[Primary Care]

Exercise Behaviors and Health Conditions of Runners After Childbirth

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Background: With a recent increase in running popularity, more women choose to run during and after pregnancy. Little research has examined exercise behaviors and postpartum health conditions of runners.

Hypothesis: Antenatal and postpartum exercise is beneficial in reducing certain postpartum health conditions.

Study Design: Cross-sectional study.

Level of Evidence: Level 5.

Methods: A self-administered, online survey was developed that consisted of questions regarding antenatal and postpartum exercise behaviors, maternal history, and postpartum health conditions. The survey was completed by 507 postpartum women who were running a minimum of once per week.

Results: Seventy-two percent of participants ran regularly during pregnancy, with 38% reporting running in the third trimester. Women with musculoskeletal pain during pregnancy were more likely to experience pain on return to running postpartum (odds ratio [OR], 3.08; 95% confidence interval [CI], 1.64-5.88). A birth spacing of <2 years or a vaginal-assisted delivery increased the odds of postpartum stress urinary incontinence (OR, 1.71; 95% CI, 1.00-2.91 and OR, 2.08; 95% CI, 1.24-3.47, respectively), while Caesarean section delivery decreased the odds (OR, 0.58; 95% CI, 0.35-0.96). Multiparous women and those who reported a Caesarean section delivery were more likely to report abdominal separation (OR, 2.11; 95% CI, 1.08-4.26 and OR, 2.20; 95% CI, 1.05-4.70, respectively). Antenatal weight training decreased the odds of postpartum pain (OR, 0.52; 95% CI, 0.28-0.94), stress urinary incontinence (OR, 0.46; 95% CI, 0.21-0.98), and abdominal separation (OR, 0.51; 95% CI, 0.26-0.96).

Conclusion: Musculoskeletal pain, stress urinary incontinence, and abdominal separation are prevalent conditions among postpartum runners and are more likely to occur with specific maternal history characteristics. Antenatal weight training may reduce the odds of each of these conditions.

Clinical Relevance: Strengthening exercises during pregnancy may prevent weakening and dysfunction of the abdominal and pelvic floor muscles, decreasing the odds of pain, stress urinary incontinence, and abdominal separation after pregnancy.

Keywords: running; pregnancy; stress incontinence; pelvic floor; weight training

Exercise in the antenatal and postpartum period offers considerable maternal health benefits. Therefore, the American College of Obstetrics and Gynecology (ACOG) recommends that women with healthy, uncomplicated pregnancies engage in at least 20 to 30 minutes of moderate physical activity on most or all days of the week.[2] After pregnancy, and in the absence of safety concerns, women are encouraged to gradually return to physical activity.[2]

Over the past decade, running has grown dramatically in popularity.[29] Participation in running events continues to increase, with women's participation now exceeding that of men's.[29] Thus, more women are running before pregnancy and

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may choose to continue their running routines through the antenatal and postpartum periods. A recent study found that 70% of competitive postpartum runners ran at some point during their pregnancy and that most resumed running within 2 months after childbirth.[33] ACOG recommendations state that women who exercised regularly prior to pregnancy and have no medical or obstetric contraindications may safely engage in vigorous-intensity activities, such as running, during pregnancy.[2] Moreover, case reports on antenatal and postpartum running consistently demonstrate no severe maternal or fetal effects.[8,27]

Despite a likely increase in the number of pregnant and postpartum women participating in vigorous-intensity activity, few studies have described this population. Pregnancy and childbirth present unique anatomical and physiologic changes and are associated with adverse postpartum conditions such as musculoskeletal pain, stress urinary incontinence (SUI), and diastasis recti. Thus, it is important to consider how vigorous, weightbearing activities, in conjunction with pregnancy-related changes, may impact the occurrence of these conditions among active postpartum women.

The purpose of this study was to describe the antenatal and postpartum exercise behaviors of an active population of postpartum runners. Maternal history and the occurrence of postpartum health conditions were also assessed to examine potential relationships.

