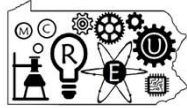


# Tibial Acceleration While Running With and Without a Stroller

## HMRC

Human Movement Research Center



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## Introduction

37-56% for runners are injured each year [1-2]

Overuse injuries account for 18% of injuries

Impact loading has been associated with several overuse injuries [3]

Tibial acceleration can be used as a surrogate measure for impact loading [4]

Stroller running has increased in popularity (1)

The population running with strollers may be vulnerable to overuse injuries due to lifestyle and physiological changes [5]

**Purpose:** To compare tibial acceleration of running with and without a stroller

Tibial acceleration will be collected using Internal Measurement Units (IMU's)

**Hypothesis:** Tibial acceleration will be less while running with a stroller

## Materials and Methods

### Subjects

Male and female runners (ages 18-45)

Minimum of 5 miles a week

No current injuries

### Protocol

IMU's placed on Foot, Shank, Thigh, Pelvis, Trunk, Hand)

2 minute warm up on treadmill

10 trials each of stroller, no stroller

### Processing

Data collected turned into CSV's

CSV's processed in MATLAB

### Analysis

Paired T-Test between stroller and non-stroller

## References

- [1] Hespanhol et al. Sports Med 2015 Oct
- [2] Hollander et al. BMJ Open Sport Exerc Med 2018 Jan
- [3] Milner et al. Med Sci Sports Exerc 2006 Feb
- [4] Tenforde et al. PM R. 2020 Jul
- [5] Edwards et al. NSCA. 2020 Feb
- [6] Milner et al. Med Sci Sports Exerc 2020 Jun
- [7] Johnson et al. Med Sci Sports Exerc 2020 Jul
- [8] Lafferty et al. Sports Health 2021
- [9] Baby Stroller Market. Statista Sept 2019

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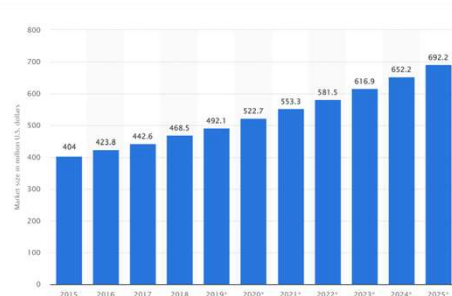


Figure (1). Popularity of stroller running [9]



Figure (2). Template for IMU placement

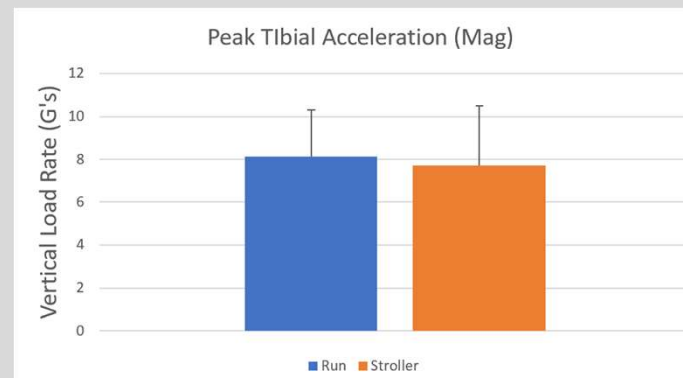


Figure (3). Bar graph of Peak Tibial Acceleration (Mag) with standard deviation

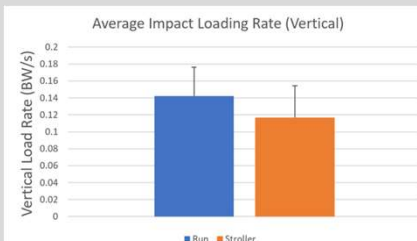


Figure (4). Bar graph of average Impact Loading Rate (Vertical) with standard deviation

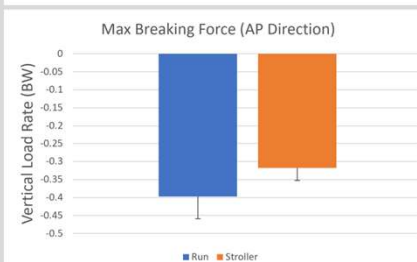


Figure (5). Bar graph of Max Breaking Force (AP Direction)

## Results

Data Collected on 11 Subjects

5% Reduction in Peak Tibial Acceleration ( $p = 0.388$ )

18% reduction in Average Impact Loading Rate (Vertical) ( $p < 0.05$ )

20% reduction in Max Breaking Force (AP Direction) ( $p < 0.05$ )

## Discussion

The decrease in Tibial Acceleration comes from the shared load of the stroller

Running with the stroller changes form

Stroller takes some of the load

Indoor lab experiment is slightly flawed

Peak acceleration is less in indoor than outdoors [6]

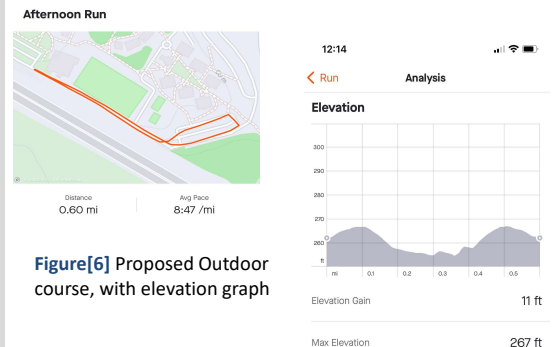
Indoor study is not realistic to outdoor conditions [7-8]

## Future Directions

Full Outdoor Trial

Running Test course with real life conditions

Data collected over much longer time frame



Figure[6] Proposed Outdoor running course, with elevation graph

## Conclusion

Overall, the study so far has found a trend that running with a stroller produces a reduction of tibial acceleration as well as impact loading