



Circadian rhythms and stride-to-stride fluctuations: is there a connection?

Joao R Vaz^a, Douglas Rowen^a, Nicholas Stergiou^{a,b}

a. Department Biomechanics, University of Nebraska at Omaha, Omaha, NE

b. College of Public Health, University of Nebraska Medical Center, Omaha, NE

INTRODUCTION

- Physiological systems exhibit rhythmic changes over the course of 24h¹ - **Circadian Rhythms**.
- Aging and neurological diseases have an increased likelihood of circadian disruption.
- Balance and gait exhibit diurnal variations^{2,3}.
- Gait is characterized by stride-to stride fluctuations⁴.
- A breakdown in the temporal structure of these fluctuations has been associated with aging and neurological diseases⁵.
- Circadian disruption may affect the stride-to-stride fluctuations over a 24h period.

The present study aims:

- 1) to investigate how stride-to-stride fluctuations vary throughout a day;
- 2) to examine the effects of chronotype in stride-to-stride fluctuations.

METHODS

Subjects:

- Three male participants (28.3±3.89yrs)

Data Collection:

- Chronotype (Morningness-Eveningness Questionnaire).
- 15min overground walking trials at 2h intervals (8am – 8pm), wearing insoles footswitches.

Data Analysis:

- Stride time was determined and we have calculated:
 - Mean.
 - Fractal scaling (i.e. temporal structure) was calculated through DFA⁶.

RESULTS & DISCUSSION

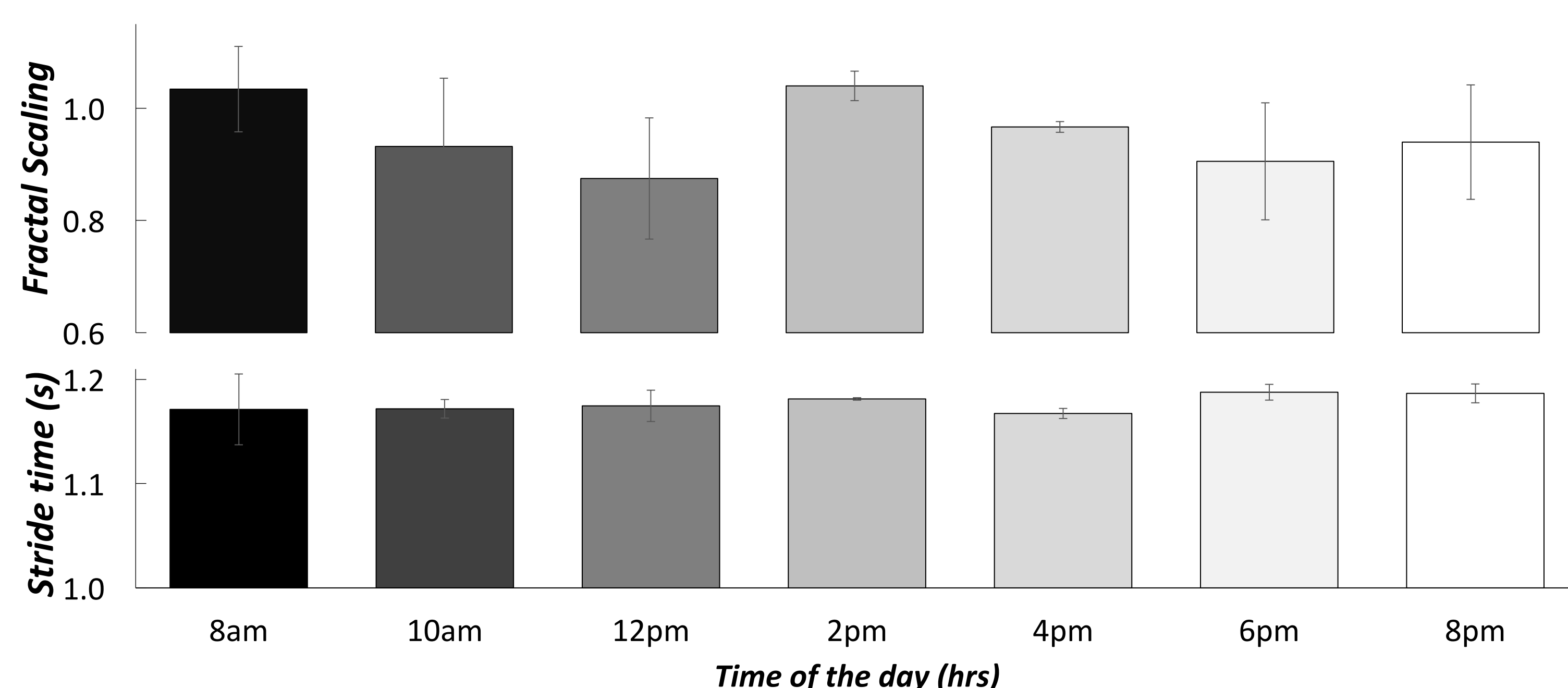


Figure 1. Mean group values of fractal scaling of inter-stride-intervals (upper panel) and stride time (lower panel) throughout the day.

