A Comparative Study on the Treatment of Exercise Induced Fatigue between Qi-supplementing Herbs and Qi-rectifying Herbs

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Abstract

Fatigue is a complex and multifaceted phenomenon. Physical exercise can induce fatigue. Studies showed that the central nervous system played an important role in the exercise-induced fatigue. Hypotheses have been developed that neurotransmitters may be involved in the origination of central nervous system fatigue. Besides central nervous system fatigue, a variety of studies have demonstrated that the exhaustive exercise induces considerable depression in the function of the immune system. In China, most physicians consider that over-training causes exercise-induced fatigue. Usually the over-training induces the Qi-deficiency (氣虛), so they often use the Qi-supplementing (補氣, QS) herbs to eliminate exercise-induced fatigue. Radix Astragali (黃芪) was one of the most often used QS herbs in treatment of exercised induced fatigue. But in clinical study, it was considered that Qi-deficiency is not the only cause of fatigue, the Qi depression and stagnation (氣滯) was another reason of the fatigue besides the deficiency of Qi. Therefore, we used the Qi rectifying (理氣, QR) herbs with QS herbs to treat fatigue, and have achieved the desired effect in the clinical treatment.

According to the clinical research, the Chinese herbs Rhizoma Cypei (香附) and Fructus Aurantii (枳椇) were effective to treat the Qi depression and stagnation in fatigue. They were selected as a combining group of QR&QS (理氣補氣) to treat fatigue. To evaluate the efficacy of QR&QS (理氣補氣) herb group, Radix Astragali (黃芪) was used as QS (補氣) herb to compare with QR&QS (理氣補氣) herbs group.

In the first part of the study, the animal model of exercise-induced fatigue was successfully established by the heavy treadmill exercise. It was found that 5-weeks of heavy exercise significantly reduced the rats’ exercise performance in treadmill exhaustion tests. Heavy exercise exhibited an increase-immobility effect on the tail suspension test. From the result of the treadmill exhaustion test and the tail suspension test, it can be concluded that the heavy exercise caused the fatigue in the rats.
In the second part of the study, the effect of heavy exercise on the nervous system was observed. It was found that the heavy exercise increased the serotonin and decreased the dopamine synthesis and the metabolism. It was also found that 5-week heavy exercise induced the reduced c-fos mRNA expression in the cortex but enhanced c-fos protein expression in the CA1, CA2 field of the hippocampus.

In the third part of the research, the effect of the heavy exercise on the immune system was observed. The 5-week heavy exercise induced an increase in serum IL-6 concentration; a decrease in the ratio of T-helper / T-cytotoxic cell in T cell subsets, which means that 5-weeks of heavy exercise induced depression in immune function of the rats.

Comparing the effect of the Chinese herbs group of QR&QS (理气补气) and Chinese herbs of the QS (补气), it was found that both of the two kinds of herbs can improve the exercise performance (increase the time of exhaustion running), exhibit an anti-depression effect during the heavy exercise (decrease the duration of the immobility in tail suspension test). Both of them improved the c-fos mRNA expression in the cortex. Both of them can blunt the decrease of the ratio of T-helper / T-cytotoxic cell in T cell subsets. But there are significant differences between the effects of these two kinds of herbs. The Chinese herb of QS not only increased the noradrenergic cell and the dopaminergic cell activity but also reduced the IL-6 level in serum after heavy exercise. The Chinese herbs group of QR&QS cannot reduced the IL-6 level in serum after heavy exercise. The Chinese herbs group of QR&QS not only can increase DA synthesis and metabolism but also can decrease the serotonin concentration in the rat brain. The Chinese herb of QS cannot blunt the increase of the level of serotonin induced by the heavy exercise. This means both QR&QS and QS herbs are effective to treat the exercise-induced fatigue, but their mechanisms are different.
摘要

疲勞是一種複雜的現象。所謂疲勞是指持久或過度勞動後引起機體不適和工作效率降低。1982年第五屆國際運動生化學術討論會上將疲勞定義為“機體生理過程不能持續在特定水平上和(或)不能維持預定的運動強度”。衆所周知運動能誘發中樞疲勞。但是運動誘發的中樞疲勞的機制還不清楚。有假說認為多種神經遞質與疲勞的產生有關。

除中樞神經系統疲勞之外，越來越多證據表明高強度的運動可以誘發免疫系統的功能下降。大部分醫生認為運動性疲勞是由過度訓練引起的。《素問·舉痛論篇》說：“勞則氣耗，勞則喘息汗出，內外皆越，故氣耗矣。”過勞可以導致氣虛，所以，他們經常用補氣藥來治療運動性疲勞。黃芪是最常用的治療運動性疲勞的補氣藥。它還能改善免疫系統的功能。在臨床研究中，我們認爲氣虛不是產生疲勞唯一原因，氣滯是另一個產生疲勞的重要原因。因此，我們在補氣藥中加入理氣中藥來治療疲勞，並在臨床的治療中達到了預期效果。枳殼和香附可以有效治療疲勞引起的氣滯。這樣，由中藥枳殼、香附和黃芪組成了理氣補氣中藥來治療疲勞。

在本研究的第一部分中，通過高強度運動訓練成功地建立了運動性疲勞的動物模型。5星期大強度訓練減少了跑台力竭試驗的力竭運動時間，增加了懸尾試驗中的靜止時間。從跑台力竭試驗和懸尾試驗的結果可以證明大運動量訓練引起了大鼠的疲勞。

在本研究的第二部分中，著重觀察了高強度運動訓練引起的神經系統的變化。高強度運動訓練能增加5-氫色胺，減少多巴胺在大腦中的合成和代謝。另外，5星期的高強度運動訓練能夠誘發靜止時期大鼠海馬的CA1、CA2區的c-fos蛋白表達增強和皮層的c-fos mRNA表達下降。

本研究的第三部分，著重觀察了高強度運動訓練對於免疫系統的影響。5星期的
高強度運動訓練引起了血漿IL-6濃度的增加，T細胞亞群中輔助性T細胞/抑制性
T細胞的比率的下降。實驗結果表明：5星期的高強度運動訓練導致大鼠的免疫功
能下降。

比較補氣藥和理氣補氣藥，兩者都能改善疲勞大鼠的運動能力（力竭運動時間增
加）；都能改善疲勞大鼠的中樞抑制狀態（減少懸尾試驗中的靜止時間）。他們
都能增加皮質c-fos的mRNA表達。兩種中藥都能增加T細胞亞群中輔助性T細胞/
抑制性T細胞的比率。

但是，兩種中藥的藥理作用也有明显的差異。

補氣藥不僅能促進去甲腎上腺素和多巴胺在大腦中的合成和代謝，還有外周性
抗疲勞作用，補氣藥能減少疲勞大鼠血漿IL-6濃度。理氣補氣藥不僅可以增強
多巴胺在大腦中的合成和代謝，還可以明顯減少疲勞大鼠大腦5-羥色胺的合成
和代謝。理氣補氣藥不能夠降低疲勞大鼠血漿IL-6濃度，而補氣藥不能減少疲勞
大鼠大腦5-羥色胺的合成和代謝。上述結果表明補氣藥和理氣補氣藥均可有效
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