Babywearing in a sling and pain ailments in women: A cross-sectional study

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DOI: https://doi.org/10.5114/phr.2022.114581

Received: 22.12.2021 **Reviewed:** 03.01.2022 **Accepted:** 04.01.2022

Abstract

Background: Babywearing, whether in a sling or a carrier, is gaining in popularity, which fosters the development of tying techniques and ways of carrying children. Women view babywearing as bond-building and reassurance of providing the need for closeness and security for their offspring. Studies suggest that babywearing reduces the incidence of depression, anxiety and lowers stress in mothers of babies born prematurely and treated in an intensive care unit.

Aims: The aim of the study was to assess the incidence of pain during and immediately after babywearing, taking into account the weight of the carried child, the duration of babywearing, and the use of babywearing consultations in a group of women babywearing in a sling.

Material and methods: The study used a survey questionnaire method that targeted women currently babywearing in a sling through social networking sites. A total of 626 women completed the questionnaire, the mean age was 31 years (min 20 years, max 42 years), and the average body weight was 65.6 kg (min 38 kg, max 135 kg).

Results: There was a weak relationship between the number of women experiencing or not experiencing pain while babywearing and child's weight (χ^2 NW=29.14 at p=0.01; Pearson's C=0.2; Cramer's V=0.2). A very weak correlation described the relationship between the number of women experiencing/not experiencing pain immediately after babywearing and the child's weight (χ^2NW=24.26 at p=0.04; Pearson's C=0.19; Cramer's V=0.19). Lack of consultation with a sling counselor was not associated with an increase in the incidence of babywearing pain.

Conclusion: It cannot be assumed that there are significant differences in the number of women experiencing pain relative to the number of women not confirming the presence of pain in the group of babywearing women, taking into account the weight of the child, the use of consultations with a sling counselor, and the duration of babywearing in the sling.

Key words

babywearing, female, health, pain

Introduction

Babywearing, whether in a sling or a carrier, is gaining in popularity, which fosters the development of tying techniques and ways of carrying children. More often, young mothers use the help of a sling advisor to select the most suitable tying techniques or sling material. The role of the sling advisor is to teach the correct positioning of the baby's hips and pelvic girdle while babywearing. The basic baby positioning in the sling was the "frog" position with the spine bent into the letter "C", but nowadays, attention is paid to modifying the positioning of the child's body depending on the stage of motor development. In case of an infant not holding the head up on its own, the pelvis should be positioned in a slight forward tilt; the spine bent into the letter "J", the lower limbs at the height and width of the hips of the baby being carried, and the head resting with one cheek against the mother's chest. In the infants already controlling the head, the pelvis should align in an intermediate position. The knee joints will be positioned progressively wider and higher than the hip joints. Babywearing comfort improves with a child's ability to sit up, which involves shifting the child's center of gravity toward the person carrying the baby. A walking baby should have the pelvis in an intermediate position and the knees above the hips, with the thighs fully supported by the sling. Attention is also paid to providing stable spinal support for the child at each stage of development by tightening the sling [1]. In babywearing children under four months of age and children born prematurely, with low birth weight, and with respiratory diseases, special attention is paid to the continuous control of nose and mouth exposure due to the risk of sudden infant death syndrome (SIDS) [2]. To the best of our knowledge, there are no guidelines as to the appropriate time to start babywearing. No recommendations were also found as to when caregivers should stop carrying their children.

By babywearing the child in the sling, the caregiver gains free hands, making it easier to perform other activities [3] or take care of an older child. However, comfort is not a deciding factor in babywearing. By following posts on the social media groups on Facebook, it is apparent that babywearing is related to the emotional realm. Women view babywearing as bond-building and reassurance of providing the need for closeness and security for their offspring. Studies suggest that babywearing reduces the incidence of depression, anxiety and lowers stress in mothers of babies born prematurely and treated in an intensive care unit [3]. In addition, the close bond between mother and child that babywearing can provide has a beneficial effect on breastfeeding [4].

