emergence of LPP during pregnancy is explained by a number of evidences. It is believed that hormonal, anatomical, biomechanical, and postural changes combine to cause pain during pregnancy **(Daneau et al., 2021)**. According to several nursing reports, there are a number of risk factors for LPP during pregnancy, including a history of LPP and LBP during menstruation, a familial history of the condition, a strenuous workload, and the younger age of the women **(Mohamed, et al., 2021 & Hemdan, et al., 2023)**.

One-third of pregnant women who experience pain may be in excruciating pain, which can negatively impact their ability to sleep, interact socially and sexually, and function physically and at work. Significantly, LPP also results in physical inactivity during pregnancy, which has been connected to a higher likelihood of problems for the mother and the unborn child. Inadequate healing can also result in long-term impairment, persistent back pain, and postpartum depression **(Yıldırım, et al., 2023)**.

For overcoming pregnancy related pain, a number of therapeutic approaches have been suggested, including pharmaceutical modality, patient counseling, taping, exercise, and manual therapy **(Xue et al., 2021).** Due to the scarcity of high-quality

trials, the evidence for these therapies is, still limited. Thus, it's critical to find effective managment strategies that can prevent and treat pain and incapacity while taking the mother's and the developing fetus's safety into account **(Daneau et al., 2022**).

According to **the American College of Obstetricians and Gynecologists (2020)**, exercise is not only safe for the mother and fetus, but it also improves crucial pregnancy outcomes such as a lower risk of gestational diabetes; hypertension, depression, and excessive prenatal weight gain that results in LPP. Furthermore, **Daneau et al., (2022)**, suggest that the exercise regimen may provide a safe and cost-effective self-management strategy to reduce the recurrence and severity of LPP in pregnant women with a pre-existing history of LPP.

Obstetrical and community nurses are key healthcare professionals responsible for providing prenatal care in most countries including Egypt. They provide basic care during prenatal clinic visits for pregnant women to promote healthy lifestyles and to prevent and treat pregnancy related symptoms especially LPP **(Bahri Khomami et al. 2021)**. As they provide pregnant women with evidence-based management practices of LPP as regular exercise programs, health education, the application of heat and/or cold and various complementary medicine options **(Kandru et al., 2023)**.

Unfortunately, in Egypt, scare nursing studies investigated the effect of various exercise modalities on pregnancy related lumbo-pelvic pain for optimizing self-management of LPP in the pregnant women. Therefore, the primary objective of the current trial was to assess the effect of concurrent exercise program (aerobic and resistance exercises) for pregnancy-related lumbo-pelvic pain. Second, we evaluated disability, anxiety, depression, and sleep quality to answer the hypothesis that reducing pain result in contextual benefits of improving pregnancy related disability, depression, anxiety, and sleep quality.

## Significance of the study:

LPP has a significant impact on the lives of pregnant women. It is the most common reason of sick leave after delivery. The clinical practice nursing guidelines suggested several therapeutic options for management of pregnancy related Lumbo-pelvic pain; exercise modality is one of the recommended therapies **(Yang et al., 2021)**. Additionally, **the American College of Nurse Midwives** recommended by various types of exercise programs as aerobic and strength-conditioning exercises before, during, and after pregnancy for managing of lower back pain **(Rudin et al., 2021)**. Besides, there is no previous study was conducted at Mansoura district addressed effect of concurrent exercise on Lumbo-pelvic pain during pregnancy. So the present study was carried out to assess effect of concurrent exercise on pregnancy-related lumbo-pelvic pain.

**Aim of the study:**

To evaluate the effect of a concurrent exercise program (aerobic and resistance exercises) on pregnancy-related lumbo-pelvic pain, disability, depression, anxiety, and sleep quality.

**Primary outcome:**

Lumbopelvic pain (LPP) intensity score

**Secondary outcomes:**

- Disability score
- Depression and anxiety score
- Sleep quality score

**Research Hypotheses:**

To achieve the study's aim, the following research hypotheses were developed:

**H1:** After implementing the exercise program, the post lumbo-pelvic pain mean score (LPP) of pregnant women in the study group would be lower than in the control group.

