



Original Article

Effect of a gymnastics program on sleep characteristics in pregnant women

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ABSTRACT

Objective: The quality and quantity of sleep represent important health issues in pregnant women. Sleep disturbances could be associated, beyond alteration of quality of life, with poor pregnancy outcome. Our aim was to investigate the effect of a regular, specific, medium-term physical training program on sleep characteristics in healthy pregnant women.

Materials and methods: A total of 132 healthy pregnant women, with gestational age between 18 weeks and 22 weeks, were enrolled in a prospective study. They were allocated into two groups; the first group involved 79 women (average age, 29.4 years) who performed a specific gymnastics program of 10 weeks, and the second group involved 53 pregnant women (average age, 27.9 years) who did not perform gymnastics. All participants completed a comprehensive questionnaire at baseline and after 10 weeks concerning general data, sleep characteristics, and psycho-emotional status. The changes arising within a diverse set of characteristics were followed and compared for the two groups using parametric and nonparametric statistics.

Results: In the control group, we observed significant worsening of 12 out of the 14 studied parameters during the 10-week period. In comparison with the women who did not perform gymnastics, women who performed specific gymnastics showed the following characteristics: (1) significantly less deterioration of psycho-emotional status (stress and anxiety levels); (2) the same general pattern of decrease in sleep quality, which is related to the progression of pregnancy; and (3) a significant attenuation of the worsening of several sleep characteristics, such as restless sleep, snoring, diurnal tiredness, and excessive daytime sleepiness. Nocturnal and diurnal sleep quantity increased significantly in both groups.

Conclusion: The 10-week training program designed for pregnant women has an overall beneficial effect on sleep characteristics, not by improving them but by attenuating their general deterioration related to the progression of pregnancy. Our data strengthen the general recommendation regarding participation of pregnant women in specific exercise programs, mainly for maintaining their psycho-emotional and general well-being.

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Introduction

Sleep represents an important health issue in pregnant women [1,2]. Pregnancy is associated with significant changes in sleep architecture and pattern, which could lead to the occurrence of sleep disorders, such as insomnia [3], nocturnal awakenings, restless legs

syndrome [4,5], habitual snoring [6,7], and obstructive sleep apnea [6,8] with consecutive excessive daytime sleepiness [1,2,9]. Sleep disorders are the result of hormonal, anatomical, and psychological changes occurring during pregnancy [10].

Up to 25% of pregnant women suffer from sleep disorders in the first trimester and reaches nearly 75% in the third trimester [11]. These sleep disturbances could be associated with poor pregnancy outcomes for both the mother and the fetus [12]: preeclampsia [8,13], gestational diabetes [14–16], intrauterine growth retardation [7], and fetal death and preterm birth [5,11,17–19]. Considering

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these facts, the prevention, early diagnosis, and safe treatment of sleep disturbances are very important [20,21]. In the general population, physical activity of at least 1 hour/day is associated with a longer sleep duration; both low and high intensity physical training have a positive effect on sleep [22].

Moderate physical activity during pregnancy is safe and could have numerous benefits, including maternal weight control, decreasing the risk of developing gestational diabetes, and strengthening the muscles required for labor and delivery [20]. Currently, we have limited data and understanding regarding the influence of physical training on sleep characteristics during pregnancy.

Our aim was to investigate the effect of a regular, specific (designed for pregnant women) physical training program on sleep characteristics in healthy pregnant women, focusing on sleep patterns, sleeping habits, sleep quality and quantity, and sleep disorders.

Participants and methods

Study population

In total, 132 pregnant women from Mures County, Romania were enrolled in the study, with gestational age between 18 weeks and 22 weeks at inclusion. These women were assigned to two groups.

In the first group (intervention group), 79 pregnant women were included who performed a specific gymnastics regime (see training program below) for 10 weeks and were evaluated before and after the training program. In the second group (control group), 53 healthy pregnant women were included who did not perform the gymnastics regime. They were also evaluated at baseline and after 10 weeks.

