

## Examination of the Effects of Physical Activity on Perceived Stress During Pregnancy

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We investigated the relationship between physical activity and perceived stress levels among pregnant women. A total of 28 pregnant women participated in the study. All participants completed psychological tests to assess stress levels and coping strategies. The physically active (PA) group consisted of 15 women aged 26-40, engaging in moderate physical activity for up to 120 minutes per week across two training sessions. The inactive (NA) group included 13 women aged 24-39 who did not exercise. Unpaired T-test analysis revealed no significant differences in stress-coping strategies between exercising and non-exercising women. Two coping scales, problem-focused coping and emotion-focused coping, showed tendencies: physically active women leaned slightly more toward religious coping ( $p = 0.15$ ), while non-physically active women favored restraint coping ( $p = 0.17$ ). Overall, perceived stress levels did not differ significantly between the groups. The study highlights the importance of using specialized tests for pregnant women due to the unique context of pregnancy.

*Keywords:* physical activity, pregnant women, stress, prenatal maternal stress

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Health organizations and associations worldwide are increasingly promoting physical activity for pregnant women. Exercise, defined as planned, structured, and repetitive bodily movements done to improve one or more components of physical fitness, is an important part of a healthy lifestyle (American College of Obstetricians and Gynecologists [ACOG], 2018). Proper medical care, social support, and education about exercise, nutrition, and mental health are becoming standard in perinatal care to ensure the safety and support of expectant mothers. Ongoing education for medical personnel will help maintain a high level of care (Szumilewicz et al., 2013). The official recommendation of the American Association of Gynecologists and Obstetricians (ACOG, 2018) states that women with uncomplicated pregnancies should be encouraged to engage in aerobic and strength conditioning exercises before, during, and after pregnancy (ACOG, 2020). According to the U.S. Department of Health and Human Services (HHS) Physical Activity Guidelines for Americans, 150 minutes of moderate-intensity aerobic exercise should be spread throughout the week during pregnancy and the postpartum period (HHS, 2019).

### **Benefits of Physical Activity During Pregnancy**

Staying active during pregnancy offers many benefits. Engaging in fitness activities can help reduce stress levels during pregnancy. Pregnancy is a unique time that brings about significant physical and emotional changes. While these changes are a source of joy, they can also be associated with feelings of fear or anxiety (Steuden et al., 2003). Targeted and cyclical physical activities positively affect physical and emotional well-being, the health of the baby, and the labor process. Studies have shown that people who were physically active during pregnancy had a reduced risk of excessive weight gain (Tedee et al., 2022; Wolfe et al., 2003) and a lower risk of gestational diabetes (Xie et al., 2024).

Physical activity during pregnancy has also been shown to improve mood and sleep quality (Alnawwar et al., 2023), cardiovascular function (Melzer et al., 2010), and reduce the risk for prenatal depression (Vargas-Terrones et al., 2019). Moderate-intensity physical activity during pregnancy reduces the risk of pre-eclampsia (Gascoigne et al., 2023; Spracklen et al., 2016) and gestational hypertension (Taliento et al., 2024). Systematic participation in a supervised exercise program during pregnancy is associated with a lower risk of preterm

labor and a lower rate of emergency cesarean deliveries (Perales et al., 2019). Studies indicate that adequate exercise during pregnancy promotes physiological fetal development (Newton & May, 2017).

### ***Research Aims and Hypotheses***

The aim of the study is to compare the level of perceived stress reported in psychological questionnaires between two groups of pregnant women. The first group regularly engages in fitness exercises, while the second group is physically inactive. We assume that physically active (PA) women are more likely to adopt active strategies for coping with stress as compared to those who do not exercise. We also hypothesize that physically active women will report lower levels of stress compared to those who are physically inactive (NA).

## **Methods**

### **Participants**

A total of 28 women participated in the study: 13 from the control group (25-39 years old) with an age median of 30.6 and 15 from the fit group (24-40 years old) with an age median of 30.7. These women completed at least two psychological questionnaires. All women completing tests were eligible for the study. This study was held in Poland in Pomeranian district. The primary study collection was stretched between March 2020-2021. Due to the COVID-19 pandemic, studies were interrupted once and resumed after four months. When the second study group was collected, most of the participants from the old group had given birth or chose not to participate in the study again. The pandemic situation resulted in fewer willing participants in the renewed study. As a result, two study groups were formed.