Holding and carrying a baby can alter the kinematics and biomechanics of the musculoskeletal system, which impacts the occurrence of pain or discomfort in the person carrying the baby [5, 6, 7]. The effect of increased levels of the relaxin hormone on the relaxation and decreased stability of the sacroiliac joints in women during pregnancy and decreased strength of the back extensor muscles [8] on the occurrence of pain in the lumbar spine or pelvic girdle, which affects up to 25% of women after childbirth, have also been considered [9]. According to Schmid et al. [7], the occurrence of pain may be related to an overload of the back muscles resulting from carrying the child on one side, which results in fatigue pain that may worsen with increased holding and carrying time.

Aims

The aim of this study was to examine the relationship between the number of women experiencing pain (1) while babywearing in a sling, (2) immediately after babywearing in a sling, and the categories determined by the child's weight, and the duration of babywearing, or the use of a sling counselor services. In addition, the probability of pain during or immediately after babywearing in a sling was examined, taking into account the categories determined by the child's weight.

Material and methods

The questionnaire investigation was conducted between January and February 2020, using an original survey addressed women via: Facebook, a Fanpage - Mataja.pl, and community groups: Slings, POLAND! - we carry, we tie, we hover - we sling!, MAMA LAMA offtopowo, Physio Support for Babies + Physiotherapist with a mission.

The questionnaire consisted of an introductory letter informing about the way of answering and the purpose of the survey and the main part, which included close-ended questions with the possibility of answering "yes" or "no" related to the occurrence of pain during or immediately after babywearing, consultation with a sling advisor and questions with answers including a list of categories such as duration of babywearing. In addition, respondents were asked an open-ended question about the child's weight. Inclusion criteria included: mother/caregiver currently babywearing, willingness to participate in the survey, Internet access, and activity on social networking groups. Surveys that were not completed have been excluded from the analysis.

The questionnaire also included questions related to the occurrence of stress urinary incontinence symptoms in women using the standardized International Consultation of Incontinence Questionnaire – Short Form (ICIQ-SF) questionnaire and methods of sling application, the analysis of which was not the aim of the presented study. Participation in the questionnaire was voluntary and anonymous.

Statistical analysis

Statistica 13.3 software was used for statistical analysis. Chi-square ($\chi 2$) NW test was used to analyze the relationship between the number of women experiencing or not experiencing pain corresponding to the categories determined by the weight of the child carried in the sling (there were 0 counts). Fisher's exact test, one-sided and two-sided, was used to determine the probability of an unequal distribution between the number of women experiencing pain and not experiencing pain and the different categories determined by weight or duration of babywearing. Pearson's Chi-square ($\chi 2$) test was used to analyze the relationship between the number of women experiencing and not experiencing pain during or immediately after babywearing (considering the total body weight category) and the use of sling consultations. In addition to the raw number of individuals in the test score interpretation, percentage scores were also included in the analysis, allowing comparisons of proportions to be made for all of the collected data. Statistical significance of the test result was assumed at $p \leq 0.05$.

Results

A total of 643 women responded to the survey, of which 626 women fully completed the questionnaire. The mean age in this group was 31 years of age (min 20 years, max 42 years), and mean body weight was 65.6kg (min 38kg, max 135kg).

The test results ($\chi^2=29.14$ at $p=0.01$) and the strength coefficients of the relationship indicate that there is a weak relationship between the number of women experiencing or not experiencing pain while babywearing in a sling and the weight of the baby. The most numerous category (101 women, 16.1% of the total) was the one determined by the child's weight of 10kg, followed by the category determined by the child's weight of 11kg (83 women, 13.26% of the total). The table shows that more than 9% of women experienced pain while carrying a 10 kg baby, and 7% experienced pain while carrying an 11 kg baby (**Table 1, Figure 1**).

Despite the difference in child weights and female counts for each category determined by child's weight, no probability of an unequal distribution of counts was detected (Fisher's exact test). The likelihood of pain while babywearing in a sling does not vary between baby weight categories.

Table 1. The relationship between the presence/absence of pain while babywearing in a sling and the child's weight category.

