JTCM 中医杂志 Journal of Traditional Chinese Medicine

Online Submissions: http://www.journaltcm.com
info@journaltcm.com

J Tradit Chin Med 2017 October 15; 37(5): 636-642
ISSN 0255-2922

RESEARCH ARTICLE

Effect of acupuncture on heart rate variability during prolonged high-intensity training in soccer players

Lin Shihang, Wichai Eungpinithpong, Amonrat Jumnainsong, Somchai Rattanathongkom

Lin Shihang, Faculty of Associated Medical Sciences, Khon Kaen University, Khon Kaen 40002, Thailand; Department of Sports, East China University of Political Science and Law, Shanghai 201620, China; Faculty of Graduation, Khon Kaen University, Khon Kaen 4002, Thailand

Wichai Eungpinithong, Amonrat Jumnaisong, Somchai Rattanathongkom, Faculty of Associated Medical Sciences, Khon Kaen University, Khon Kaen 40002, Thailand

Correspondence to: Prof. Somchai Rattanathongkom, Faculty of Associated Medical Sciences, Khon Kaen University, Khon Kaen 40002, Thailand. somch_ra@kku.ac.th; shihang_lin@hotmail.com

Telephone: +66-43202399; +66-862308606

Accepted: September 22, 2016

Abstract

OBJECTIVE: To investigate the effects of acupuncture therapy compared with sham acupuncture on heart rate variability (HRV) in 24 elite soccer players during 4-week, high-intensity training sessions.

METHODS: The subjects were randomly divided into two groups: acupuncture group (AG) and sham acupuncture group (SG). In addition, AG had been implemented two times/week to stimulate Zusanli (ST 36), Hegu (LI 4), Shenshu (BL 23), and Chize (LU 5). While SG, had been applied to utilize a special "placebo-needle" technique on the same sites. What's more, the HRV parameters were calculated before and after interventions, respectively.

RESULTS: First, stress index (SI) had a significantly increased in SG (P = 0.031) compare pre-test with post-test, however, no significantly difference in AG (P = 0.102). Secondly, standard deviation of N-N intervals (SNDD) have enormously significantly higher in AG when comparing baseline with post therapy (P = 0.001), while, declined in SG (P = 0.827). Meanwhile, the root mean square of successive differences (RMSSD) were significant differences in AG (P = 0.023). What's more, when the high-frequency (HF) were significantly higher in AG (P = 0.047) after receiving the acupuncture therapy, the lowe-frequency (LF) power were decreased but no significant in AG and SG. Comparing with pre-experiment, the ratio of LF/HF was lower in AG, but higher in SG. Furthermore, it was significant difference when compare the post-experiment parameters of AG with SG (P = 0.015). And HF parameters have significance (P = 0.005) compare between two groups during the post-experiment.

CONCLUSION: Based on evidence, acupuncture therapy on special acupoints could strengthen the parasympathetic nervous activity and modulates the balance between parasympathetic and sympathetic activity in soccer players while they engage in high-intensity training.

Keywords: Acupuncture; Heart rate; High-intensity interval training; Autonomic nervous system; Soccer

INTRODUCTION

In the athletic field, competition becomes more and more intense, and, in generally, prolonged and high-intensity training, as well as fierce competitive season would induce insufficient recovery, fatigue accumulation, decline performance, or sports injuries. However, appropriate recovery strategies have positive significance to accelerate recovery progress and even promote

athletic performance. Selection of specific recovery techniques and strategies to minimize any residual fatigue from training and competition is one of the basic principles of training methodology.[1]

Acupuncture, one of the most essential of Traditional Chinese Medicine (TCM) technology, has been used for more than 2500 years already. The goal of acupuncture is to re-establish the balance of internal body energies, or dredge *Qi* (the circulating vital energy whose existence and properties are the basis in TCM) chances and balance *Yin* and *Yang*. Based on TCM philosophy theories, the body is considered as a delicate balance of two opposing and inseparable forces, *Yin* and *Yang*. Disease is caused by an imbalance of *Yin* and *Yang*, leading to a blockage in the flow of *Qi*.