METHODS

This cross-sectional survey was approved by the University of Wisconsin–Madison Educational and Social/Behavioral Science Institutional Review Board. A self-administered, anonymous, online survey was created to collect information regarding exercise behavior before, during, and after pregnancy; maternal history; and postpartum health conditions. Thirty running organizations throughout the United States were contacted and invited to distribute a link to the online survey to their members. The survey was available between August 2013 and May 2015. Participants included women 18 years or older who have given birth to at least 1 child and were currently running a minimum of once per week, on average. Before beginning the survey, participants were provided with study information and an electronic consent form. Participants checked boxes confirming they met the inclusion criteria and agreed to participate.

As there is no standardized questionnaire designed to investigate exercise behavior and health conditions among postpartum women, a survey was developed to obtain this information (see Appendix 1, available at http://sph.sagepub.com/content/suppl). The survey included questions regarding the types of exercise performed before and during pregnancy as well as the occurrence of antenatal and postpartum musculoskeletal pain, SUI, and the perception of separation between rectus abdominis (RA) muscles. To assess musculoskeletal pain, participants reported any recurring pain during their most recent pregnancy, and in a separate question, any recurring pain during the initial months of returning to running after their most recent pregnancy. Information on SUI was obtained by asking participants whether they currently have problems with leakage of urine when they run, cough, or sneeze and if this problem started before, during, or after their first pregnancy. To assess RA separation, participants indicated whether they were currently aware of any separation in their abdominal muscles and were provided no specific guidelines. In addition, participants reported characteristics of maternal history including parity, age of their youngest child, shortest birth spacing, and all delivery modes.

Statistical Analysis

Statistical analyses were restricted to nonpregnant women who ran regularly prior to pregnancy and reported giving birth within the past 2 years, unless otherwise specified. Participants who completed all questions related to the variables involved in each analysis were included. To calculate associations among variables, univariate analysis using 2-sided chi-square tests, Fisher exact tests, or logistic regression were performed using the statistical package RStudio (version 0.99.489). In all analyses, $P < 0.05$ was considered statistically significant.

RESULTS

Among the 808 survey respondents, 725 (90%) met the inclusion criteria and consented to participate. Of those excluded, 49 (59%) did not agree to participate, 3 (4%) were not 18 years or older, 4 (5%) had not given birth to at least 1 child, 13 (16%) did not run regularly, and 14 (17%) failed to meet more than 1 criterion. Among the eligible participants, 507 (70%) completed the survey, were not currently pregnant, and ran regularly prior to pregnancy. The study population was restricted to 416 (82%) women who reported giving birth within the past 10 years and to 199 (39%) women who reported giving birth within the past 2 years (Table 1).

Antenatal and Postpartum Exercise Behavior

Among women who reported giving birth within the past 2 years, nearly 90% exercised regularly during any pregnancy (see Appendix 2, available at http://sph.sagepub.com/content/suppl). Of these women, approximately one-half engaged in 30 minutes of exercise 3 to 5 days per week, and more than 96% felt their antenatal activity level positively affected their pregnancy and/or delivery. Seventy-two percent of participants ran regularly during pregnancy, with 38% running in the third trimester. Compared with prepregnancy running volume, most women ran less during pregnancy.

After pregnancy, nearly one-half of participants returned to running less than 6 weeks after childbirth (Appendix 2). Compared with running behavior before their most recent pregnancy, most cited decreased running volume, running speed, and number of running races in the postpartum period. Despite these changes, the majority of women stated receiving

Table 1. Population characteristics

	≤2 y Postpartum (n = 199); n (%)	≤10 y Postpartum (n = 416); n (%)
Parity		
Primiparous	74 (37.2)	130 (31.3)
Multiparous	122 (61.3)	280 (67.3)
No response	3 (1.5)	6 (1.4)
Shortest birth spacing[a]		
<2 y	45 (36.9)	114 (40.7)
≥2 y	77 (63.1)	164 (58.6)
No response	0 (0.0)	2 (0.7)
All delivery modes		
Vaginal	149 (74.9)	283 (68.0)
Vaginal-assisted	28 (14.1)	80 (19.2)
Caesarean section	48 (24.1)	124 (29.8)
Antenatal musculoskeletal pain		
Yes	73 (36.7)	121 (29.1)
No	112 (56.3)	246 (59.1)
No response	14 (7.0)	49 (11.8)
Postpartum musculoskeletal pain		
Yes	70 (35.2)	123 (29.6)
No	127 (63.8)	290 (69.7)
No response	2 (1.0)	3 (0.7)
Postpartum SUI		
Yes	38 (19.1)	113 (27.2)
No	159 (79.9)	301 (72.4)
No response	2 (1.0)	2 (0.5)
RA separation		
Yes	64 (32.2)	122 (29.3)
No	100 (50.3)	220 (52.9)
Unsure	32 (16.1)	71 (17.1)
No response	3 (1.5)	3 (0.7)
Antenatal weight training		
Yes	86 (43.2)	156 (37.5)
No	113 (56.8)	260 (62.5)

