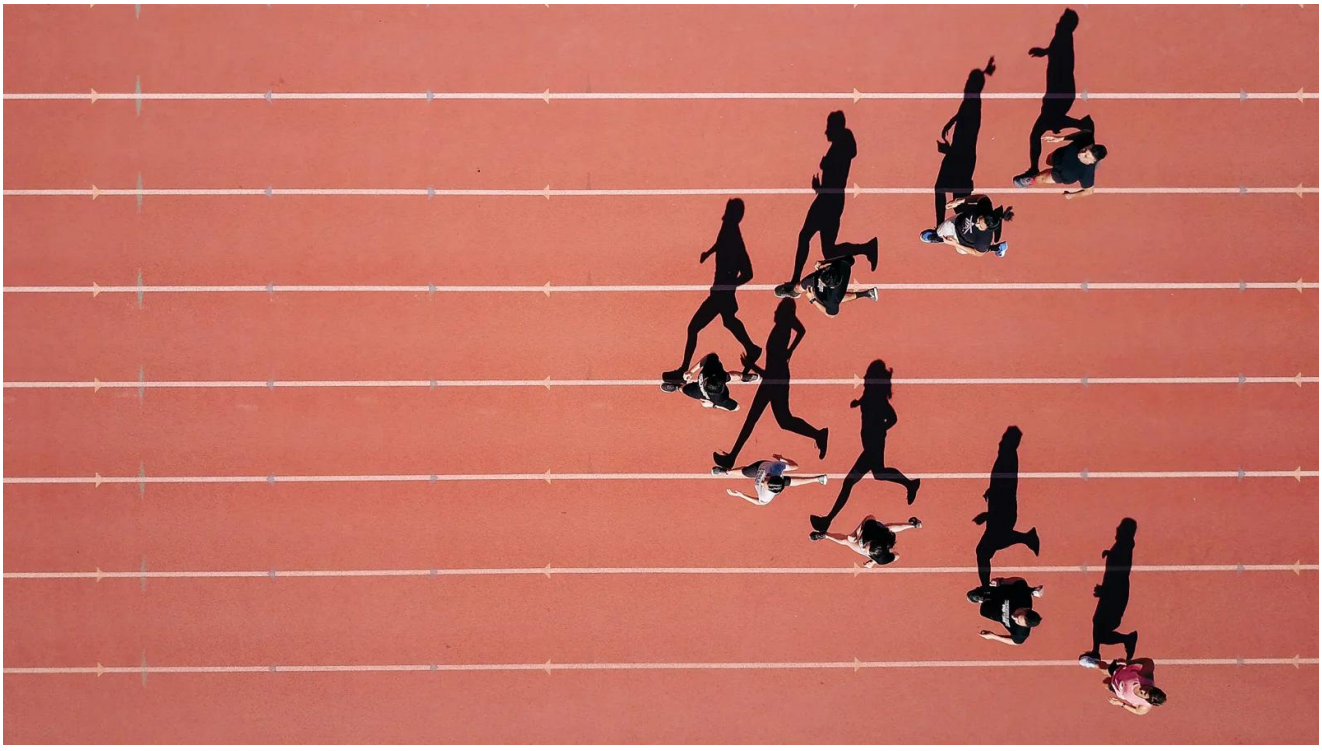
Iranian Society for Exercise Physiology

Evening Exercise Performance Is Higher Than Morning Performance, With Differences Associated With Individual Chronotype

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A study published in the European Journal of Applied Physiology found that healthy young adults performed better during a 10-minute cycling time trial in the evening than in the morning. In a randomized crossover study involving 24 participants, mean power, peak power, and distance covered were significantly higher in the evening. Individual chronotype and habitual sleep timing were associated with the magnitude of the performance difference, highlighting the potential importance of circadian characteristics in exercise testing and prescription.

How Circadian Characteristics Influence Morning and Evening Exercise Performance

Human exercise performance is not necessarily constant throughout the day. Sleep–wake cycles, core body temperature, hormonal rhythms, and other circadian processes may influence physical performance at different times.