The recruitment of study participants was done through social media. Thirty women in different trimesters of pregnancy (gestational weeks 8-40) participated in the study. Two women were excluded from the study, one due to age and the other due to pregnancy complications. The criteria for participation in the study were as follows: age 25-40, single pregnancy, not consuming alcohol, not smoking cigarettes, pregnancy not at risk. All the respondents had a master's or bachelor's degree. Declared earnings were 3,000-5,000 thousand zlotys (\$755-\$1260) per month. The women declared maintaining a diet rich in unsaturated fatty acids, protein, fruits and vegetables,

and moderate carbohydrate intake. In addition, each subject presented a certificate from a gynecologist stating that there were no contraindications to fitness training. Each participant signed a consent form to participate in the study. The Bioethics Committee approved the study (KB-4/20).

### ***Physical Activity and Control Groups***

The PA group reported moderate physical activity up to 120 minutes per week in 2 training sessions, each lasting 60 minutes. Each session included a 10-minute fitness warm-up, 40 minutes of the main strength portion with strengthening exercises, and 10 minutes of cool-down with pelvic floor training and relaxation. The NA group did not exercise at all. All women receiving ongoing obstetric care and completing at least two questionnaires between March 2020 and March 2021 were eligible for inclusion in the study.

The women who agreed to participate in the research were asked to complete psychological tests to assess the level of stress they felt and to assess strategies for coping with stress. It was assumed that each woman would complete a questionnaire assessing her coping strategy in difficult and stressful situations and a sense of stress questionnaire, which assesses not only the overall stress level but also points to its potential sources. The questionnaires were to be completed once during pregnancy.

### **Psychological Assessments**

#### ***Coping Orientations to Problems Experienced (COPE)***

The COPE Inventory (Carver et al., 1989; in the adaptation of Juczyński & Ogińska-Bulik, 2009) is a multidimensional coping inventory that assesses how people respond to stress. The COPE Inventory contains 60 questions and is on a 15-scale scale. Five scales (of four items each) measure conceptually distinct aspects of problem-focused coping (active coping, planning, suppression of competing activities, restraint coping, seeking of instrumental social support), five scales measure aspects of what might be viewed as emotion-focused coping (seeking of emotional social support, positive reinterpretation, acceptance, denial, turning to religion), and three scales measure coping responses that arguably are less useful (focus on and venting of emotions, behavioral disengagement, mental disengagement).

Two additional scales assess the sense of humor, treated as a way of alleviating unpleasant emotions and a tendency to reach for stimulants (alcohol, drugs) as immediate measures to alleviate unpleasant emotions. Subsequent analysis divided the scale into three factors: (1) Problem-focused coping, (2) Emotion-focused coping, and (3) Avoidant coping. Each of the 60 statements had to be responded to on a 4-point scale, where (1) means “I usually don’t do this at all,” (2) “I usually do this a little bit,” (3) “I usually do this a medium amount” and (4) “I usually do this a lot.” The  $\alpha$  coefficients for individual scales ranged from 0.48-0.94 and were weakest for behavioral disengagement and active coping strategies while highest for the turning to religion. Internal concordance was above 0.60 for all scales but behavioral disengagement (Juczyński & Ogińska-Bulik, 2009). In the presented research, the COPE Inventory was used to measure the frequency of use of strategies for coping with stress in the studied groups of women.

### ***Perceived Stress Questionnaire (KPS)***

The Perceived Stress Questionnaire (KPS) is a test developed by Polish researchers Mieczysław Plopa and Ryszard Makarowski (Plopa & Makarowski, 2010). The questionnaire was constructed based on the assumption of multidimensionality of stress experiences. In addition to measuring the generalized level of stress, KPS indicates and measures three additional indicators: intrapsychic stress, external stress, and emotional tension. The questionnaire also contains a Lie Scale. It consists of 27 statements concerning various problems and the ways of experiencing and solving them. The answers are given on a 5-point scale, where five is *true*, and one is *not true*.

