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ORIGINAL ARTICLE

Acute effects of flexible pole exercise on heart rate dynamics



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KEYWORDS

Autonomic nervous system;
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Abstract

Introduction: Exercise with flexible poles provides fast eccentric and concentric muscle contractions. Although the literature reports significant muscle chain activity during this exercise, it is not clear if a single bout of exercise induces cardiac changes. In this study we assessed the acute effects of flexible pole exercise on cardiac autonomic regulation.

Methods: The study was performed on 22 women between 18 and 26 years old. We assessed heart rate variability (HRV) in the time (SDNN, RMSSD and pNN50) and frequency (HF, LF and LF/HF ratio) domains and geometric indices of HRV (RRTri, TINN, SD1, SD2 and SD1/SD2 ratio). The subjects remained at rest for 10 min and then performed the exercises with the flexible poles. Immediately after the exercise protocol, the volunteers remained seated at rest for 60 min and HRV was analyzed.

Results: We observed no significant changes in time domain (SDNN: $p=0.72$; RMSSD: $p=0.94$ and pNN50: $p=0.92$) or frequency domain indices (LF [nu]: $p=0.98$; LF [ms^2]: $p=0.72$; HF [nu]: $p=0.98$; HF [ms^2]: $p=0.82$ and LF/HF ratio: $p=0.7$) or in geometric indices (RRTri: $p=0.54$; TINN: $p=0.77$; SD1: $p=0.94$; SD2: $p=0.67$ and SD/SD2: $p=0.42$) before and after a single bout of flexible pole exercise.

Conclusion: A single bout of flexible pole exercise did not induce significant changes in cardiac autonomic regulation in healthy women.

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PALAVRAS-CHAVE

Sistema nervoso autônomo;
Sistema cardiovascular;
Exercício

Efeitos agudos do exercício com hastes flexíveis sobre a dinâmica da frequência cardíaca**Resumo**

Introdução: Exercícios com hastes flexíveis proporcionam rápidas contrações musculares excêntricas e concêntricas. Embora a literatura relate importante ativação da cadeia muscular durante este exercício, não é claro se uma única sessão de exercício induz alterações cardíacas. Neste estudo foram avaliados os efeitos agudos da haste flexível sobre a regulação autonômica cardíaca.

Métodos: O estudo foi realizado em 22 mulheres entre 18 e 26 anos. Avaliou-se a variabilidade da frequência cardíaca (VFC) no domínio do tempo (SDNN, RMSSD e pNN50) e no domínio da frequência (HF, LF e LF relação/HF) e os índices geométricos de VFC (RRtri, TINN, SD1, SD2 e a razão SD1/SD2). Os indivíduos permaneceram em repouso por 10 minutos. Após o período de repouso, os voluntários realizaram os exercícios com as hastes flexíveis. Imediatamente após o protocolo de exercício, os voluntários permaneceram sentados em repouso por 60 minutos e a VFC foi analisada.

Resultados: Não foram observadas alterações no domínio do tempo (SDNN: $p=0,72$; RMSSD: $p=0,94$ e pNN50: $p=0,92$) e nos índices no domínio da frequência (LF (nu): $p=0,98$; LF (ms2): $p=0,72$; HF (nu): $p=0,98$; HF (ms2): $p=0,82$ e a razão LF/HF: $p=0,7$), bem como para os índices geométricos (RRtri: $p=0,54$; TINN: $p=0,77$; SD1: $p=0,94$; SD2: $p=0,67$ e SD/SD2: $p=0,42$) entre o antes e o depois de um único exercício com haste flexível.

Conclusão: Uma única sessão de exercício com vara flexível não induziu mudanças na regulação autonômica cardíaca em mulheres saudáveis.

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Introduction

The autonomic nervous system plays a major role in the modulation of the cardiovascular system in various situations,¹ including exercise.² In order to maintain cardiovascular homeostasis during exercise, mechanisms based on the rapid action of the autonomic nervous system on the heart are necessary.² The cardiovascular responses induced by exercise are characterized by immediate parasympathetic withdrawal at the beginning of exercise, increasing heart rate, followed by an increase in sympathetic nervous system activity. Immediately after exercise, heart rate falls due to vagal reactivation.³ Cardiac autonomic responses after exercise are important indicators of risk for cardiac events.⁴

In this context, heart rate variability (HRV) is a non-invasive method that assesses cardiac autonomic regulation by analyzing variations in the intervals between consecutive heart beats (RR intervals) that are related to the influence of the autonomic nervous system on the sinus node.⁵ At rest, high HRV is an indicator of good adaptation, as in athletes, while reduced HRV may indicate cardiac impairment.^{6,7} During endurance exercise HRV is modulated by reduced vagal tone and increased sympathetic modulation, while after the end of exercise HRV progressively increases.⁸

Studies of cardiac autonomic response after resistance exercise show less intense responses compared to endurance exercise.⁹ Isometric contractions with different intensities have also been observed to change vagal modulation of the heart.¹⁰ Considering that endurance exercise induces greater cardiac overload, this style of exercise will induce a stronger cardiac autonomic response in the recovery phase compared to resistance exercise.⁹

The flexible pole is an instrument that produces muscle contractions generated by co-contraction of the shoulder and trunk muscles.^{10,11} Although flexible pole exercise has been used in rehabilitation therapy for shoulder instability,¹² there is little research in the literature on its acute effects on cardiac autonomic regulation as a part of cardiovascular rehabilitation programs. Furthermore, additional modalities for cardiac therapy are always welcome. This study was therefore undertaken to assess the acute effects of a standardized exercise protocol with flexible poles on cardiac autonomic regulation.

Methods**Study population**

The study was performed on 22 healthy female subjects, all nonsmokers, aged between 18 and 26 years. All volunteers were informed about the procedures and objectives of the study and gave their written informed consent. All study procedures were approved by the Research Ethics Committee of the Faculty of Science of Universidade Estadual Paulista, Marília Campus (study no. 0554-2012), and were in accordance with National Health Council Resolution no. 196/96 of 10/10/1996.

Exclusion criteria

Subjects were excluded under the following circumstances: body mass index (BMI) >35 kg/m²; systolic blood pressure (SBP) >140 mmHg or diastolic blood pressure (DBP)

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