**H2:** After implementing the exercise program, the post disability mean score of pregnant women in the study group would be lower than in the control group.

**H3:** After implementing the exercise program, the post-depression and anxiety mean score of pregnant women in the study group would be lower than in the control group.

**H4:** After implementing the exercise program, the post sleep quality mean score of pregnant women in the study group would be better than in the control group.

**Method:**

**Research design:**

A prospective randomized, controlled clinical trial was used to implement this study.

**Settings:**

The study was conducted at the family health centers (antenatal clinics) affiliated to Mansoura district, as well as the antenatal clinics of Mansoura University hospital in El Dakahlia Governorate.

## Subjects and Sampling:

The study subjects were pregnant women aged between 18- 40 years who were 16–24 gestational weeks, had a singleton pregnancy, had a Visual Analog Scale (VAS) score ≥2, and had not engaged in any exercise program within the last three months prior to the intervention. While the pregnant women who were excluded: had any medical condition causing LPP (e.g., previous lumbar surgery, any herniation); had a chronic medical or surgical

condition that interrupted the exercise program (e.g., vascular diseases, rheumatoid arthritis, and neurologic disorders); had previous lower extremities injuries or surgeries; and had pregnancy-related complications that preclude exercise.

Sample size was computed using power analysis software and based on the parameters of **Yildirim, et al., (2023)**, who estimated that Cohen's d effect size (d = 0.72), 80% power, and 0.05 for α error rate, equal proportional allocation (1:1 ratio), resulting in 62 women being randomized for each group. Considering the possibility of a post-randomization exclusion rate of 15%, 72 women were randomized for each study group.

A simple random technique was employed to allocate the subjects to either the control or exercise group using the random number generation function in commercially available software (Microsoft Excel; Minitab, SPSS). Participant pregnant women were not blinded to intervention allocation; however, the content of exercise sessions was distributed exclusively to those randomized to the intervention group to avoid cross-contamination.

**Data collection methods:** data was collected by using five adapted and previously validated tools.

**Tool I: A structured interview schedule.** This tool consisted of two parts. Part 1 involved pregnant women' demographic and clinical data, which included age, educational level, occupation, marital status, gestational age, pre-pregnancy body mass index, pain site, and practicing physical activity prior to pregnancy. Part 2 included the pain diagram that utilized to determine the location of self-reported Lumbo-pelvic Pain (a combined LBP and PGP) The LBP level was established if the pregnant women specified a pain point above the L5 level. On the other hand, the PGP level was determined if the pain site below the L5 level were indicated by the pregnant women. The pain site below the level of the L5, as well as those marked above and below the L5, was classified as LPP.

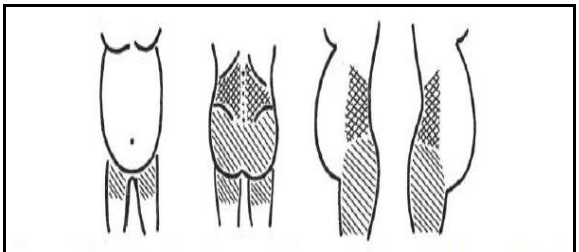

Figure (1). The pain diagram for self- reported LBP and PGP

**Tool II: The Numeric Rating Scale (NRS).** It is a scale that pregnant women use to rate the intensity of their low lumbo-pelvic pain on an eleven-point scale. It is a reliable and valid method of measuring pain **(Nugent, et al., 2021)**. It is a straight line with symbols spaced 1 cm distant. Pregnant women were given the option to verbally rate their pain intensity as a score (verbal version) or to sign a dot on the numerical line. It ranged from 0 (no pain) to 10, with 1-3 indicating mild pain, 4-6 indicating moderate pain, 7-9 indicating severe pain, and 10 indicating the worst pain.

