Influence of neuromuscular fatigue on the reliability of gait variability measures

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INTRODUCTION

- Walking in healthy young adults display an optimal pattern of variability from one stride to the next. (1,2)
- This level ensures that each step taken is not stereotyped but also not completely unpredictable.
- Previous studies have investigated differences in stride-to-stride characteristics comparing groups of young to groups of elderly. (3)
- **The first aim of this study is to determine the between day and between trial consistency of gait variability measures in healthy young adults.**
- While a decrease of optimal gait variability is evident with aging, the origins of this are unclear.
- It's possible that impairments of the muscular and neuromuscular systems increasing fatigue causes this inherent decrease in optimal gait variability.
- **The second aim of this study is to determine how neuromuscular fatigue will affect stride-to-stride variability.**

METHODS

- Fifteen healthy young subjects (age 19 -35) will participate in a five-day collection (Figure 1).
- Reflective markers will be placed in specific anatomical locations to collect spatiotemporal measures using a 12-camera system (stride time, stride with, stride length & stride speed).
- Lower body fatigue will be induced by asking subjects to perform a squat and calf raise task until they reach exhaustion and can no longer perform the task.
- Detrended fluctuation analysis (DFA) will be applied to spatiotemporal measures to quantify the amount of variability for each series (Figure 2). This will give us a scaling exponent, alpha, which estimates the pattern of variability for a given time series.

METHODS CONT.

- Cronbach's alpha from Intra-Class correlation will be used to estimate the reliability of alpha.

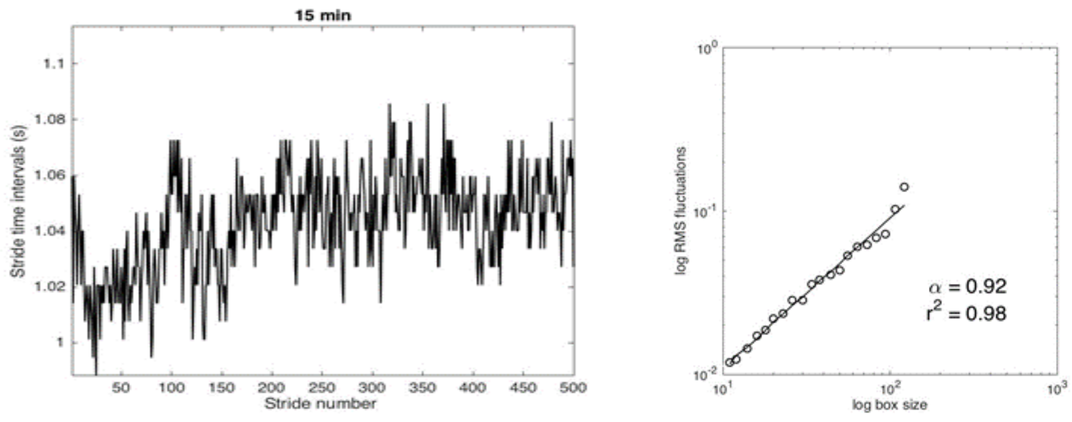

Figure 2: Stride time series and corresponding DFA value

DISCUSSION

- **Aim 1: Determine the reliability of gait variability measures**
- Hypothesis 1.1. The between-day intra-class correlation (ICC) will be above 0.7 for measures of gait variability, suggesting a high consistency from day-to-day.
- Hypothesis 1.2. The within-day ICC will be above 0.7 for measures of gait variability, suggesting a high consistency between trials for a given individual.
- **Aim 2: Determine the effect of neuromuscular fatigue on stride-to-stride variability**
- Hypothesis 2.1. Gait variability will be more random immediately after fatigue protocol
- Hypothesis 2.2. Gait variability will be back to normal values one day after the fatigue protocol.

CONCLUSIONS

- If confirmed, our results would suggest that any changes in DFA values observed for a given individual would likely be the result of experimental constraints, not an artifact from the measurement.

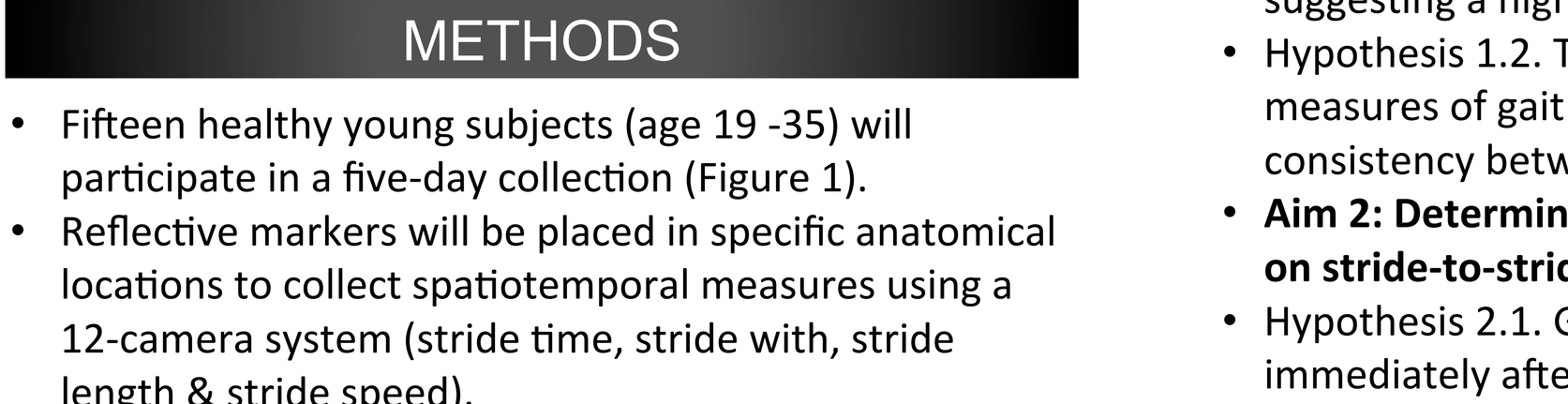

Figure 1. 5-day Protocol

REFERENCES

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[3] Goldberger *et al*. (2002) *Proc. Natl. Acad. Sci. U.S.A.*, 99, 2466-2472.

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