- A certain cycle emerges for **daily fluctuations** of the fractal scaling of the **stride-to-stride fluctuations**. (Fig 1, upper panel)
- Consistency of the linear measures of stride time throughout the day (Fig 1, lower panel)

CIRCADIAN RHYTHM in gait control

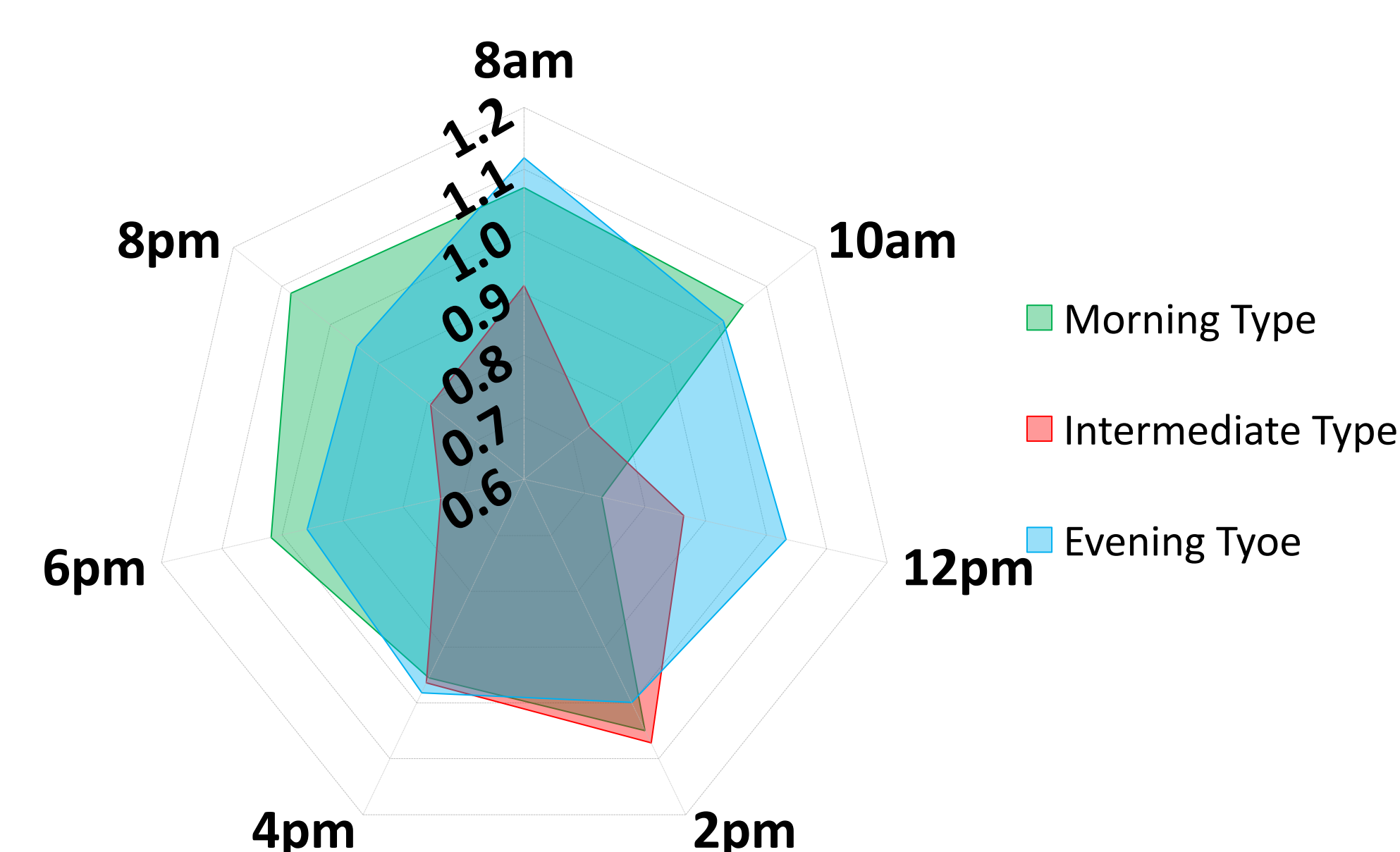


Figure 2. Individual daily pattern of α -value of stride time for three participants. Each chronotype seems to show a specific pattern of daily variations.

- Individuals with different chronotypes seem to present a specific pattern of gait variability

CONCLUSIONS

- Stride-to-stride fluctuations in gait are likely to be influenced by circadian rhythms.
- New insights of a potential increased risk of falling in older adults at specific times of the day that can be targeted of interventions.

REFERENCES

1. Bass et al. (2012). Nature . 49(7424):348-356
2. Bessot et al. (2015). Chronobiol Int. 32(1):136-142
3. Jorgensen et al. (2012). Gait & Posture . 35(4):683-687
4. Hunt et al. (2014) Sci Rep . 4:5879
5. Hausdorff et al. (1997). J Appl Physiol . 82(1):262-269
6. Peng et al. (1995). Chaos . 5(1):82-87

ACKNOWLEDGEMENTS

This work was supported by NIH-P20GM109090 and NIH-R15HD08682