**Tool III**: **Roland-Morris Disability Questionnaire (RMDQ)**. It is a self-reported measure that was used to assess disability resulting from LPP **(Roland & Morris, 1983)**. It is one of the most comprehensively validated evaluation tools for LPP **(Küçükdeveci, et al., 2001)**. Furthermore, it included 24 statements about "physical functions likely to be affected by lower back pain." Each item awarded 0 or 1. The total RMD score fluctuated from 0 to 24, as the higher scores represented higher related disability.

**Tool IV: An Arabic version of Hospital Anxiety and Depression Scale (HADS).** It is adapted from **Zigmond & Snaith (1983)** to measure levels of depression and anxiety during pregnancy. The cognitive and emotional components of anxiety were carefully reflected in the HADS items. It had (14) items, seven of which were on the depression scale and seven of which were on the anxiety scale. The scores for each item ranged from 0 to 3, with a score of 0 denoting no distress and a score of 3 denoting greater distress. The total HADS score for each subscale was determined by adding the pertinent items, with a maximum score of 21 for each subscale. According to **Terkawi et al. (2017)**, the total subscale score was categorized as: as normal for a score (0–7); a borderline case for score (8–10); and a case (anxiety or depression) for score (11–21).

**Tool V: The Arabic version of the Pittsburgh Sleep Quality Index (PSQI)**. PSQI is a self-completed tool that developed in **(1989) by Buysse, Reynolds, Monk, Berman, & Kupfer.** It was used to assess sleep quality over the previous month. The scale included 19 items, five of these questions on the scale were answered by bedmates or roommates that were not accounted for in the PSQI's overall score and were only used for clinical purposes. The scale items were arranged into seven categories: daytime dysfunction, sleep disturbances, use of sleep medications, habitual sleep efficiency, sleep latency, and rather subjective sleep quality. The global score was calculated by summing the seven components, giving a range from 0 to 21. Based on **Buysse et al. (1989),** the global scores were categorized as: (>5 scores) as poor sleep quality index; those with (≤ 5 scores) as good sleep quality index.

**Validity and reliability:**

Academic experts assessed the concurrent exercise program and the study tools regarding their content, language, layout, and structure to compute the **content validity index (0.92)** of the first draft of the exercise program and the study tools.

**A pilot study** was implemented on 10% of the total sample size of pregnant women (15) who weren't included in the sample to test the study's feasibility, practicality, required resources, and time before implementing the concurrent exercise program on the total sample size.

The reliability of the Numeric Rating Scale (NRS); the Roland-Morris Disability Questionnaire (RMDQ); an Arabic version of the Hospital Anxiety and Depression Scale (HADS); and an Arabic version of the Pittsburgh Sleep Quality Index (PSQI) were tested by Cronbach's α and all emerged as high (α=0.88, α = 0.86, α =0.83 and α =0.83 respectively).

## Ethical considerations:

The study protocol was approved by the research ethics committee of the faculty of Nursing, Mansoura University (no: 0511). The researchers received formal approval to conduct the study through a letter from the Mansoura Faculty of Nursing to the directors of Mansoura university hospitals and ministry of health and population directorate. Written consent was also secured from pregnant women participating in the study by answering questions after guarantee their right to withdraw at any time.

**Procedure:**

**Preparatory phase:**

After determining the eligibility criteria of the pregnant women by using **Tool I**, the pregnant women in both study groups' pain intensity (the primary outcome) was assessed using **Tools II**. Additionally, the secondary outcomes (disability, depression, anxiety, and sleep quality) of the exercise and control groups were assessed by utilizing **Tools III, VI, and V.**

**Implementation phase:**

The concurrent exercise program (CEP), which lasted for 8 weeks (3 days per week, 50 minutes per session), began on the 17th week and included a mix of mild-to-moderately intense aerobic-resistance exercises, taking into account each woman's endurance as determined by the kinesiologist. This CEP schema was designed by the researchers' multidisciplinary team (Obstetrics, community health nursing experts and kinesiology consultant) following the recommendations from the American College of Obstetrics and Gynecology. The exercise group began with a one-session educational and movement-learning phase. The participants in this initial phase were taught basic movement patterns (pull and push movements, hip and knee dominant movements). Subsequently, the main exercise training phase lasted from the 18th until the 25th G.W. and focused on maintaining and enhancing physical fitness. Each CEP session started with a 10-min warm-up period with walks, mobility exercises, and activation exercises. The main part of the 18th and 25th weekly sessions consisted of 30 min of eight resistance exercises (16″ work/14″ rest), alternating with cardiovascular blocks. The second session of the week concentrated on aerobic exercise through step aerobics, and interval walking. The sessions finished with a 10-min cool-down period of relaxation, stretching, and breathing. The exercise session was implemented at the physiotherapy room at family centers and at nursing room at Mansoura University hospital

