

Risk Factors for Running-Related Pain After Childbirth



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School of Health Sciences, College of Health, Medicine and Wellbeing

The University of Newcastle

This is to certify that the thesis entitled *Risk Factors for Running-Related Pain After Childbirth*, submitted in fulfilment of the requirements for the degree Doctor of Philosophy (Physiotherapy), is in a form ready for examination.

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By signing below, I confirm that Shefali Christopher contributed to the concept and research design, acquisition of data, analysis and interpretation of data, as well as writing, reviewing and editing of the publications entitled:

- **Christopher S**, McCullough J, Snodgrass SJ, Cook C. Do alterations in muscle strength, flexibility, range of motion, and alignment predict lower extremity injury in runners: a systematic review. *Archives of Physiotherapy*. 2019;9(2):1-4
- **Christopher S**, McCullough J, Snodgrass SJ, Cook C. Predictive risk factors for first-onset lumbopelvic pain in postpartum women: a systematic review. *Journal of Women's Health Physical Therapy*. 2019 Jul 1;43(3):127-35.
- **Christopher S**, Garcia AN, Snodgrass SJ, Cook C. Common musculoskeletal impairments in postpartum runners: an international Delphi study. *Archives of Physiotherapy*. 2020 Oct;10(19)
- **Christopher SM**, Cook CE, Snodgrass SJ (2021) What are the biopsychosocial risk factors associated with pain in postpartum runners? Development of a clinical decision tool. *PLoS ONE* 16(8): e0255383.
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- **Christopher SM**, Cook CE, Snodgrass SJ (2021) What are the biopsychosocial risk factors associated with pain in postpartum runners? Development of a clinical decision tool. *PLoS ONE* 16(8): e0255383. <https://doi.org/10.1371/journal.pone.0255383>

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Table of Contents

Statement of Originality	iii
Acknowledgement of Authorship	iv
Copyright Permission	vi
Acknowledgements	vii
Publications and Presentations Arising from this Thesis	ix
Table of Contents	xi
List of Figures	xvi
List of Tables	xvii
Abstract	1
Background	1
Purpose	1
Methods	1
Results	2
Conclusions	3
CHAPTER 1. Introduction	4
1.1 Background	4
1.1.1 Current Evidence	6
1.2 Rationale for the Thesis	8
1.3 Aims and Hypothesis	8
1.3.1 Aims	9
1.3.2 Specific Aims of the Studies in this Thesis	9
1.4 Overview of Thesis	10
1.5 Significance	11
CHAPTER 2. Literature Review	13
2.1 Introduction	13
2.2 Risk Factors for Running Injuries and Pain in the General Population	15
2.2.1 Personal Factors	39
2.2.1.1 Short Distance Runners	39
2.2.1.2 Long Distance Runners	40
2.2.1.3 Running Distance Not Reported	41
2.2.2 Training Factors	42
2.2.2.1 Short Distance Runners	42
2.2.2.2 Long Distance Runners	43
2.2.2.3 Running Distance Not Reported	43

2.2.3 Biomechanics Factors.....	44
2.2.3.1 Short Distance Runners	44
2.2.3.2 Long Distance Runners.....	44
2.2.3.3 Running Distance Not Reported	45
2.2.4 Health Factors	46
2.2.4.1 Short Distance Runners	47
2.2.4.2 Long Distance Runners.....	47
2.2.4.3 Running Distance Not Reported.....	47
2.3 Risk Factors for Running Injuries and Pain in Female Runners.....	47
2.3.1 Personal Factors	48
2.3.1.1 Short Distance Runners	48
2.3.1.2 Long Distance Runners.....	49
2.3.2 Training Factors	49
2.3.2.1 Short Distance Runners	49
2.3.2.2 Long Distance Runners.....	50
2.3.3 Biomechanics Factors.....	50
2.3.3.1 Short Distance Runners	50
2.3.3.2 Long Distance Runners.....	50
2.3.3.3 Running Distance Not Reported	52
2.3.4 Health Factors	52
2.4 Risk Factors for Running Injuries and Pain in Postpartum Runners	52
2.4.1 Personal Factors	53
2.4.2 Training Factors	53
2.4.3 Biomechanics Factors.....	53
2.4.4 Health Factors	53
2.5 Unique Considerations for the Postpartum Population	54
2.5.1 Recovery from Pregnancy and Birthing Process	55
2.5.2 Neuromuscular Weakness and Structural Changes.....	55
2.5.3 Weight Gain.....	56
2.5.4 Biomechanical Considerations for Running.....	57
2.6 Postpartum Pain in Non-Running Populations	58
2.6.1 Risk Factors for Pain in Postpartum Non-Running Populations.....	58
2.6.2 Specific Causes of Pain in Postpartum Women.....	59
2.7 Summary.....	60
CHAPTER 3. Do Alterations in Muscle Strength, Flexibility, Range of Motion, and Alignment Predict Lower Extremity Injury in Runners: A Systematic Review	63
3.1 Overview	63