An important question in exercise physiology is whether morning-to-evening performance differences are similar across individuals or whether personal circadian characteristics contribute to these variations.

A study published on July 15, 2026, in the European Journal of Applied Physiology examined the relationship between chronotype, habitual sleep timing, and exercise performance during morning and evening testing.

Study Design and Participants

The randomized crossover study involved 24 healthy young adults, including 12 men and 12 women.

Each participant completed two 10-minute cycling time trials:

- Morning trial between 8:00 and 9:00 a.m.
- Evening trial between 5:00 and 6:00 p.m.

Trial order was randomized and counterbalanced, with at least 72 hours between sessions.

To reduce potential confounding effects, researchers standardized pre-trial sleep, dietary intake, and physical activity as closely as possible.

Participants also underwent seven days of wrist-worn activity monitoring to characterize habitual sleep and wake timing.

Assessing Chronotype and Sleep Timing

Chronotype refers to an individual's tendency to prefer activity and sleep at particular times of the day.

Some individuals naturally favor earlier schedules, while others prefer later sleep and activity periods.

In this study, chronotype was assessed using the Composite Morningness Questionnaire.

Researchers also calculated sleep midpoint, defined as the halfway point between sleep onset and waking.

Sleep midpoint provides a behavioral indicator of habitual circadian timing, although it does not directly measure the body's endogenous circadian phase.

Better Performance During Evening Trials

The researchers found that mean cycling power output was significantly higher in the evening than in the morning.

The average difference was 6.57 watts.

Peak power output was also greater in the evening, with a mean difference of 16.48 watts.

Participants covered approximately 0.11 kilometers more during the evening time trial.

All three performance outcomes demonstrated statistically significant morning-to-evening differences.

The researchers reported that mean power output was approximately 6–8% higher in the evening.

The effect was observed in both male and female participants, with no statistically significant interaction between sex and time of day.

Chronotype Was Associated With Performance Differences

One of the most important findings was the association between circadian characteristics and the magnitude of the evening performance advantage.

Participants with a stronger evening preference generally demonstrated greater improvements in evening performance relative to morning performance.

Chronotype scores were negatively correlated with the evening-minus-morning difference in mean power output, with a correlation coefficient of −0.47.

Habitual sleep midpoint was also associated with performance differences, with a correlation coefficient of 0.52.

Later sleep timing was associated with a greater evening performance advantage.

Chronotype explained approximately 22% of the variance in individual performance differences, while sleep midpoint explained approximately 27%.

These findings suggest that individual sleep timing and circadian preferences may contribute to differences in performance across the day.

However, the associations do not establish causality.

Physiological Responses During Morning and Evening Exercise

Despite higher evening performance, heart rate responses did not differ significantly between testing conditions.

Blood lactate responses were also comparable.

Overall perceived exertion did not demonstrate a significant main effect of time of day, although a small interaction in the perceptual response was observed.

Core body temperature was slightly higher in the evening.

However, this difference did not independently explain the observed performance advantage.

These findings indicate that improved evening performance was not accompanied by substantial differences in all measured cardiovascular and metabolic responses.

Implications for Exercise Testing and Prescription

The findings suggest that time of day should be considered when evaluating exercise performance.

For repeated performance assessments, testing at consistent times may help reduce variability associated with daily physiological rhythms.

Chronotype and habitual sleep timing may also provide useful information when scheduling training sessions or performance evaluations.

Nevertheless, the study does not establish that evening exercise is optimal for everyone.

The sample was relatively small and consisted of healthy young adults.

Each participant completed only one morning and one evening experimental trial, and the investigation did not assess long-term training adaptations.

Therefore, the findings cannot determine whether regularly training in the evening produces greater improvements than training in the morning.

Overall, the study supports considering both time of day and individual circadian characteristics when interpreting exercise performance and developing personalized exercise strategies.

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