Number [% overall]	Child's body mass [kg]															
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**Overall**
No	3	22	9	33*	32*	33*	43*	39*	39*	24*	11	14	6	8	0	316
% overall	0.48	3.51	1.44	5.27	5.11	5.27	6.87	6.23	6.23	3.83	1.76	2.24	0.96	1.28	0.00	50.48
Yes	2	5	17	25*	31*	44*	58*	44*	22*	30*	10	11	7	3	1	310
% overall	0.32	0.80	2.72	3.99	4.95	7.03	9.27	7.03	3.51	4.79	1.60	1.76	1.12	0.48	0.16	49.52
Overall	5	27	26	58	63	77	101	83	61	54	21	25	13	11	1	626
% overall	0.80	4.31	4.15	9.27	10.06	12.30	16.13	13.26	9.74	8.63	3.35	3.99	2.08	1.76	0.16	100.00
$\chi 2$ NW=29.14; df=14; p=0.01; Pearson's contingency coefficient C=0.2; V Cramer's=0.2																

**number of women ≤20*

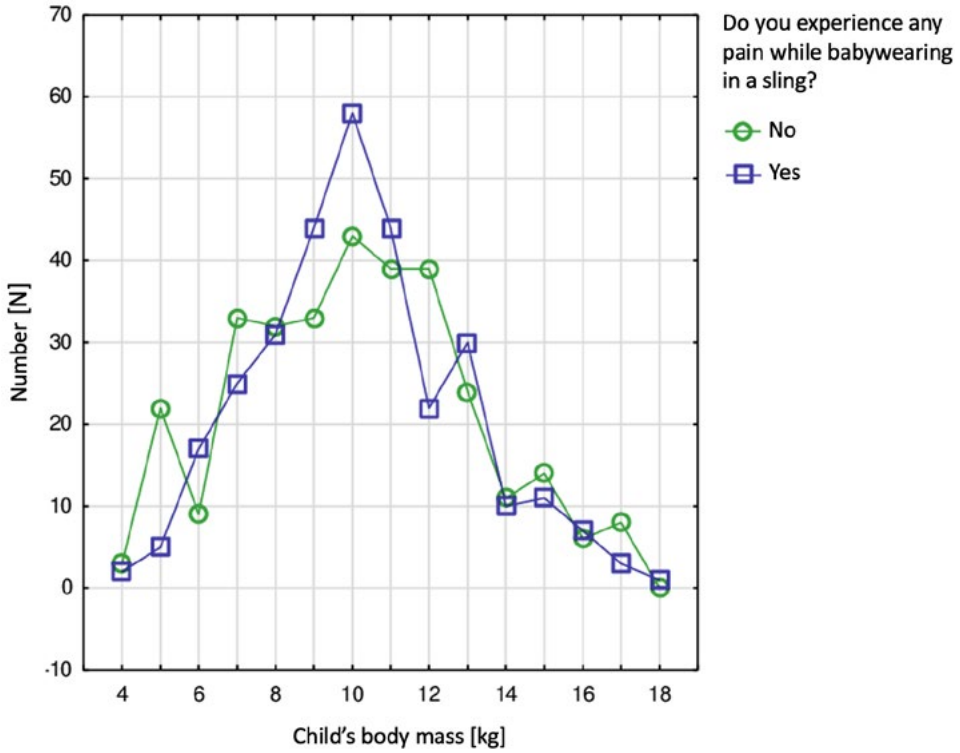

Figure 1. An interaction chart between the number of women experiencing and not experiencing pain while babywearing in a sling, with a distribution considering the child's weight.

The test results ($\chi2$=24.26 at p=0.04) and the strength coefficients of the relationship indicate that there is a very weak relationship between the number of women experiencing/not experiencing pain immediately after babywearing in a sling and the weight of the baby. The most numerous category (101 women, 16.1% of the total) was the one determined by the child's weight of 10 kg, followed by the category determined by the child's weight of 11 kg (83 women, 13.26% of the total). The table shows that 4.6% of women experienced pain immediately after carrying a 9kg and 11kg baby, and 7.3% of women in experienced pain immediately after carrying a 10kg baby (**Table 2, Figure 2**).