All participants were informed about the aim of the survey, and they gave informed consent for their participation. The approval of the Research Ethics Committee of the University of Medicine and Pharmacy of Tirgu Mures was obtained for both anonymous data collection and publication (Approval no. 41-16). The role of the investigators was to monitor prospectively the participants who had already (before any study activity) decided to participate or not in the training program. Control group members were recruited consecutively during routine, follow-up obstetrical examinations in an outpatient clinic. These women were not currently involved in and were not willing to participate in any regular exercise training program. General exclusion criteria for both groups included refusal to participate and any significant medical condition related or not to pregnancy. To make the two groups more comparable, only women aged 18–40 years were included. In addition, women with body mass index $>35 \text{ kg/m}^2$ and those with a history of three or more completed pregnancies were not enrolled.

Short description of the physical training program

The intervention group followed a specific exercise program for pregnant women at the Rheum-Care Foundation, Tirgu Mures, Romania, under the strict control of an exercise training specialist. Supervised specific gymnastics designed for pregnant women differ from the generally recommended home-based exercises due to the following: (1) the type of exercises, which are fully adapted for the pregnant body, with the main goal being the maintenance of muscle tone; (2) the duration of the gymnastics session, which is flexible and dependent on the individual's exercise capacity; (3) the association (at the end of session) of respiratory exercises and a period of psycho-somatic relaxation; and (4) the qualified surveillance during the entire training session, which permits continuous interactions both physically (correction of posture and movements) and emotionally.

The structure of the exercise program consisted of 2 hours per training session, twice per week for 10 weeks. The exercises included were for posture correction, preserving muscle tone, and strengthening pelvic and posterior muscles, breathing exercises, and relaxation techniques [23]. The last included the progressive relaxation technique of Jacobson [24], based on the control of muscle contractions and the autogenic training of Schultz [25] that can efficiently reduce stress and psychosomatic symptoms.

Data collection

Data were collected through (face to face) interviews using standard [26,27] and custom-designed questionnaires. All study participants filled a questionnaire at baseline and after 10 weeks. The questionnaire included two main parts: (1) demographic and obstetrical data, such as maternal age, weight, and parity, and (2) specific sleep questionnaires, completed as a custom-based part referring to sleep characteristics and psycho-emotional status.

To ensure a comprehensive assessment of sleep characteristics, the questionnaire included two validated instruments, the Berlin Questionnaire for sleep-disordered breathing (sleep apnea) [26] and the Epworth Sleepiness Scale for excessive daytime sleepiness [27]. The Berlin and Epworth questionnaires were used only at baseline to characterize and compare the two groups regarding the presence of sleep-related breathing disorder.

The custom-designed questionnaire involved sleep quality (general perception) and quantity, number of awakenings, difficulty of falling asleep, insomnia, restless sleep, snoring, diurnal sleep, consequences of inadequate sleep (diurnal tiredness, excessive daytime sleepiness), and characteristics of psycho-emotional status (level of anxiety and stress).

The answers to the questions were quantified using a visual analog scale, the response ranging from 0 to 10, where 0 indicated “not at all or poor quality” and 10 indicated “very frequently or good quality”.

Statistical analysis

For statistical analysis, R: A language and environment for statistical computing was used (R Core Team, R Foundation for Statistical Computing, Vienna, Austria, www.R-project.org). Descriptive statistics were performed first, followed by the analysis of the changes in parameters during the 10-week observational period in each group, and the comparison of changes in the two groups. The median, the first (Q1), and the third (Q3) quartiles were calculated for each dataset. If there was an even number of values in the set, the result was calculated as the average of the two numbers in the middle.

For comparison of parameters we used the chi-square test for categorical variables and parametric (Student's *t* test) and nonparametric statistics (Wilcoxon rank sum test) for continuous and discrete variables. For non-normal distributions, the Wilcoxon test was used. A value of $\alpha < 0.05$ was considered significant.

Results

The control and intervention groups were comparable at baseline regarding the general and socioeconomic characteristics, although the two groups were not recruited from the same clinic (Table 1). A slight dominance of primipara was observed in the intervention group, but this difference was not significant.

Statistical analysis of the specific characteristics revealed that the studied parameters did not follow a normal distribution. Furthermore, several outliers were identified; thus, nonparametric statistics were used for further analysis. Baseline characteristics of

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