The Relationship Between Breast Acceleration and Perceived Comfort

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Summary

Excessive breast motion due to lack of support can cause breast pain and discomfort, reducing participation in physical activity. Most breast motion research has been conducted in laboratory environments, with few studies utilising inertial measurement units (IMUs). This study investigated the relationship between breast acceleration using IMUs and perceived comfort in nine female runners across two sports bra conditions. A significant relationship was found between comfort and breast acceleration while wearing a low support sports bra. Understanding this relationship will help to progress breast biomechanics research and bra development.

Introduction

Excessive breast motion during physical activity can contribute to breast pain and discomfort, affecting exercise performance and participation [1]. External breast support can reduce breast displacement and associated pain [1]. However, there are few evidence-based guidelines on breast support for active women [1], despite the effectiveness of sports bras varying with activity intensity [2]. Additionally, breast motion has predominantly been studied in laboratory environments, with few studies utilising inertial measurement units (IMUs), which allow for real-world assessment of breast kinematics. A study on larger breasted women (D and E cup) found a significant positive correlation between breast discomfort and acceleration during running [3]. Therefore, we aimed to investigate the relationship between breast acceleration and perceived comfort, providing insights for sportswear innovation.

Methods

Nine female runners (30.56 ± 4.65 years; 168.22 ± 5.51 cm; 60.67 ± 5.14 kg; cup size range: B-DD, band size range: 32-36) ran on a treadmill in standardised shoes at two speeds (2.7 m/s and 5.0 m/s) under two sports bra conditions (low and high support) in a randomised order. Three-dimensional breast acceleration was measured using four IMUs placed on the suprasternal notch, left and right breast (directly above the nipple) and sacrum. Breast acceleration was measured relative to the suprasternal IMU, and steps were segmented using the sacral IMU. Resultant acceleration was calculated per breast and averaged. After each condition, participants rated breast comfort on a seven-point Likert scale from extremely uncomfortable (1) to extremely comfortable (7). Correlation coefficients were calculated between breast acceleration and comfort, with a linear regression fit to determine if a simple linear relationship existed between breast acceleration and comfort.

Results and Discussion

Breast acceleration in the low support bra showed a very strong negative correlation with comfort when jogging ($r = -0.836$, $p < 0.01$) and running ($r = -0.751$, $p < 0.02$). In contrast, breast acceleration in the high support bra exhibited low correlations with comfort when jogging ($r = -0.193$, $p > 0.05$) or running ($r = 0.378$, $p > 0.05$), neither of which were statically significant. We found significant linear relationships between breast acceleration and comfort in the low support bra during jogging ($R^2 = 0.699$, $p_{coefficient}$ and $p_{intercept} < 0.01$) and running ($R^2 = 0.564$, $p_{coefficient} < 0.01$, $p_{intercept} < 0.05$). There was no significant relationship in the high support bra. These findings show that in low support bras, participants who experienced higher breast acceleration tended to be less comfortable, irrespective of running speed.

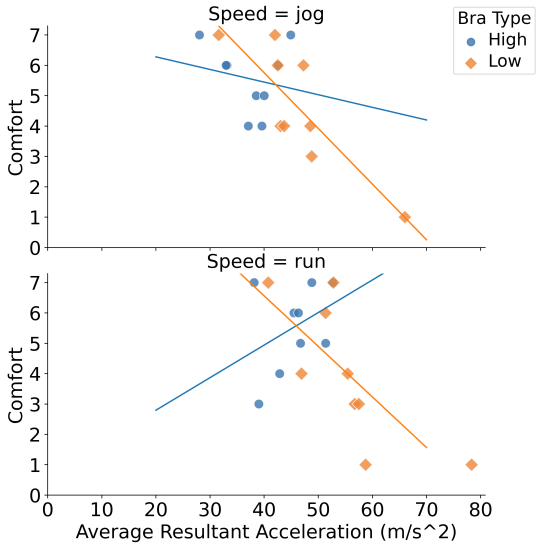

Figure 1: Perceived comfort and average breast acceleration with regression lines for low (orange) and high (blue) support bras.

Conclusions

When wearing a low support bra, higher breast acceleration is associated with reduced comfort. Using IMUs highlights how we can capture breast kinematics during real-world activities. This could increase the scope of breast motion research and improve sports bra innovation.

Acknowledgments

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References

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