The authors have defined emotional tension as a feeling of anxiety, excessive nervousness, inability to relax, lack of willingness and energy to act, and excessive fatigue for no apparent reason. External stress represents an individual's confrontation with events in the outside world. It is a feeling of being unfairly judged at home or work, but also a growing sense of helplessness, frustration, fatigue, and a feeling that the set requirements exceed one's ability to cope. Intrapsychic stress is defined as stress resulting from a confrontation with oneself; it is expressed by excessive worry, a feeling of being mentally weak and thinking about the future, which causes anxiety and pessimism. Raw results can be converted into results on the ten scale, where 1-4 is low, 5-6 is medium, and 7-10 is high. The analysis results show that the

highlighted scales' reliability is satisfactory. For the subscale, emotional tension is  $\alpha = .811$ , external stress  $\alpha = .726$ , intrapsychic stress  $\alpha = .697$ , and lying scale  $\alpha = .568$ . The coefficients of internal consistency oscillate between 0.697 (intrapsychic stress) and 0.811 (emotional tension) (Plopa & Makarowski, 2010). In the presented research, KPS was used to determine the generalized stress level and identify its sources in pregnant women.

## Results

Data collections were conducted periodically with the training group, while participants in the physically inactive group made individual appointments to complete tests and data. However, due to the COVID-19 pandemic, arranging appointments was difficult. The subjects had various concerns about their health and meeting in a larger group; on more than one occasion, it was necessary to travel to their place of residence, which was often interrupted due to illnesses of, for example, older children, private matters, and, on three occasions, just before the scheduled data collection a woman went into labor. All this affected the size of the study group and depleted it considerably.

The following results can be indicated from the collected data using unpaired *t*-test analysis. No differences were found between exercising and non-exercising women when choosing a stress-coping strategy. The results did not fully confirm the hypothesis of differences in the frequency of choosing problem-focused coping with stress. Both problem-focused coping and emotion-focused coping were chosen just as often. Avoidant coping was chosen least often, but no statistically significant difference between the groups was observed. The COPE Inventory contains 15 scales, most of which did not indicate any differences between women from the physically active group and women from the non-physically active group.

Only in two scales of coping with stress, belonging to problem-focused coping and emotion-focused coping, a difference was noticed at the tendency level: it was a turning to religion, where physically active women chose this strategy slightly more often ( $p = 0.15$ ), and the strategy of restraint in which non-physically active women chose this strategy more often ( $p = 0.17$ ). The overall level of stress was measured with the Perceived Stress Questionnaire. There were no differences in the level of perceived stress between the analyzed groups, and the results on individual dimensions were considered (i.e., by

analyzing emotional tension, intrapsychic stress, and external stress). The hypothesis that there are differences has not been confirmed.

**Table 1**

*Summary Perceived Stress in Physically Active (PA) and Not Active (NA)*

| KPS                 | PA       | NA       | <i>p</i> |
|---------------------|----------|----------|----------|
| Stress level        | 47±8.5   | 49.8±5.5 | 0.658    |
| Emotional tension   | 18±2.8   | 19.1±2.4 | 0.858    |
| Intrapsychic stress | 14.6±3.9 | 15.2±3.9 | 0.784    |
| External stress     | 14.2±3.4 | 14.8±3.4 | 0.786    |

*Note.* Values are presented as mean ± standard deviation [SD] expressed in relative or absolute values

**Table 2***Summary of Selected Stress Coping Strategies*

| COPE Inventory                                    | PA        | NA       |              |
|---|-----------|----------|--------------|
| N=28  | N=15      | N=13     | <i>p</i>     |
| Active coping                                     | 11.06±1.2 | 11.8±1.0 | 0.190        |
| Planning  | 11.1±1.7  | 12±1.4   | 0.513        |
| Seeking instrumental social support               | 11.6±1.6  | 13±1.7   | 0.221        |
| Seeking emotional and social support              | 11.5±2.7  | 13.4±1.9 | 0.267        |
| Suppression of competing activities               | 10.4±1.8  | 9.8±1.0  | 0.218        |
| Turning to religion                               | 7.3±3.0   | 5.5±1.7  | <b>0.146</b> |
| Positive reinterpretation                         | 11.8±1.0  | 10.6±1.0 | 0.254        |
| Restraint coping                                  | 5.4±1.3   | 6.4±1.0  | <b>0.168</b> |
| Acceptance  | 9.8±1.2   | 9.1±1.7  | 0.295        |
| Focus on and venting of emotions                  | 12.1±1.8  | 11.7±1.7 | 0.662        |
| Denial  | 5.2±1.1   | 5.0±0.8  | 0.821        |
| Mental disengagement                              | 7.6±1.5   | 7.2±1.2  | 0.619        |
| Behavioral disengagement                          | 5.8±1.3   | 6.4±1.3  | 0.265        |
| Tendency to reach for stimulants (alcohol, drugs) | 4.4±0.7   | 4.2±0.3  | 0.664        |
| Sense of humor                                    | 6.7±1.9   | 5.8±1.3  | 0.254        |

*Note.* Values are presented as mean ± standard deviation [SD] expressed in relative or absolute values. Bold *p*-values indicate the highest significance.