The control group was not invited to the CEP sessions and was asked to continue with their regular activities. For ethical reasons, the research team distributed a guidance booklet for both control and exercise groups at the end of the program included general information about concurrent exercises (advantages, drawbacks, considerations, and contraindications of performing them), along with illustrations, schemas, and pictures of each technique.

**During the two-months evaluation phase,** the pain intensity of pregnant women in both study groups was assessed using the Numeric Rating Scale. As well as the secondary outcomes of the exercise and control groups assessed through the Roland-Morris Disability Questionnaire, Hospital Anxiety and Depression Scale, and Pittsburgh Sleep Quality Scale.

## Statistical analysis:

Data were analyzed using IBM SPSS version 20.0 (IBM Corp., Armonk, NY, USA). In the descriptive statistics, the mean (standard deviation) was used for quantitative variables. In between-group comparisons, the independent t-test was used for variables that fit a normal distribution. The Pearson chi-square test was used also for testing similarity of the baseline qualitative characteristics. For two-by-two structures, Fisher exact test was used. Significance level at 5%.

## Results

**Table (1): Participants' baseline Scio demographic and clinical characteristics**

| Items | Total number of pregnant women =144 | | | | P- value Significance test |
|---|---|---|---|---|---|
| | Exercise group N=(72) | | Control group N= (72) | | |
| | No. | % | No. | % | |
| **Age** | | | | | |
| 18-<28 | 23 | 31.9 | 30 | 41.7 | 0.170 |
| 28-<38 | 47 | 65.3 | 38 | 52.8 | |
| -38 and more | 2 | 2.8 | 4 | 5.6 | |
| **$\bar{X}$ (SD)** | 32.11(4.28) | | 31.02(5.09) | | |
| **Gestational age** | | | | | |
| **$\bar{X}$ (SD)** | 20.43(2.16) | | 20.88(1.82) | | 0.172 |
| **Pre-pregnancy body mass index (kg/m2)** | | | | | |
| **$\bar{X}$ (SD)** | 25.20(1.29) | | 24.79(1.25) | | 0.067 |
| **Educational level** | | | | | |
| Diploma | 42 | 58.3 | 40 | 55.6 | 0.257 |
| University | 24 | 33.3 | 30 | 41.7 | |
| Post graduated | 6 | 8.3 | 2 | 2.8 | |
| **Occupation** | | | | | |
| Governmental work | 28 | 38.9 | 27 | 37.5 | 0.898 |
| Private work | 34 | 47.2 | 33 | 45.8 | |
| Housewife | 10 | 13.9 | 12 | 16.7 | |
| **Marital status** | | | | | |
| Married | 67 | 93.1 | 65 | 90.3 | 0.163 |
| Divorce | 3 | 4.2 | 7 | 9.7 | |
| Widow | 2 | 2.8 | 00 | 00 | |
| **Pain site (using pain diagram)** | | | | | |
| Low Back Pain (LBP) | 29 | 40.3 | 25 | 34.7 | 0.260 |
| Pelvic Girdle Pain (PGP) | 7 | 9.7 | 3 | 4.2 | |
| Combined LBP and PGP | 36 | 50 | 44 | 61.1 | |
| **Practiced physical activity prior to pregnancy** | | | | | |
| No | 63 | 87.5 | 67 | 93.1 | 0.261 |
| Yes | 9 | 12.5 | 5 | 6.9 | |

*P-value for Chi-square test and/or Independent t test, P Significance* ** Significant (p≤ 0.05)*

