順天堂大学大学院スポーツ健康科学研究科 和文抄録
2024年度修士論文

運動開始のタイミングと心周期の関係性についての研究

学籍番号　4123010
氏名　金箱　ちひろ

【目的】
運動開始時における心周期と運動パフォーマンスの関係性を明らかにするために、「動脈圧受容器からの求心性入力が強い心周期の収縮期に開始された運動の方が、動脈圧受容器からの求心性入力が弱い拡張期に開始した運動よりも、反応時間の短縮や強い力発揮ができる」という仮説を検証することを目的とする。

【方法】
健康な成人男女10名を対象に、(1)外的刺激に対してできる限り「早く」ジャンプする（External-triggered, Quickly Jump; ExtQ）課題、(2)外的刺激に対してできる限り「早く」・「高く」ジャンプする（External-triggered, Quickly and Highly Jump; ExtQH）課題、(3)内的なタイミングでできる限り「高く」ジャンプする（Internal-triggered Jump; Int）課題の三つの課題を行ってもらった。実験中は実験参加者の心電図、呼吸、床反力、予告音、運動開始音を記録した。

【結果】
反応時間はExtQ課題（237.2 ± 45.9 ms）の方がExtQH課題（324.6 ± 76.6 ms）よりも早かった（$p = 0.0195$, Wilcoxonの符号順位検定）。跳躍高はInt課題（0.281 ± 0.096 m）の方がExtQH課題（0.224 ± 0.072 m）よりも高かった（$p = 0.0098$, Wilcoxonの符号順位検定）。心拍応答について、ExtQH課題でより高いジャンプができていた試行は、ExtQ課題でより早くジャンプができていた試行と比べ、運動開始の直前におけるR波の表出頻度が有意に高かった（$p < 0.05$, Benjamini-Hochberg多重検定補正を用いたt検定）。

【結論】
外的な運動開始を伴う跳躍運動において、できる限り「高く」ジャンプすることを要求された際、運動開始の直前が心周期の収縮期であったことによって跳躍高が増加した可能性が示唆された。

Juntendo University, Graduate School of Health and Sports Science 英文抄録（Abstract）
2024 Master's Thesis

The relationship between timing of the initiation of exercise and the cardiac cycle

Student ID Number: 4123010
Name: KANEBAKO, Chihiro

[Purpose]
To clarify the relationship between the cardiac cycle and exercise performance during the initiation of exercise. The aim of the study was to test the hypothesis that 'exercise initiated during systole, when afferent input from the arterial baroreceptor is strong, results in shorter reaction times and stronger exertion than exercise initiated during diastole, when afferent input from the arterial baroreceptor is weak'.

[Methods]
Ten healthy adult male and female participants were tested in (1) an external-triggered, Quickly Jump (ExtQ) task, in which they jumped as 'quickly' as possible in response to an external stimulus, and (2) an ExtQ task, in which they jumped as 'quickly' and 'high' as possible in response to an external stimulus (External-triggered, Quickly and Highly Jump; ExtQH) task, and (3) an internally-triggered jump as 'high' as possible (Internal-triggered Jump; Int) task. During the tasks, electrocardiogram, respiration, floor reaction force, warning sound and exercise initiation sound were recorded.

[Results]
Reaction times were faster in the ExtQ task (237.2 ± 45.9 ms) than in the ExtQH task (324.6 ± 76.6 ms) ($p = 0.0195$, Wilcoxon signed rank test). Leap height was higher in the Int task (0.281 ± 0.096 m) than in the ExtQH task (0.224 ± 0.072 m) ($p = 0.0098$, Wilcoxon's signed rank test). For heart rate response, trials in which higher jumps were made in the ExtQH task had a significantly higher frequency of R wave expression just prior to the initiation of exercise than in the trials in which earlier jumps were made in the ExtQ task ($p < 0.05$, t-test with Benjamini-Hochberg multiple test correction).

[Conclusion]
The results suggest that jump height may have been increased by the systolic phase of the cardiac cycle immediately prior to the initiation of the exercise when the participant was required to jump as 'high' as possible in jumping exercises with external initiation of exercise.