## Discussion

Both in the study group and in the control group, the most frequently declared style of coping with stress was problem-focused coping, almost on par with emotion-focused coping. This means that women in a stressful situation do not avoid confrontation with the problem but take several actions to solve it,



and, at the same time, seek emotional support, also through prayer and treating religion as a signpost to a positive re-evaluation (Juczyński & Ogińska-Bulik, 2009). This is also confirmed by studies that indicate that these two strategies are most often used during pregnancy (Lobel et al., 2008; Rehbein et al., 2023). Avoidance-oriented style was the least frequently chosen style. Many researchers consider this style ineffective in coping with difficult and stressful situations. They may become dysfunctional in many situations, leading to feelings of helplessness or resorting to substitute activities that do not contribute to coping with stress (Juczyński & Ogińska-Bulik, 2009). Although being pregnant is one of the most stressful life events (Scully et al., 2000), in the presented results, women both active and non-physically active during pregnancy declared a low level of perceived stress, both in terms of perceived emotional tension as well as intrapsychic and external stress. In 45% of women, the level of emotional tension was defined as average, but in both the control and research groups, no statistically significant differences were observed. Prenatal stress has a negative effect on the mother and the developing fetus. It can be associated with the risk of premature birth (Lilliecreutz et al., 2016) and low birth weight of the newborn (Khashan et al., 2014). In addition, symptoms of anxiety or depression can increase the risk of life-threatening pre-eclampsia (Maher et al., 2017). Long-term exposure to stressors during pregnancy can have negative effects on both mother and child (Gangadharan & Jena, 2018). Rates of prenatal stress range from 13% to 36% and are comparable to other diseases that can occur during pregnancy, such as obesity, gestational diabetes, or hypertension in pregnancy (Kingston et al., 2012). It is, therefore, important to take various measures during pregnancy to reduce the stress, emotional tension, and anxiety experienced.

### **Study Limitations and Future Research**

The study's limitations include the small group of women in the samples and the lack of comparison to the post-pandemic study group. In addition, a significant limitation is the lack of tools in the form of special questionnaires to measure stress in pregnant women. The study is continuing, and further results will appear in future publications. Our study shows a relationship between mental health and physical activity. However, follow-up studies in a larger group are needed. Movement through active participation in fitness activities can be an effective factor in dynamic coping with stressful situations

during pregnancy. Movement lowers cortisol levels in the body, an increase of which is correlated with declared mental stress. This study is part of a larger work intended to serve as a doctoral dissertation, which supports the hypothesis that regular exercise affects levels of declared and perceived stress.

As the declared stress we assessed with the KPS tool did not show significant differences, it is possible that another tool targeted for studying stress in pregnant women would have shown more significant differences. For example, an overview of such methods can be found in the article by Fiona Alderdice, Fiona Lynn, and Marci Lobel (Alderdice et al., 2012). Unfortunately, these tools are not widely available in Polish. Recently, Polish authors decided to translate the Pandemic-Related Pregnancy Stress Assessment PREPS into Polish (Ilska et al., 2021). However, this tool was unavailable when the study's methods were planned. We suggest that these studies should be enriched by checking hair cortisol levels, which would give a retrospective look at the actual level of stress the pregnant woman was experiencing. We suggest that the stress level in pregnancy should not be determined only by self-report questionnaires but also by objectively measurable indicators such as testing hair cortisol levels.