Despite the difference in baby weights and the number of women for each category determined by baby weight, there are no statistically significant differences in the likelihood of experiencing pain immediately after babywearing between the different categories determined by baby weight (pairwise comparison, Fisher's exact test). Therefore, the likelihood of experiencing pain immediately after babywearing in a sling is similar for various baby weight categories.

The test results ($\chi2$=5.8 at p=0.2) and Pearson's contingency coefficient C indicate no relationship between the number of women experiencing or not experiencing pain while babywearing in a sling and the duration of babywearing (**Table 3, Figure 3**).

Table 2. The relationship between the presence/absence of pain directly after babywearing in a sling and the child's weight category.

Number [% overall]	**Child's body mass** [kg]															
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**Overall**
No	1	23	16	33*	39*	49*	55*	54*	41*	33*	14	20*	9	10	1	398
% overall	0.16	3.67	2.56	5.27	6.23	7.83	8.79	8.63	6.55	5.27	2.24	3.19	1.44	1.60	0.16	63.58
Yes	4	4	10	25*	23*	29*	46*	29*	20*	21*	7	5	4	1	0	228
% overall	0.64	0.64	1.60	3.99	3.67	4.63	7.35	4.63	3.19	3.35	1.12	0.80	0.64	0.16	0.00	36.42
Overall	5	27	26	58	62	78	101	83	61	54	21	25	13	11	1	626
% overall	0.80	4.31	4.15	9.27	9.90	12.46	16.13	13.26	9.74	8.63	3.35	3.99	2.08	1.76	0.16	100.00
$\chi2$ NW=24.26; df=14; p=0.04; Pearson's contingency coefficient C=0.19; V Cramer's=0.19.																

**number of women ≤20*

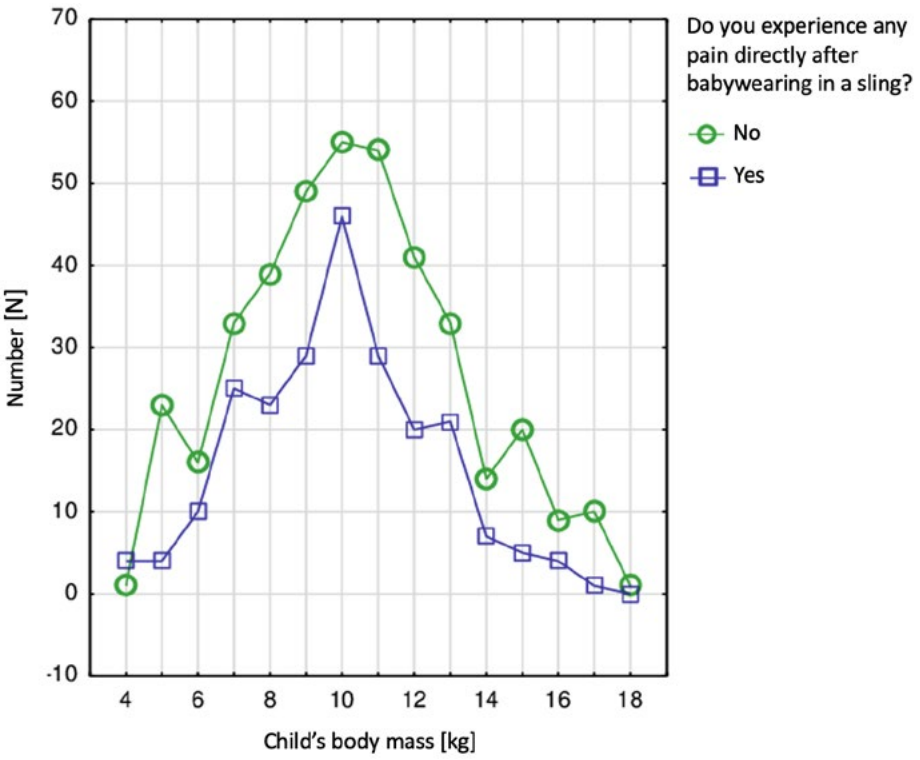

Figure 2. An interaction chart between the number of women experiencing and not experiencing pain directly after babywearing in a sling, with a distribution considering the child's weight.