RA, rectus abdominis; SUI, stress urinary incontinence.
[a]Among multiparous women.

the same or more enjoyment from running as they did prior to their most recent pregnancy. In relation to prepregnancy injury risk, approximately one-quarter of women perceived a greater risk after pregnancy. For most women, current average weekly mileage was 20 miles or less, and many reported running regularly for more than 6 years.

Maternal History and Postpartum Health Conditions

More than one-third (35%) of participants had postpartum musculoskeletal pain on returning to running after their most recent pregnancy (Table 1). The majority of these women cited pain in the lumbopelvic region (91%): low back, pelvis, and/or hips. Women who reported any postpartum musculoskeletal pain were more likely to have recurring musculoskeletal pain during that same pregnancy (Table 2).

Because SUI commonly afflicts women several years after childbirth, analyses were expanded to include women who had given birth to a child within the past 10 years. Twenty-seven percent of women had current symptoms of SUI that developed after their first pregnancy (Table 1). Among multiparous women, those who had a birth spacing of <2 years had significantly greater odds of postpartum SUI than women who had a greater period between births (Table 2). Postpartum SUI was also more common among women who had a vaginal-assisted delivery. Women who had a Caesarean section delivery had lower likelihood of SUI, while those with a spontaneous vaginal delivery experienced no significant increase in SUI.

Among women who had given birth to a child within the past 2 years, 32% perceived RA separation (Table 1). Compared with primiparous women, multiparous women were more likely to report a perceived RA separation (Table 2). The odds of perceived RA separation were greater among women with a Caesarean section delivery than women who never had a Caesarean section. Postpartum SUI increased the odds of perceived RA separation more than 2-fold (odds ratio [OR], 2.25; 95% confidence interval [CI], 1.02-5.08; $P = 0.040$).

Associations of Antenatal Weight Training

Of the 199 women who had a child within the past 2 years, 86 (43%) weight trained during pregnancy (Table 1). Weight training during pregnancy was significantly associated with lower odds of postpartum musculoskeletal pain (OR, 0.52; 95% CI, 0.28-0.94; $P = 0.030$). While antenatal pain was associated with postpartum pain among women who did not engage in antenatal weight training, this association was insignificant among those who reported weight training (Table 3).

Women who weight trained during pregnancy had significantly lower odds of postpartum SUI (OR, 0.46; 95% CI, 0.21-0.98; $P = 0.042$). A birth spacing of <2 years was associated with SUI among women who did not weight train during pregnancy (Table 3). However, SUI and birth spacing were not associated in women who reported antenatal weight training. A similar interaction between antenatal weight training, SUI, and any report of a vaginal-assisted delivery was also observed.

Perceived RA separation was less likely among women who weight trained during pregnancy (OR, 0.51; 95% CI, 0.26-0.96; $P = 0.037$). Compared with their primiparous counterparts, multiparous women who weight trained during pregnancy had increased odds of postpartum RA separation (Table 3). In contrast, multiparous women who did not weight train during pregnancy did not experience these increased odds. Antenatal weight training had no effect on the relationship between Caesarean section delivery and perceived RA separation.

DISCUSSION

Musculoskeletal pain, SUI, and RA separation are prevalent conditions among women who run after childbirth and are more likely to occur with specific maternal history characteristics. Antenatal weight training may be beneficial in reducing the odds of these adverse conditions in the postpartum period.