**Table (2): Comparison between percentages and means of pain intensity before, and two months after the exercise program between both study groups**

| Numeric Rating Scale (NRS) | Exercise group N=(72) | | Control group N= (72) | | Significance test between mean scores | Effect size (Cohen's d) |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | | |
| **Baseline score** | | | | | | |
| Mild | 00 | 00 | 7 | 9.7 | t*= 1.21 P=0.225 | 0.2 |
| Moderate | 51 | 70.8 | 23 | 31.9 | | |
| Sever | 21 | 29.2 | 42 | 58.3 | | |
| **$\bar{X}$ (SD)** | 6.11(1.57) | | 6.45(1.83) | | | |
| **After two-month score** | | | | | | |
| Mild | 38 | 52.8 | 7 | 9.7 | t*= 9.09 P ≤0.001 | 2.36 |
| Moderate | 34 | 47.2 | 25 | 34.7 | | |
| Sever | 00 | 00 | 40 | 55.6 | | |
| **$\bar{X}$ (SD)** | 3.80(0.98) | | 6.12(1.95) | | | |

***t*:** Independent t-test, d: Effect size of t tests (Cohen's d) d<0.2 small, d=0.5 medium, >0.8 large, Significant (p≤ 0.05).*

**Table (3): Comparison of the pain-related disability mean scores before, and two months after the exercise program between both study groups**

| Roland-Morris Disability Questionnaire (RMDQ) | Exercise group N=(72) | | Control group N= (72) | | Significance test | Effect size (Cohen's d) |
|---|---|---|---|---|---|---|
| | $\bar{X}$ | SD | $\bar{X}$ (SD) | SD | | |
| **Baseline score** | 9.89 (1.74) | | 10.37(1.96) | | t*= 1.52<br>P= 0.130 | 0.25 |
| **After two-month score** | 3.91(1.74) | | 10.90(1.74) | | t*= 24.06<br>P ≤0.001 | 4.02 |

**Table (4): Comparison between percentages and means of the sleep quality index before, and two months after the exercise program between the both study groups**

| Pittsburgh Sleep Quality Index (PSQI) | Exercise group N=(72) | | Control group N= (72) | | Significance test | Effect size (Cohen's d) |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | | |
| **Baseline score** | | | | | | |
| Poor sleepers | 65 | 90.3 | 67 | 93.1 | t*=1.50<br>P=0.135 | 0.24 |
| Good sleepers | 7 | 9.7 | 5 | 6.9 | | |
| $\bar{X}$ (SD) | 7.040(1.73) | | 7.45(1.59) | | | |
| **After two-month score** | | | | | | |
| Poor sleepers | 55 | 76.4 | 72 | 100 | t*=8.719<br>P ≤0.001 | 1.45 |
| Good sleepers | 17 | 23.6 | 00 | 00 | | |
| $\bar{X}$ (SD) | 6.029(1.73) | | 8.55(1.60) | | | |

***t**********:** *Independent t-test, d: Effect size of t tests (Cohen's d) d<0.2 small, d=0.5 medium, d>0.8 large, Significant (p≤ 0.05).*

**Table (5): Comparison between percentages and means of the anxiety and depression score before, and two months after the exercise program between the both study groups**

| Hospital Anxiety and Depression Scale | Exercise group N=(72) | | Control group N= (72) | | Significance test | Effect size (Cohen's d) |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | | |
| **Baseline score** | | | | | | |
| Normal | 51 | 70.8 | 49 | 68.1 | t*=1.189<br>P=0.236 | 0.21 |
| Borderline case | 14 | 19.4 | 15 | 20.8 | | |
| A case (anxiety or depression) | 7 | 9.7 | 8 | 11.1 | | |
| $\bar{X}$ (SD) | 7.20(2.36) | | 6.76(1.95) | | | |
| **After two-month score** | | | | | | |
| Normal | 65 | 90.3 | 35 | 48.6 | t*=9.857<br>P ≤0.001 | 1.64 |
| Borderline case | 5 | 6.9 | 29 | 40.3 | | |
| A case (anxiety or depression) | 2 | 2.8 | 8 | 11.1 | | |
| $\bar{X}$ (SD) | 4.10(2.36) | | 7.78(1.95) | | | |

**t**********:** Independent t-test, d: Effect size of t tests (Cohen's d) d<0.2 small, d=0.5 medium, d>0.8 large, Significant (p≤ 0.05).