In addition to the concept of stress, the literature on stress often points to coping strategies and styles for dealing with difficult and stressful situations. Women use a variety of ways to cope with the challenges and stresses of pregnancy (Strelau et al., 2007). A coping style can be considered a relatively fixed, persistent, and characteristic way of responding. Coping style in a stressful situation expresses personality functioning in action; coping is a cognitive or behavioral attempt to cope with demands perceived as burdening or exceeding one's resources (Lazarus & Folkman, 1984). All pregnant women from our study tried to solve problems proactively by confronting the stressor, although women who were inactive preferred to remain seemingly passive, more often trying to delay confrontations and wait for the right moment. Most of the studies that have examined how women cope with stress during pregnancy have not considered possible period-specific aspects but have used generally known methods to validate and identify coping strategies in difficult and stressful situations (Alderdice et al., 2012). These studies were also performed at different times during pregnancy, in different trimesters, low-risk pregnancies, and complicated pregnancies (Lobel et al., 2008).

Researchers have described several strategies that pregnant women use to cope with anxiety, insecurity, and emotional tension. In a study devoted to the

comparison of coping styles in difficult situations in women with normal pregnancies compared to women with high-risk pregnancies, it was found that in both the study and control group, the most frequently declared style of coping with stress was task focused. This means that women experiencing stress do not avoid confronting the problem but take various actions to solve it effectively (Rutkowska et al., 2010). In a study on stress, depressive symptoms, and coping styles in women undergoing infertility treatment and women with high-risk pregnancies, it was found that women undergoing infertility treatment most often chose active ways to cope with stressful situations, followed by denial and distraction.

Women with at-risk pregnancies were most likely to seek emotional support, turn to religion, or focus on emotions and their discharge (Chanduszko-Salska & Kossakowska, 2018). Our study shows a noticeable trend among physically active women to choose emotional support for problem-solving, described as a turn to religion. A study of coping in women with their first pregnancy indicates that an emotion-focused coping strategy was more often used at the beginning of pregnancy than in the middle or third trimester, and a problem-focused style was more often seen in the first and second trimesters of pregnancy (Lobel et al., 2008). Lobel and colleagues conducted a study showing that half of women with high-risk pregnancies use strategies such as prayer, preparation, avoidance, and positive reappraisal (Lobel et al., 2002). Another study has shown that spiritual coping translates into lower levels of anxiety or perceived stress in normal pregnant women, and again, in a study by Lobel et al., a coping style of prayer caused more emotional distress in high-risk pregnant women (Lobel et al., 2008).

Our study also confirmed that pregnant women choose a task-oriented style and that women actively seek to solve problems and deal with stress. They do not use avoidance strategies. It cannot be ignored that emotion-oriented strategies were also eagerly chosen, especially in terms of seeking emotional and instrumental support and the need to focus on experienced emotions and discharge them. For some physically active women, such emotional support was precisely the turn to religion.

Recent research on religiosity and spirituality is very promising, showing that faith can be a valuable resource in the fight against stress. In a recent prospective study, African American mothers who were more religious and more spiritual had fewer depressive symptoms during the year following birth (Lobel et al., 2016). These data mostly coincide with previous studies but also

show that an important differentiating factor may be the abnormal course of pregnancy and the trimester during which the tests are performed.

The examples from the research presented above illustrate the difficulty in defining a specific coping strategy for difficult or stressful situations as either adaptive or maladaptive. Coping styles are likely to be influenced by individual characteristics and environmental conditions. In addition, the coping style may depend on the type of stressors the woman encounters, which will be directly influenced by the course of the pregnancy itself, its regularity, the woman's well-being, receiving support, etc. Whether the type of physical activity would affect the frequency of choosing the strategy to restrain from action remains open.

### **Conclusion**

Exercise is an important part of a healthy lifestyle; however, the effect of physical activity on stress, as declared in questionnaires and experienced in the body during pregnancy, is still little known; larger groups should be studied. Our results could be used to focus on more thorough screening offered to women during pregnancy to monitor their psychological stress levels. It would be appropriate to present them with effective tools to deal with stress. It should be a daily practice for caregivers and gynecologists to educate people on the benefits of physical activity.

Recognizing that people experience severe psychological stress during pregnancy allows healthcare providers to more thoroughly assess the nature of the stress and sensitize women to evaluate related risk factors. Addressing high stress during pregnancy will increase maternal well-being. Although many of the factors associated with stress are difficult to overcome (e.g., material status or violence), this leaves ample room for health caregivers to educate on mental and physical relaxation, diet, and the impact of sports on health.

Pregnancy is a special time in a person's life, and popular tools to measure the level and type of stress may not be sufficient. Questionnaires presented to pregnant women should explore aspects such as concerns about the health of the baby, economic status, and social and emotional support. This could reveal significant differences between physically active and inactive women.

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