Table 3. Relationship between the number of women experiencing or not experiencing pain while babywearing in a sling and the length of babywearing in a sling.

Number [% overall]	**< 0.5h**	**< 1h**	**> 1h**	**2h**	**> 2h**	**Overall**
No	45*	191*	61*	6	13	316
% overall	7.19	30.51	9.74	0.96	2.08	50.48
Yes	53*	166*	68*	13	10	310
% overall	8.47	26.52	10.86	2.08	1.60	49.52
Overall	98	357	129	19	23	626
% overall	15.65	57.03	20.61	3.04	3.67	100.00
$\chi 2$ NW=5.8; df=4; p=0.2; Pearson's contingency coefficient C=0.09;V Cramer's=0.09.						

**number of women ≤20*

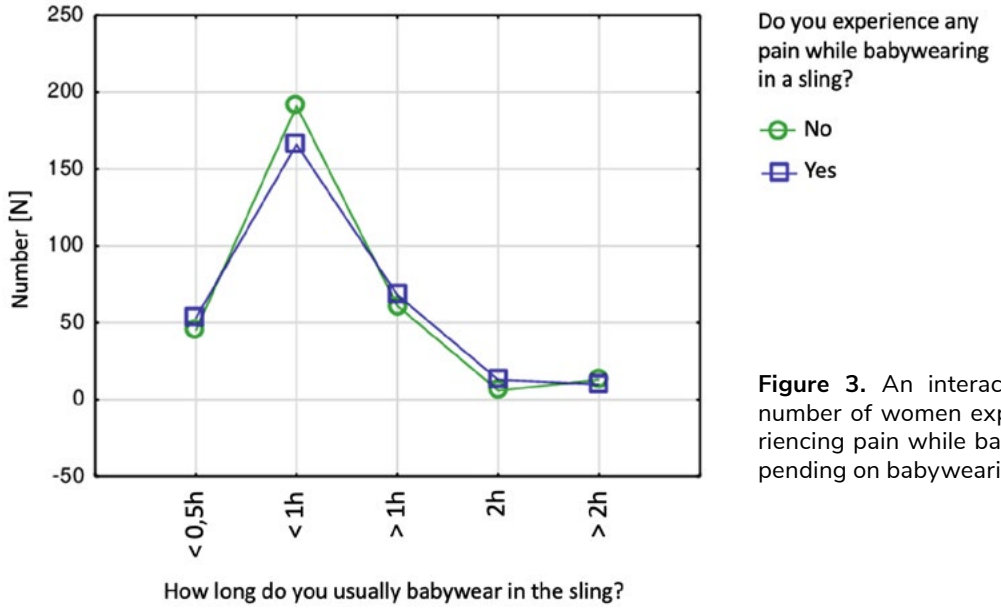

Figure 3. An interaction chart between the number of women experiencing and not experiencing pain while babywearing in a sling, depending on babywearing time.

The test results ($\chi 2$=1.3 at p=0.2) and Pearson's contingency coefficient C do not indicate any relationship between taking the advice of a sling counselor and the occurrence of pain during babywearing (considering the entire body weight category) (**Figure 4**).