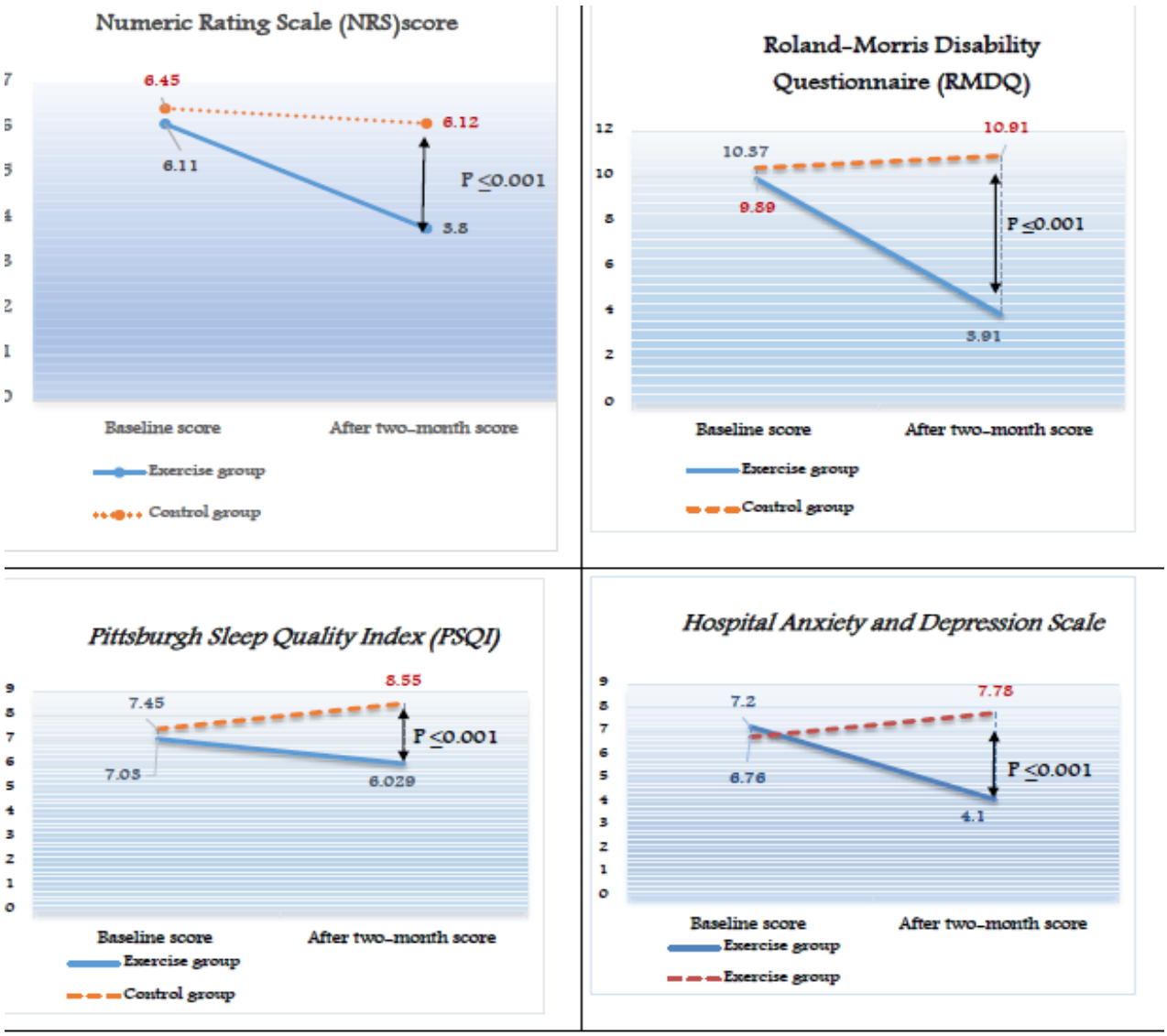


**Figure 1. Changes in mean values for NRS, RMDQ, PSQI, and HADS over time for both groups.**

The baseline socio-demographic and clinical characteristics of the exercise and control groups are shown in **Table (1):** There was similarity between the two groups, as homogeneity-determining tests indicated no differences between the control and exercise groups in the rest of the socio-demographic and clinical characteristics, including age, body mass index, gestational age, educational level, occupation, marital status, pain site, and practicing physical activity prior to pregnancy (all, $p > 0.05$). The mean ages in the exercise and control groups were 32.11±4.28 and 31.02±5.09, respectively. Both groups were pregnant at 20 gestational weeks. More than half of both groups had diplomas. In both groups, nearly half of the participants had private work. As regards marital status, most of them were married. Concerning the pain site, nearly half of the exercise group (50%) and control group (61.1%) suffered from combined LPP. In terms of practicing physical activity prior to pregnancy, a very small percent of the study participants were practicing physical activities (exercise group: 12.5%, and control group: 6.9%).

**Primary outcome (lumbo-pelvic pain intensity):**

**Table (2):** Reveals the comparison of the pain intensity score changes between pre- and post-intervention for the control and exercise groups. At the baseline assessment, the independent t test indicated similarity in the mean pain score between the two groups (P-value = 0.225). After two months

of concurrent exercise program implementation, the exercise group demonstrated a significant reduction in mean pain score (3.80±0.98) compared to the control group, which showed negligible results regarding the mean pain score (6.12±1.95), which indicated highly significant differences with a huge effect size at (**t = 9.09, P ≤0.001, d =2.36**).

**Secondary outcomes (disability, sleep quality, anxiety and depression):**

Differences in the mean pain-related disability score before and two months after the exercise program between the control and exercise groups are demonstrated in **Table (3):** An independent t test demonstrated homogeneity between disability baseline scores (P = 0.130). After two months of the exercise program, there was a significant statistical reduction in the total exercise group disability mean score (3.91±1.74) compared to the minimal change in the control group mean score (10.90±1.74), as demonstrated by the t test (t = 24.06, P ≤0.001) with a very high effect size (d = 4.02).

