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Research Paper

The Static Balance Performance Prediction Based on Arousal and Activation in Circadian Rhythm

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ABSTRACT

Background and Aims Time-of-day is a factor that could affect balance performance. On the other hand, arousal fluctuates throughout the day. The aim of this study was to investigate the static balance performance prediction based on arousal and activation in circadian rhythm.

Methods In the current study, 30 healthy subjects (age= 21± 0.5 years) participated. Static balance performance was measured three times: 10:00 am, 15:00 pm, and 8:00 pm. Arousal was recorded continuously during the performance of the balance task. A balance scoring test (BESS) and a Bioderm device were used to measure static balance and arousal. Repeated measures ANOVA, Pearson correlation coefficient, and regression analysis were used to analyze the data.

Results Results indicated that balance performance was greater at 3:00 pm than at 8:00 pm and 10:00 am ($P<0.05$). The relationship between activation and static balance performance was significant ($P<0.05$), while no significant relationship was found between arousal and static balance performance. Also, the intensity of activation correlation and static balance performance was higher at 3:00 pm ($P<0.05$, $r=-0.46$). The regression results showed that activation was a significant predictor at three different times of the day.

Conclusion According to the results, these findings can provide evidence for differentiation between arousal and activation as separable aspects of the energetics of physiological and behavioral function. It also introduces activation as a factor that raises the static balance in the afternoon to morning and evening.

Keywords Arousal, Activation, Skin Conductance Level, static Balance, Performance

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Extended Abstract

Introduction

Optimal postural balance is an important foundation for the individual's ability to perform the movement, and constitutes a central element in ensuring adequate movement capabilities. The time-of-day effect is recognized as a physiologic and neurologic function, which is influenced by diurnal patterns to follow a proposed circadian rhythm in humans. The circadian rhythm is an example of a rhythm, which is primary environmentally driven. The circadian rhythm is influenced by external environmental factors, such as daylight, temperature, social interactions, and the timing of meals. During the 24-h time span, the circadian rhythms govern many physiological functions in the human organism (cognitive and metabolic state) and induce fluctuations in physiological functions that in turn affect our ability to perform various types of motor tasks. On the other hand, arousal fluctuates throughout the day. The aim of this study was to investigate the static balance performance prediction based on arousal and activation in circadian rhythm.

Materials and Methods

In the current study, 30 healthy subjects (age=21± 0.5 years) participated. Inclusion criteria included no history of multiple ankle sprains in the past year (three times or more), no history of ankle sprains or sprains in the past six months, no history of multiple knee injuries in the past year (three or more), no injuries or knee surgery over the past year, no history of multiple hip injuries over the past year (three times or more), no history of hip injury or surgery over the past six months, no history of disease or medication that affects the nervous system, and lack of a history of signs and symptoms of inner ear diseases, such as tinnitus, dizziness, and imbalance. A balance scoring test (BESS) and a Bioderm device were used to measure static balance and arousal. Before collecting the data, the participants were introduced to the objectives of the research and completed the consent form. On the day of the test, the electrodes of the Bioderm device were attached to the first finger of the index finger and the middle of the non-superior hand. The electrolyte (potassium, sodium, and chloride 0.05) was used as a skin ointment to better conduct the flow. The electrical conductivity level of their skin was measured 18-16 minutes before the static task was performed by the measuring device and its mean was recorded as the baseline level of arousal. Each participant then performed a static task in the order announced by the researcher. During the balance task, a computer connected to a device recorded the electrical conductivity of the skin information about the individual at a frequency of 10 Hz per second. To calculate the activation, the mean of the lowest level of electrical conductivity of the skin while performing the task was subtracted from the level of electrical conductivity of the base skin. Participants in 1 day and 3 times (10:00; 15:00 and 20:00) The average level of electrical conductivity of the skin during performing BESS as the level of arousal, deducting the mean of the lowest level of electrical conductivity of the skin while performing the task, the level of electrical conductivity of the base skin as activation and the number of recorded errors as the static equilibrium score was calculated and used for statistical analysis. Repeated measures ANOVA, Pearson correlation coefficient, and regression analysis were used to analyze the data.

Results

The highest amount of arousal and activation of participants with an average of 15.32 and 6.2 µş was related to the afternoon time. Also, the best static balance performance was achieved in the afternoon with a score of ten. Results indicated that balance performance was greater at 3:00 pm than at 8:00 pm and 10:00 am ($P<0.05$). The relationship between activation and static balance performance was significant ($P<0.05$), while no significant relationship was found between arousal and static balance performance. Also, the intensity of activation correlation and static balance performance was higher at 3:00 pm ($P<0.05$, $r=-0.46$). The regression results showed that activation was a significant predictor at three different times of the day.

Discussion

According to the results, these findings can provide evidence for differentiation between arousal and activation as separable aspects of the energetics of physiological and behavioral function. It also introduces activation as a factor that raises the static balance in the afternoon to morning and evening.

Ethical Considerations

Compliance with ethical guidelines

The paper was extracted from the PhD thesis. Also, the executive protocol of this research has been approved by the physical education and sports science department. All people received written information about the research and participated in the research if they wished

Funding

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Authors' contributions

Conceptualization and Supervision: Mohammad Vaez Mousavi and Pouneh Mokhtari; Investigation, Writing original draft, Data collection, and Writing review & editing: Amir Hamzeh Sabzi.

Conflict of interest

The authors declared no conflict of interest.

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