Antenatal and Postpartum Exercise Behavior

The majority of women exercised regularly during pregnancy, with many meeting the ACOG recommendations of 20 to 30 minutes of exercise most days of the week. Compared with results of other cross-sectional studies, the prevalence of antenatal exercise is much higher than that of women in the general population.[24,38] In a study among competitive runners, 70% ran during the antenatal period, with 31% running in the third trimester.[33] Many pregnant competitive runners also reduced their running volume from prepregnancy levels, similar to the reports of most participants in this study.[33]

Compared with nearly 50% of competitive runners, approximately one-quarter of women in this study returned to running within 1 month after childbirth.[33] ACOG recommendations suggest that women without medical contraindications gradually return to exercise after pregnancy.[2] However, the guidelines also state that rapidly resuming activity postpartum does not appear to pose any adverse effects.[2] Thus, women in this study who returned to running shortly after parturition were likely safe in doing so, presuming they had neither medical nor surgical complications.

Compared with prepregnancy, the majority of women did not perceive an increased risk of injury but decreased their running volume, running speed, and number of running races. Despite these declines, most women cited the same or greater enjoyment from running in the postpartum period. Continued enjoyment of running postpartum may have encouraged these women to maintain an active lifestyle after pregnancy.[12] This is important, as returning to and continuing physical activity after parturition significantly reduce one's risk of postpartum depression and assist in attaining prepregnancy weight and fitness.[11,21,30]

Maternal History and Postpartum Health Conditions

After pregnancy, more than 1 in 3 women reported musculoskeletal pain on return to running. As expected, the majority of this pain was located in the lumbopelvic region. A review found an average prevalence of 24.7% for postpartum lumbopelvic pain, but this varied widely among studies.[37]

Antenatal musculoskeletal pain was significantly associated with postpartum musculoskeletal pain. This association has

Table 2. Univariate analysis of maternal history and postpartum health conditions

	Odds Ratio	95% CI	*P* Value
Postpartum musculoskeletal pain[a]			
Antenatal musculoskeletal pain	3.08	1.64-5.88	<0.001
Multiparity	0.75	0.41-1.38	0.350
Birth spacing <2 y	0.61	0.26-1.35	0.215
Delivery mode			
Any vaginal	0.83	0.43-1.64	0.584
Any vaginal-assisted	0.74	0.29-1.75	0.490
Any Caesarean section	1.00	0.49-1.96	0.985
Stress urinary incontinence[b]			
Antenatal musculoskeletal pain	1.01	0.61-1.65	0.978
Multiparity	1.08	0.68-1.75	0.736
Birth spacing <2 y	1.71	1.00-2.91	0.046
Delivery mode			
Any vaginal	1.52	0.95-2.51	0.084
Any vaginal-assisted	2.08	1.24-3.47	0.005
Any Caesarean section	0.58	0.35-0.96	0.033
Rectus abdominis separation[a]			
Antenatal musculoskeletal pain	0.83	0.42-1.63	0.584
Multiparity	2.11	1.08-4.26	0.029
Birth spacing <2 y	2.08	0.91-4.88	0.077
Delivery mode			
Any vaginal	1.18	0.57-2.56	0.647
Any vaginal-assisted	0.71	0.27-1.72	0.434
Any Caesarean section	2.20	1.05-4.70	0.033

CI, confidence interval.
[a]Among women who reported giving birth within the past 2 years.
[b]Among women who reported giving birth within the past 10 years.

been observed in other studies that have not also accounted for antenatal and postpartum activity.[26,34,36,37] While parity was not associated with postpartum musculoskeletal pain, previous studies have suggested a possible relationship.[23,26] However, this association may be confounded by maternal age and conflicts with other studies that have cited no relationship.[16,34,37]

SUI that persists during the postpartum period can have negative effects on a woman's daily life and may prevent her from participating in physical activity.[6,14] Twenty-seven percent of these postpartum runners experienced symptoms of SUI that began after their first pregnancy. A review of incontinence 3 months after pregnancy demonstrated a pooled prevalence of 33% and found that longitudinal studies showed little change in this prevalence over the first postpartum year.[35]

Similar to other studies, postpartum SUI was less likely among women who had a Caesarean section and more likely among those with a vaginal-assisted delivery.[14,35] Pudendal nerve damage during vaginal delivery may decrease the strength of

Table 3. Associations of antenatal weight training with maternal history and postpartum conditions

