Why does exercise in water reduce breast pain?

Nichola Renwick[1], Jonathan White[1], Carlie Jones-Hershinow[2], Chris Mills[1], Joanna Wakefield-Scurr[1]
[1]Research Group in Breast Health, School of Psychology, Sport and Health Sciences, University of Portsmouth, UK
[2]Under Armour, Portland, USA
Email: nichola.renwick@port.ac.uk

Summary

This study investigated breast-torso coordination during jogging under various breast support conditions using continuous relative phase (CRP) analysis to explore its relationship with exercise-induced breast pain. Ten females jogged bare-breasted and in a sports bra on land, and bare-breasted in water, while left breast and torso motion were captured using electromagnetic sensors. CRP analysis revealed that breast-torso coordination patterns differed between breast support conditions, with higher CRP variability in the land bare-breasted and bra conditions compared to water. Three CRP variables showed moderate correlations with breast pain: time spent in-phase, CRP at right foot midstance, and CRP at right toe-off. Significant differences in CRP variables were observed around midstance, suggesting that the inferior breast time-lag, or "breast slap," contributes to exercise-induced breast pain. These findings highlight the role of breast support in mitigating pain during exercise.

Introduction

During running, as the torso begins to ascend following foot strike, the breast continues to move downwards before abruptly decelerating. This breast-torso time-lag results in the inferior aspect of the breast slapping down against the chest wall with this movement thought to be a contributing factor to exercise-induced breast pain [1]. Exercising in water has resulted in women experiencing less exercise-induced breast pain which is thought to be due to reduced velocity of the breast [2]. While previous research has explored breast-torso coordination using vector coding, a continuous relative phase (CRP) analysis may offer better insights into the role of velocity in mitigating breast pain. The aim of this study was to evaluate breast-torso coordination using CRP and evaluate the relationship between CRP and breast pain.

Methods

Ten females jogged on the spot while bare-breasted and in a sports bra on land and then in water while bare-breasted at a matched step rate of 160bpm. Electromagnetic sensors captured nipple and torso motion calculated relative to a global reference system; gait cycles were identified from right foot contact. Participants rated perceived breast pain (scale 0 to 10). CRP was used to analyse superior-inferior (SI) breast-torso coordination and its variability (SD across a gait cycle). CRP was averaged across ten gait cycles for each participant; CRP variables were compared between breast support conditions using a repeated measures ANOVA. Spearman's rho correlation coefficients assessed the relationship between breast pain and CRP variables.

Results and Discussion

CRP analysis demonstrated that patterns of breast-torso coordination varied between conditions during midstance (Table 1). CRP variability was significantly higher in the land conditions (bare-breasted and bra) compared to water (Table 1). Three variables had a moderate relationship with breast pain: time spent in-phase ($r=.34$, $p=.033$), CRP at right foot midstance ($r=.33$, $p=.038$) and at right toe-off ($r=.32$, $p=.042$). Significant differences between conditions and variables with a relationship with breast pain occur around midstance where the torso has reached its lowest position and is beginning to ascend while the breast is continuing to move downwards therefore suggesting that "breast slap" is a contributing factor in exercise-induced breast pain.

Conclusions

Breast-torso coordination is significantly altered by changes in breast support and environment conditions during midstance. CRP analysis indicates that a delay in inferior breast movement relative to the torso, commonly referred to as "breast slap," could be a contributing factor in exercise-induced breast pain. These findings highlight the importance of appropriate breast support in mitigating discomfort during exercise.

Acknowledgments

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References

1. Haake et al, *Sports Eng* 2010
2. Mcghee et al, *Br J Sports Med* 2007

Table 1: Repeated measures ANOVA significant results for variables derived from CRP analysis across bare-breasted, sports bra and water conditions.

Variable	Bare-breasted Mean (SD)	Sports Bra Mean (SD)	Water Mean (SD)	Significant Pairwise Comparisons
CRP Variability (º)	109.4 (5.0)	107.1 (2.6)	102.3 (3.3)	BB > Water, p = .015; BRA > Water, p = .031
CRP Right foot midstance (º)	-4.1 (77.7)	22.5 (56.0)	-53.5 (32.1)	BRA > Water, p=.031
CRP Left foot midstance (º)	19.4 (74.9)	21.7 (78.1)	-49.4 (65.6)	BB > Water, p=.033; BRA > Water, p=.036