Recently, acupuncture has been used to modulate the physical well being of various athletes. Acupuncture alleviates muscle tension, improves local blood flow, increases the pain threshold, modulates the autonomic nervous system, and readjusts the nervous-endocrine-immune systems.[2]

Heart rate variability (HRV) has used to measure the recovery from fatigue, which reflects the balance between the sympathetic nervous system and the parasympathetic nervous system.[3,4] Measuring HRV is a simple, sensitive, and non-invasive technique, which used to quantify the time intervals of beat-to-beat alteration in heart rate. What's more, acupuncture therapy has been found to change HRV and restores the imbalance of the autonomic nervous system.[5-7] However, previous studies seems to be focused on short term effects of acupuncture therapy, or non-fatigue state, or healthy man. No study reported the long-term effects of acupuncture in athletes during prolonged and high-intensity training.

Therefore, we tried to do a research about the effects of 4 weeks acupuncture intervention on HRV in soccer players during the period of high-intensity training. We also hypothesized that acupuncture therapy could improves HRV parameter of athletes who get into prolonged high-intensity training sessions. And this improvement may enhance recovery and maintain their peak performance.

MARERIALS AND METHODS

Subjects

Twenty-four male elite soccer players in East China at Political Science and Law University included though poster and randomly allocated into 2 groups: acupuncture group (AG) and sham group (SG) by a computer program using a list from the soccer coach (Figure 1). The coach and volunteers did not know which players were in the AG or SG. All of soccer players were in good health based on clinical and physical examinations, and without smoking, alcohol, history of hormone therapy, injury and acupuncture therapy during last 6 months. All subjects underwent more than 2 h 6 times/week session of high-intensity training for 4 weeks. This study was approved by the Ethical Committee of Khon Kean University, Khon Kean, 4002, Thailand (HE582343).

The baseline features of subjects were as follows (Table 1): the average age (AG *vs* SG) was (21.75 ± 1.76) *vs* (21.75 ± 1.78) years (P = 0.820), the average weight was (70.82 ± 4.83) *vs* (72.08 ± 4.99) kg (P = 0.534), the average height was (176.93 ± 6.97) *vs* (175.44 ± 4.23) cm (P = 0.535). In addition, the average duration of training experiences was (6.00 ± 1.31) *vs* (6.46 ± 1.59) years (P = 0.450). All subjects had been informed the safety efficacy and possible risks of acupuncture therapy as well as experimental protocol. The subjects were also informed of the experimental protocol and signed a consent form for participation in this experiment. The research protocol was approved from the Ethical Committee of Khon Kean University (HE582343).

The two groups were evaluated during the same time between 7:00 am and 8:00 am pre-experiment and post-experiment. The experimental room temperature was maintained at 25 ℃ and relative air humidity was between 50% and 60%. Every subject was instructed to rest for longer than 20 min before measurements, have an empty stomach, and keep in the supine position during measurements.

HRV

HRV data were collected 24 h before the experiments and 24 h after the experiments in the morning (between 7:00 am and 8:00 am). Participants were asked not to eat anything for at least 12 h and were allowed to drink some water. During the test, subjects were asked to remain supine, quiet, and without any disturbances to stabilize breathing at a frequency of 1 breath/4 s (0.25 Hz).[8] To record HRV, we used a portable blood pressure monitor (Certificate by KFDA; Bio-Sense Creative Co., Ltd., uBioMacpa, Seoul, Korea). Multiple data of HRV were calculated as follows. The stress index (SI) was calculated. Another measure of HRV was the time domain, including the standard deviation of normal-to-normal intervals (SDNN) and the root mean square of successive differences (RMSSD), which are related to exercise fatigue and recovery.[9] Additionally, the frequency domain was calculated, including low-frequency (LF; 0.04-0.15 Hz), high-frequency (HF; 0.15-0.40 Hz), and the ratio of LF/HF, which is the balance the sympathetic and parasympathetic nervous system activity.[8, 10]

Acupuncture therapy

In this study, a special "placebo-needle" had been designed by Streitberger (1998) had been utilized and changed. The sham needle tip was blunt and just touch the subject's skin and a small pricking sensation be felt. Short needles had been applied in the SG, long needles had been applied in the AG.