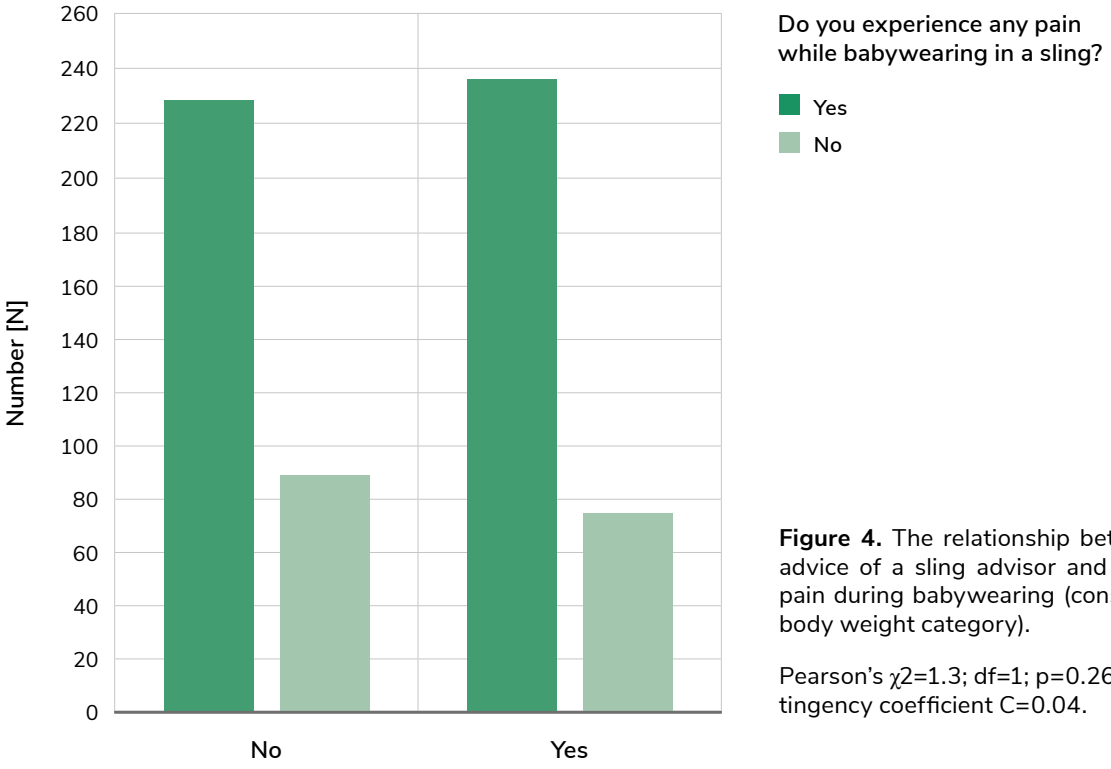

Figure 4. The relationship between taking the advice of a sling advisor and the incidence of pain during babywearing (considering the total body weight category).

Pearson's $\chi 2$=1.3; df=1; p=0.26; Pearson's contingency coefficient C=0.04.

The test results ($\chi 2$=0.9 at p=0.3) and Pearson's contingency coefficient C do not indicate any relationship between taking the advice of a sling counselor and the occurrence of pain immediately after babywearing (considering the entire body weight category) (**Figure 5**).