Differences in the sleep quality index score before and two months after the exercise program between the control and exercise groups are portrayed in **Table (4):** There were similar baseline sleep quality indices, which indicated insignificant results (P = 0.135). At two months post-test, the total exercise group sleep quality mean score improved to (6.029±1.73), compared to the control group mean score, which worsened to (8.55±1.60). These changes were significant, as demonstrated by the t test (t = 8.719, P ≤0.001) with a large effect size (d = 1.45).

**Table (5):** Illustrates the differences in the anxiety and depression scores before and two months after the exercise program between the control and exercise groups. There were homogenous baseline anxiety and depression scores, which indicated insignificant results (P = 0.236). After two months of the program implementation, the total exercise group anxiety and depression mean score reduced to (4.10±2.36) compared to the control group mean score raised to (7.78±1.95). These changes were significant, as indicated by the t test (t = 9.857, P ≤0.001), with a very high effect size (d = 1.64).

**Figure (1):** Portrays the changes in mean scores for the study outcomes after two months in both groups. The t test demonstrated highly significant differences between the exercise and control groups (P ≤0.001).

## Discussion:

Lumbo-pelvic pain (LPP) related problems arise among nearly 70%–72% of the pregnant women, and it would be labeled as a public health issue. As, it influences on pregnant women's ability to accomplish everyday tasks as well as their overall quality of life **(Fatmarizka, et al., 2021**). Based on this context, one of the major nurses' roles is to support pregnant women to enhance exercise behavior during pregnancy through nursing process at antenatal care clinic. Thus, the current trial aimed to evaluate the effect of practicing a concurrent exercise program on the intensity of pregnancy-related lumbo-pelvic pain.