Maternal History	Postpartum Condition	Reported Weight Training			Did Not Report Weight Training		
		OR	95% CI	*P* Value	OR	95% CI	*P* Value
Antenatal pain	Postpartum pain	2.00	0.68-5.82	0.183	3.66	1.62-8.56	0.001
Birth spacing <2 y	SUI	1.30	0.50-3.30	0.581	1.96	1.02-3.79	0.041
Vaginal-assisted delivery	SUI	1.73	0.64-4.33	0.249	2.28	1.21-4.29	0.009
Multiparity	RA separation	3.42	1.14-12.0	0.025	1.39	0.57-3.48	0.454
Caesarean section delivery	RA separation	2.33	0.64-8.28	0.192	1.93	0.75-5.14	0.163

OR, odds ratio; CI, confidence interval; RA, rectus abdominis; SUI, stress urinary incontinence.

the pelvic floor muscles (PFMs) and lead to SUI.[1,3] Prior research has also suggested that reductions in vaginal resting pressure (VRP) may occur after vaginal-assisted delivery.[18] PFM strength, PFM endurance, and VRP decreased by 66%, 65%, and 30%, respectively, from midpregnancy to 6 weeks postpartum in women after vaginal-assisted deliveries.[18] These declines in PFM function and VRP may contribute to the development of postpartum SUI.

In the later stages of pregnancy, many women experience a separation of the 2 RA muscles at the linea alba as the uterus expands out of the pelvis. This separation frequently lasts into the postpartum period and may only partially resolve within 1 year after parturition.[10,19] Thirty-two percent of women who had a child within the past 2 years reported perceived RA separation, similar to a study of women 6 months postpartum.[22]

In this study, perceived RA separation was associated with increased parity and Caesarean section delivery. These associations are consistent and may be related to cumulative physical stress placed on the connective tissue of the RA.[5,20,28,32] This study also found a relationship between perceived RA separation and current symptoms of postpartum SUI. This finding suggests that physical disruption of the abdominal muscles, as indicated by a separation of the RA, may be associated with weakness or dysfunction of the PFM and is supported by previous evidence.[32]

Antenatal Weight Training

While postpartum musculoskeletal pain, SUI, and RA separation are common among active postpartum women, antenatal weight training may reduce the odds of each of these conditions. Musculoskeletal pain, SUI, and RA separation are related to or the result of lumbopelvic, abdominal, and PFM dysfunction and weakness.[15,16,18,19,31] Weight training during pregnancy may strengthen abdominal and PFMs, prevent lumbopelvic instability and pelvic floor dysfunction, and thereby reduce the odds of these postpartum conditions. Previous evidence suggests that antenatal exercise, particularly abdominal strengthening, decreases the intensity of low back pain in pregnant women and may help prevent or improve postpartum RA separation.[5,9,13] Exercises specifically targeting the PFM also tend to improve outcomes regarding SUI.[3,7] Additionally, supine and machine-based exercises have been found to increase intravaginal pressure, which may strengthen PFMs, but these effects are variable in women.[25]

The associations observed between antenatal weight training and postpartum conditions in this study may also be related to prepregnancy activity or overall fitness. All the women who reported weight training during pregnancy also trained prior to pregnancy. Thus, we could not determine whether antenatal weight training itself or the history and continuation of this activity into the antenatal period contributed to these findings.

Limitations

Like all survey design studies, these results are subject to recall bias. To address this concern, most of the analyses were restricted to women who gave birth within the past 2 years. Additionally, women with more severe symptoms of these postpartum conditions may have been more likely to complete the survey, resulting in potential bias. Because most participants of this study engaged in vigorous-intensity activity before, during, and after pregnancy and all were currently running on a regular basis, the study findings may not be generalizable to a less active population.

While detailed information was collected on antenatal and postpartum running, participants were not asked specific questions about their weight training behaviors. Therefore, the type, duration, or intensity of weight training is unknown. Body mass index and age were not accounted for in the analyses, which could further bias the results. Maternal body mass index and age may not affect postpartum musculoskeletal pain,[23,34,36]

SUI,[4,14,17] or RA separation.[22,28] However, much of the evidence is conflicting.[5,14,16,32,34,36,37]

CONCLUSION

Postpartum musculoskeletal pain, SUI, and RA separation are associated with specific maternal history characteristics. Women who engaged in antenatal weight training had lower odds of postpartum musculoskeletal pain, SUI, and perceived RA separation even with potential risk factors.

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