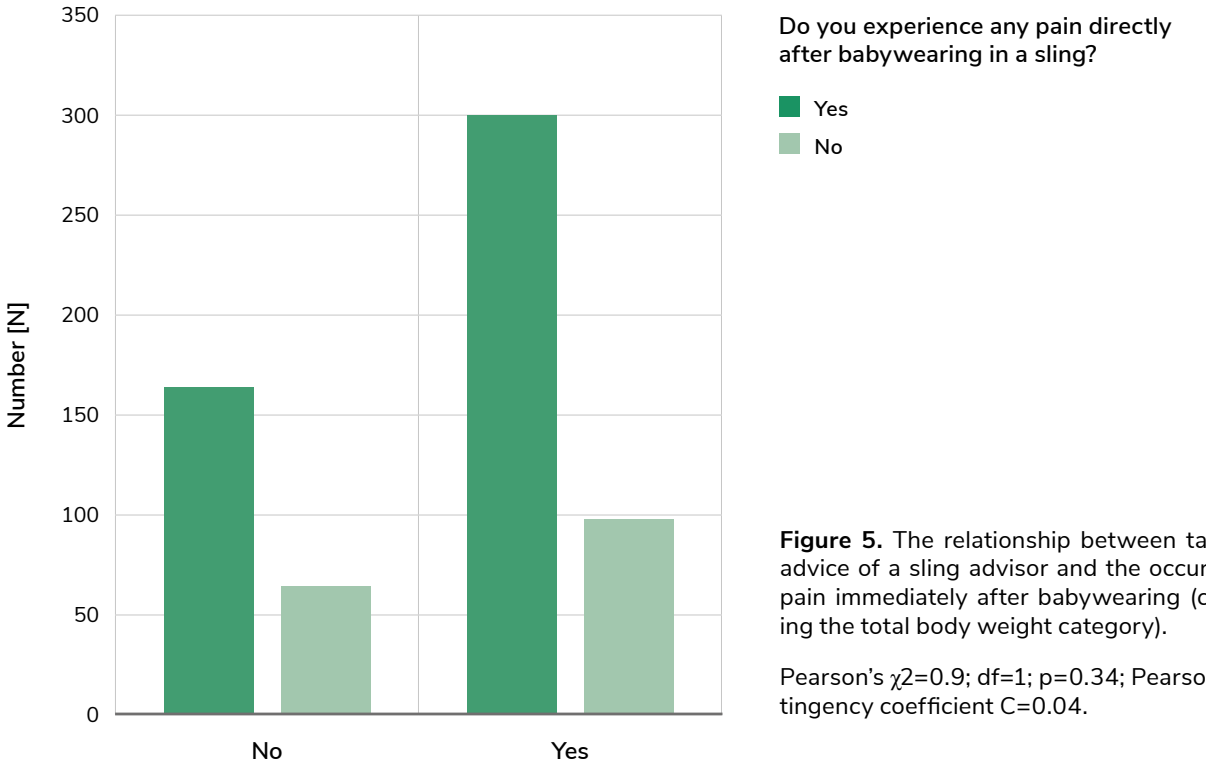

Figure 5. The relationship between taking the advice of a sling advisor and the occurrence of pain immediately after babywearing (considering the total body weight category).

Pearson's $\chi 2$=0.9; df=1; p=0.34; Pearson's contingency coefficient C=0.04.

Discussion

The study results indicate that popular babywearing should not be considered a predisposing factor for the occurrence of pain. The weak relationship between the analyzed characteristics does not allow us to conclude the relationship between the occurrence of pain during and immediately after babywearing, the weight of the carried child, the duration of babywearing, or the lack of advice from a sling counselor. The results lead to the additional conclusion that women, although much less frequently, carry their child weighing more than 10kg in a sling. However, the incidence of back pain is similar when carrying a child of lower and higher weight.

Caring for an infant and young child requires frequent carrying and lifting, which can cause or exacerbate back and spine muscle aches. Therefore, it is important to follow the principles of ergonomics during everyday activities, including carrying a child. Currently, women's interest in slinging is increasing with evidence of a strengthened relationship between child and mother due to babywearing [10, 11]. Research findings indicate that pain may accompany women for up to 3 years after childbirth [12]. A meta-analysis conducted in 2020 [13] suggested no single treatment option available for lumbar pain, pelvic pain, and mixed pain in postpartum women. Therefore, there are

no clear recommendations for effective treatment for women experiencing pain. Conservative methods used to treat lumbar and pelvic pain include specialized physiotherapy, transcutaneous electrical nerve stimulation (TENS), mobilization, manipulation, and pharmacotherapy [13, 14].

Increasing knowledge of the changes occurring in the woman's body during pregnancy allows early implementation of treatment and avoidance of the consequences of long-term pathological symptoms. Musculoskeletal changes occur during pregnancy [15]. Musculoskeletal changes may result in lumbar spine pain or pelvic girdle pain in women [15, 16]. An increase in the severity of spinal pain during standing and sitting in the third trimester has been demonstrated despite the lack of significant changes in spinal curvature with the duration of pregnancy [17]. Subsequent studies on this topic have reached similar conclusions. Through comparison via an electromagnetic motion capture system of pelvic and spinal alignment in women in a standing position, no differences were found between women in the third trimester of pregnancy, postpartum, and not pregnant women. However, the 5-second electromyographic (EMG) recording demonstrated increased activity of lumbar extensor muscles in women during the third trimester [18].