Similarity-determining tests showed statistically non-significant differences regarding all tested socio-demographic and clinical characteristics between the exercise and control groups, which indicates the homogeneity between the two groups. This homogeneity is the basic requisite for any randomized controlled trial to be more confident that the observed changes in outcomes between the groups are due to the exercise program rather than confounding factors. This finding is compatible with several nursing conclusions of **(Haslia, 2022; Kurniyati, & Bakara, 2021)**, who reported that "there were no statistically significant differences in descriptive characteristics between the study and control groups."

The findings of the present trial achieved the primary study outcome and indicated a huge effect size (**d =2.36**) of a two-month concurrent exercise program on the mean LPP pain score of the participants in the exercise group, compared to negligible change in the control group. This outcome agreed with a randomized trial study conducted by **Aparicio et al. (2023)** to explore the influence of a concurrent exercise training program from the 17th gestational week until birth on LBP and pain disability. They concluded that "the exercise group showed better scores than the control group in pain while sleeping and lifting weight and limitations of social life due to pain." Additionally, it is supported by a master nursing thesis of **Hemdan et al. (2023)** who cited that "sitting pelvic tilt exercise was effective in reducing low back pain in primigravidae women."

Pain has been shown to have a negative impact on quality of life during pregnancy, as well as to be associated with disability, anxiety, depression, and poor sleep quality; thus, all types of safe pain-relief strategies are especially welcome during this physiological period **(Aparicio et al., 2023).** Therefore the current RCT investigated the effect of the concurrent exercise program on three secondary outcomes including pain related disability, sleep quality, anxiety and depression.

As regards pain-related disability, the current trial indicated a substantial reduction in the total exercise group disability score compared to the minimum change in the control group score, as evidenced by the t test (P≤0.001) with a grand effect size (d = 4.02). A systematic review and meta-analysis of **Hu et al. (2020)** confirmed that "using exercise therapy was superior in treating disability in patients with chronic LPP." Additionally, it is compatible with the findings

of nursing thesis **Haslia, (2022)**, who stated that "the improvement of Disability pain is main outcome of of sitting pelvic tilt exercise on low back pain that resulted in improving the woman's ability to perform daily activities." Form the researchers' point of views, this improvement in the disability score is the result of reducing the LPP pain mean score.

In terms of sleep quality, the current trial showed that there was an improvement in the exercise group's mean sleep quality score compared to the control group, as revealed by the t test ($P \leq 0.001$) and a higher effect size ($d = 1.45$). This result is consistent with the findings of **Tan, et al. (2020)**, who stated that "moderate physical activity had the potential for improving sleep quality both in the first and third trimesters, and a high level of physical activity was also beneficial to improving the sleep quality of pregnant women in later pregnancy." This conclusion was also confirmed by systematic review of **Yang et al.'s (2020)** that published in Asian Nursing Research journal, which cited that "exercise had a favorable influence on the sleep quality of pregnant women."

Concerning the anxiety and depression results after two months of the program implementation, the total exercise group anxiety and depression mean score was reduced by three points, in contrast to the control group mean score, which rose by one point. These changes were significant, as indicated by the t test ($P \leq 0.001$), with a grand effect size ($d=1.64$). This outcome is congruent with the systematic review results of **Sánchez-Polán et al. (2021),** who reported that "practicing exercise during pregnancy may be beneficial for preventing and reducing the prenatal depression and depressive symptoms." It is also supported by another systematic review by **Singh et al. (2023),** who confirmed the same findings.

## Conclusion:

Concurrent exercise program demonstrated a positive effect on the mean scores of pregnancy-related LPP and its related disability, sleep quality and anxiety, depression scores among the exercise group compared to negligible changes in the control group. Ultimately, the concurrent exercises have a promising therapeutic option for pregnancy-related LPP and its related problems.

## Recommendation:

Thus, we recommend that midwives and community nurses emphasize providing solutions for LPP pain relief, including different exercise modalities (concurrent, motor control, Pilates, and yoga) integrated with birth preparation programs and counseling sessions.

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