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ORIGINAL ARTICLE

# The effects of musical auditory stimulation on cardiorespiratory variables after aerobic exercise

*Les effets de la stimulation auditive musicale sur les variables cardio-respiratoires après un exercice d'aérobic*

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## KEYWORDS

Music;  
Exercise;  
Heart rate;  
Blood pressure

## Summary

**Objective.** – To investigate the effect of music auditory stimulation on cardiorespiratory parameters in recovery from exercise.

**Methods.** – Thirty-five healthy men underwent an experimental protocol with three steps: maximal exercise test, control protocol and music protocol. The control protocol consisted of 15 minutes of rest, followed by 30 minutes of exercise on a treadmill and 60 minutes of recovery. In the music protocol volunteers were exposed to music auditory stimulation during exercise and recovery from exercise. We analyzed the following parameters: heart rate, blood pressure, respiratory rate and blood oxygen level during the initial rest stage and recovery.

**Results.** – Statistical differences in heart rate between rest and post exercise ( $P < 0.05$ , 5%) were found from the 1st to the 40th minute in the music protocol while in the control protocol was observed until the end of recovery. For systolic blood pressure, differences were found until the 10th minute of recovery in the control protocol and until the 7th minute in the music protocol.

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## MOTS CLÉS

Musique ;  
Exercice ;  
Fréquence  
cardiaque ;  
Pression artérielle

*Conclusion.* – Music auditory stimulation accelerated the recovery of heart rate and systolic blood pressure, however we can not state that this method alone can improve recovery after exercise in healthy subjects.

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## Résumé

*Objectif.* – Rechercher l'effet de la stimulation auditive musicale sur les paramètres cardio-respiratoires concernant la récupération à la suite d'un exercice.

*Méthode.* – Trente-cinq individus en bonne santé furent soumis à un protocole expérimental décomposé en trois étapes : test d'effort maximum de la fréquence, protocole contrôle et protocole musical. Le protocole contrôle se décompose en 15 minutes de repos, suivi de 30 minutes d'exercice sur un tapis roulant et 60 minutes de récupération. Concernant la phase musicale, les volontaires furent confrontés à la stimulation auditive musicale durant l'exercice et durant la phase de récupération de cet exercice. Les différents paramètres suivants sont analysés : fréquence cardiaque, pression artérielle, fréquence respiratoire, niveau d'oxygène dans le sang durant la phase initiale de repos et récupération.

*Résultats.* – Des différences statistiques apparaissent pour la fréquence cardiaque au repos et post exercice ( $p < 0,05$ , 5 %) de la première minute à la 40<sup>e</sup> durant le protocole musical ; alors que durant la phase contrôle, l'observation dura jusqu'à la fin de la récupération. Concernant la pression artérielle systolique des différences furent relevées jusqu'à la 10<sup>e</sup> minute dans la phase récupération du protocole contrôle et jusqu'à la 7<sup>e</sup> minute dans le protocole musical.

*Conclusion.* – La stimulation auditive musicale accéléra la récupération de la fréquence cardiaque et de la pression systolique. Cependant, nous ne pouvons affirmer que seule cette méthode peut améliorer la récupération après un exercice sur des individus sains.

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## 1. Introduction

The application of musical auditory stimulation (MAS) can promote physiological [1], psychological [2] and psychoneuroimmunologic [3] responses. It has been endorsed as an alternative and complementary therapy in several conditions, for example, in neurological [4] patients, those with psychological disorders [5] and after sustained exercise [6].

The MAS completed by "calm" and "relaxing" music induces blood pressure (BP) [7], heart rate (HR) [8] and cerebral artery flow [9] reduction – generally a majority of effects reported were considered at rest [10]. Throughout exercise, MAS enhances performance [11], causes greater motivation to perform the exercise [12], increases work capacity, decreases perceptions of effort [13] and delays fatigue. These responses result in higher resistance levels [14].

Nevertheless, there are few studies regarding the effects of MAS on recovery from exercise, which aims to restore physiological systems to a baseline level [15]. Previous studies investigated the influence of MAS on recovery from period of exercise presented only slight differences. Lee and Kimmerly [16] established it lowered blood lactate levels, with quicker HR recovery. Eliakim et al. [17] despite finding reduction in lactate levels, observed no effect on HR. Whilst, Tan et al. [18] found effects of MAS on only the initial minutes of recovery.

The non-restoration of physiological systems to their initial condition can promote various complications during recovery from exercise [19,20], for instance ventricular arrhythmias [21]. Henceforth, additional studies are

important relating to post-exercise period and different ways to augment it.

Consequently, this study aimed to investigate the influence of MAS through classical music applied during and after submaximal aerobic exercise on cardiorespiratory parameters in the recovery period. It is postulated that MAS promotes quicker recovery of cardiorespiratory parameters.

## 2. Methods

### 2.1. Population

We examined 35 apparently healthy volunteers, aged  $21.74 \pm 2.59$  years. Smokers, alcoholics, subjects with cardiovascular, respiratory and neurological disorders known or other pathological conditions that prevented the achievement of protocols were excluded from the study.

The volunteers were informed about the study objectives and procedures, and after agreement signed a confidential and informed consent form. The project was approved by the Research Ethics Committee of the Paulista State University, Campus of Marília, Simoni Aparecida Capellini, Case No. CEP-2200/11, March 14, 2012.

### 2.2. Study design

To implement the experimental protocol, all volunteers were informed to not ingest alcoholic or caffeine-based drinks for 12 hours before the experimental procedure; con-

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