CHAPTER 4. Predictive Risk Factors for First-Onset Lumbopelvic Pain in Postpartum Women: A Systematic Review.....	78
4.1 Overview	78
4.2 Abstract.....	80
4.2.1 Background	80
4.2.2 Objectives	80
4.2.3 Study Design.....	80
4.2.4 Methods	80
4.2.5 Results	81
4.2.6 Conclusion	81
4.3 Introduction.....	81
4.4 Methods	83
4.4.1 Study Design.....	83
4.4.2 Search Strategy.....	83
4.4.3 Inclusion/Exclusion Criteria	84
4.4.4 Study Selection.....	85
4.4.5 Data Extraction.....	85
4.4.6 Quality Assessment	85
4.4.7 Risk Factors	86
4.5 Results	87
4.5.1 Study Selection and strategy.....	87
4.5.2 Quality of Studies.....	89
4.5.3 Data Extraction.....	89
4.5.3.1 Incidence of First Onset Low Back Pain	90
4.5.3.2 Identification of risk factors.....	94
4.5.3.2.1 Back Pain	94
4.5.3.2.1.1 Extrinsic Risk Factors.....	94
4.5.3.2.1.2 Intrinsic Risk Factors.....	95
4.5.3.2.1.3 Mixed Risk Factor	95
4.5.3.2.2 Pelvic Pain.....	96
4.6 Discussion.....	96
4.7 Conclusion	102
4.8 Chapter 4 Appendices	103
4.8.1 PRISMA Checklist.....	103
4.8.2 Search Strategy.....	106
CHAPTER 5. Common Musculoskeletal Impairments in Postpartum Runners: An International Delphi Study	108
5.1 Overview	108

CHAPTER 6. What are the Biopsychosocial Risk Factors Associated with Pain in Postpartum Runners? Development of a Clinical Decision Tool.....	121
6.1 Overview	121
CHAPTER 7. Biomechanical and Musculoskeletal Differences Between Postpartum Runners and Nulliparous Controls	137
7.1 Overview	137
7.2 Introduction.....	139
7.3 Methods	141
7.3.1 Experimental Approach to the Problem	141
7.3.2 Eligibility Criteria.....	142
7.3.3 Overground Running Kinetics	142
7.3.4 Flexibility and Strength Measurements.....	143
7.3.5 Statistical Analysis	144
7.4 Results	145
7.4.1 Demographics	145
7.4.2 Overground Running Kinetics	145
7.4.3 Flexibility and Strength	147
7.5 Discussion.....	149
7.5.1 Limitations	151
7.6 Conclusion.....	152
7.7 Supplemental Digital Content A.....	153
7.7.1 Positioning for Lower Extremity Flexibility and Strength testing (Gabbe et al; Faherty et al, 2020)	153
7.7.1.1 Flexibility.....	153
7.7.1.2 Lower Extremity (LE) Strength	153
CHAPTER 8. Summary and Conclusions	155
8.1 Summary of Study Findings.....	155
8.1.1 What is the evidence for alterations in muscle strength, flexibility, joint range of motion, and alignment to predict lower extremity injury in runners?	156
8.1.2 What is the evidence for risk factors (modifiable and nonmodifiable) for first-onset lumbopelvic pain during the postpartum period?	158
8.1.3 What are the common musculoskeletal impairments and risk factors for pain in postpartum runners, as perceived by experts in female running or pelvic health?	159
8.1.4 What biopsychosocial and musculoskeletal risk factors are associated with pain in postpartum runners?	161
8.1.5 What are the musculoskeletal differences in overground running kinetics, strength, and flexibility between postpartum runners and age-matched nulliparous controls?	162
8.2 Limitations of the Studies.....	163

8.2.1 Study 1 (Chapter 3)	163
8.2.2 Study 2 (Chapter 4)	164
8.2.3 Study 3 (Chapter 5)	164
8.2.4 Study 4 (Chapter 6)	165
8.2.5 Study 5 (Chapter 7)	166
8.3 Strength of Studies	166
8.3.1 Overall Strength of the Thesis	166
8.3.2 Specific Strengths of Each Study	167
8.4 Implications for Research and Clinical Practice.....	170
8.4.1 Implications for Future Research	170
8.4.1.1 Validation of Risk Factors Associated with Running-Related Pain in Postpartum Runners	170
8.4.1.2 Validation of Pregnancy-Related Changes and the Effects of Pain on Outcomes	171
8.4.1.3 Intervention Studies.....	171
8.4.1.4 Future Research Recommendations From Each Study.....	172
8.4.2 Clinical Implications	174
8.4.2.1 Clinical Implications from Each Study.....	175
8.5 Future Research Questions	179
8.6 Conclusions.....	181
CHAPTER 9. References.....	183
CHAPTER 10. Appendices.....	225
Appendix A: Statements from Co-Authors of Published Papers	226
Appendix B: Journal of Orthopedic and Sports Physical Therapy- Viewpoint	237
Appendix C: Journal of Women’s Health Physical Therapy - Clinical Commentary	243
Appendix D: Delphi Survey Consent and Survey Round I.....	280
Appendix E: Delphi Round II Survey.....	296
Appendix F: Delphi Round III Survey.....	312
Appendix G: Survey Flyer (Study 4, Chapter 6).....	408
Appendix H: Survey Questionnaire (Study 4, Chapter 6).....	410