Out of the few papers concerning the effect of babywearing on gait mechanics in wearers, the research conducted by Schmid et al. [7], performed measurements using an optoelectronic system while walking on five sequentially stacked posturographic platforms along with simultaneous EMG recording of back and abdominal muscle activity. Lumbar lordosis was found to worsen while standing and walking when a 6 kg dummy was placed in the front, while an increase in thoracic kyphosis was observed when the dummy was held on the participant's preferred side. The increase in EMG activity of the paraspinal muscles during walking affected only one side when carrying on the side (in the lumbar region when carrying on the preferred side and in the thoracic region when carrying on the non-preferred side). The results indicate that carrying a dummy in the front requires adaptive changes in gait mechanics relative to unweighted gait. The experts recommend holding and carrying an infant alternately on both sides using a sling, which may be beneficial in preventing musculoskeletal pain caused by excessive lordotic positioning of the lumbar spine and increased activity of the paraspinal muscles.

In other studies, participants (n=18) performed three trials: 3 minutes of unweighted walking, 15 minutes of walking while holding a 2.73 kg dummy in their arms, and 15 minutes of walking while carrying the dummy in a front carrier. By comparing tests under various load conditions (carrying a dummy in the arms and a carrier) to a test without load during the first minute of walking, an increase in joint moments in the frontal and sagittal planes was observed for the knee joints, with no change in joint moments for the hip and ankle joints. A more substantial increase in joint moments was observed during the test under the condition of carrying the dummy in the arms when compared to the no-load condition. Comparison during the last minute of walking (between trials) indicated that the arm carrying trial produced a further increase in joint moments in the frontal plane at the knee joint relative to the first minute of the trial and an increase at the hip joint relative to the unloaded condition. However, the carrying conditions did not significantly increase parameters relative to the unloaded trial. In a practical sense, the research results indicate that carrying the child in a carrier is more beneficial because the mechanical load on the knee and hip joints is reduced compared to carrying the child in the arms. This is especially important when carrying a baby for long periods. The ability to perform natural arm swings while walking with the baby in the sling is similar to walking without weight load. However, the researchers point out that the results cannot be directly transferred to a woman's gait after delivery because pregnancy is associated with a high concentration of the relaxin hormone in the blood, which is associated with increased ranges of motion of the pelvic girdle joints and surrounding joints [5].

Research conducted by Havens et al. [6] used an optoelectronic motion tracking system for gait analysis (Vicon Motion Systems, Oxford, UK) and two posturography platforms. Spatio-temporal parameters such as stride length, stride time, support time, gait speed, and stride width were analyzed, and kinematics in the sagittal plane were evaluated for the lower limb joints and spine. Ten not pregnant women with no previous babywearing experience participated in the study. Participants walked and lifted an item from the floor in three different conditions: no-load, holding and carrying a 5kg dummy in their arms similar to holding a baby, and holding and carrying a dummy in an Ergobaby soft carrier. Although the research showed differences only in stride length between trials performed under no-load conditions and carrying a dummy in the arms, in the latter case, the stride was shorter. In contrast, the act of picking items up from the floor was performed more ergonomically, with the back straight when the dummy was held in the carrier. In addition, some differences in lower limb kinematics were observed between the tasks performed with the dummy and the no-load test, which was not clinically relevant according to the researchers.

It should be noted that in Schmidt's study [7] postpartum women were also recruited. In two studies [5, 6], the findings were based on the results collected from healthy subjects without experience of childbirth and childbearing, which has limited clinical relevance. The importance of babywearing specialist guidance was recognized by researchers when planning an instructional session for participants with no babywearing experience [5, 6]. In our study, receiving expert advice on slinging a baby was not associated with fewer women experiencing pain during or immediately after slinging a baby.

Limitations of the study include the lack of questions regarding pain before pregnancy and previous babywearing experience. Another limitation is the restriction of survey respondents to national coverage and thus the failure to consider cultural considerations resulting from cross-national surveys.

Conclusions

The research found a weak relationship between the number of women experiencing pain during or immediately after carrying a baby in a sling and the weight of the carried baby. However, no relationship was found between the number of women experiencing pain while babywearing in a sling and the duration of babywearing or the use of a sling counselor. In addition, the likelihood of pain was similar across body mass categories. Thus, the results of the study indicate that there were no significant differences in the number of women experiencing pain relative to the number of women not experiencing pain in the group of babywearing women about the child's weight, the use of consultations with a sling specialist, and the duration of babywearing.

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