List of Figures

Figure 4.1 PRISMA flow diagram.....	88
Figure 7.1 Comparison of mean instantaneous braking loading rates between postpartum runners and nulliparous controls.....	146
Figure 7.2 Comparison of mean hamstring flexibility between postpartum runners and nulliparous controls.....	148
Figure 7.3 Comparison of mean A) Hip abduction strength and B) hip adduction strength between postpartum runners and nulliparous controls.	148

List of Tables

Table 1.1 USA Running Trends 2020 Report data, which summarizes everyone who registered for USA running-related races in 2019.....	4
Table 2.1 Comprehensive summary of risk factors associated with running-related injury in the general, female and postpartum populations respectively.....	16
Table 4.1 Quality of prognostic study tool results in the four articles.....	89
Table 4.2 Predictive risk factors for lumbopelvic pain reported in the studies included in this review	91
Table 4.3 Strength of significant odds ratios for postpartum first onset low back pain	95
Table 7.1 Comparing mean \pm SD of overground running kinetics from vertical ground reaction force between postpartum runners and nulliparous controls	146
Table 7.2 Comparing mean \pm SD of overground running kinetics from antero-posterior ground reaction force between postpartum runners and nulliparous controls	147
Table 7.3 Comparing mean \pm SD of bone mineral density, flexibility and strength between postpartum runners and nulliparous controls	149

Abstract

Background

Women are initiating or returning to running for exercise after childbirth while also recovering from a myriad of perinatal changes to the body. For these women, integration into a high impact sport is not easy; up to 35% of postpartum runners report painful running. While there are established evidence-based rehabilitation protocols for returning to sport after a major injury, such evidence does not exist for the postpartum running population. This is likely due to a lack of evidence on possible musculoskeletal risk factors associated with running-related pain in postpartum women. A baseline understanding of potential risk factors for running-related pain in postpartum runners is needed to provide a starting point for future validation and interventional studies.

Purpose

The overall aim of this thesis is to identify possible risk factors for running-related pain in postpartum runners and determine their relationship to running, postpartum variables, and movement kinematics.

Methods

Because information on risk factors for running-related musculoskeletal injury in postpartum runners was non-existent, a systematic review was initially performed to understand the relationship between running injury and musculoskeletal strength, flexibility, range of motion and alignment alterations. A separate systematic review was also conducted to understand the risk factors associated with first-onset lumbopelvic pain (the most common type of pain) in postpartum women. A Delphi study was performed to gain expert consensus on musculoskeletal impairments and running-related risk factors

observed in postpartum runners. The information gathered from these studies was used to design and conduct a survey of postpartum runners with and without running-related pain to explore the relationship between demographic, postpartum and running-related risk factors, and pain. Since the effects of postpartum musculoskeletal changes on running are unknown, a laboratory study determined kinematic and musculoskeletal differences between postpartum runners and nulliparous controls.

Results

Both systematic reviews found low-quality evidence and bias within the studies reviewed. Seven studies found seven clinical assessments that predict running-related pain: hip strength, range of motion, flexibility, and alignment, and, knee strength and ankle alignment. Four studies identified five risk factors associated with first-onset postpartum lumbopelvic pain: C-section with epidural anesthesia, length of first stage labor, race, age and urinary tract infections. The 45 experts in the Delphi study reached consensus on the following risk factors observed in postpartum runners: abdominal, hip, and pelvic floor weakness, hip extension restriction, anterior pelvic tilt, general hypermobility, laxity in the abdominal wall, tightness in hip flexors, lumbar extensors, iliotibial band and hamstrings, a Trendelenburg sign, dynamic knee valgus, lumbar lordosis, over-pronation, and thoracic kyphosis. The survey of 538 postpartum runners found six variables that increased the odds of postpartum running-related pain: runner type-novice, postpartum accumulated fatigue scale score, previous running injury, most recent delivery-vaginal, incontinence, and amount of sleep. Using these variables, a clinical tool was created that indicated a 62% probability of having postpartum running-related pain if 4 of 6 variables were present. The laboratory study concluded that postpartum runners had 24.3% greater braking loading rate (mean difference (MD): 3.41 NBW/s; 95% CI 0.08, 6.74), 14% less hamstring flexibility (MD:10.98°; 0.97, 20.99), 25.9% less hip abduction (MD: 0.04

NBW, 95% CI 0.00, 0.08), and 51.6% less hip adduction strength (MD: 0.06 NBW; 0.02, 0.10) than controls.

Conclusions

This thesis established the first steps in identifying running-related risk factors in postpartum runners. This baseline understanding of potential risk factors for running-related pain provides a starting point for prospective studies to investigate risk factors for the onset of running-related pain in postpartum runners. It can also assist health care providers educate postpartum runners and develop interventions to assist postpartum women to stay injury free as they initiate or return to running.