

國立體育學院九十二學年度研究所碩士班入學考試試題
人體生理學 (本試題共 一 頁)

※注意:答案一律寫在答案卷上,否則不予計分

1. 吾人由安靜狀態進入運動狀態,運動強度由小逐漸增加至最大,由安靜至最大運動整個過程中,三大能量系統(ATP-PC energy system, lactic-acid energy system, and aerobic energy system)皆全程參與,並無分先後順序,試說明解釋。(30分)
2. oxygen-hemoglobin dissociation curve 成 S 形狀,說明解釋在甚麼情形下有特殊好處。(25分)
3. 根據下段資料,解答:(共 45 分)
 - (1) 作者想研究的問題為何?(5分)
 - (2) 為何有此研究問題?(10分)
 - (3) 用甚麼方式解決研究問題?(5分)
 - (4) 為甚麼用此方式解決問題?(10分)
 - (5) 問題解決了沒有?需說明解釋。(10分)
 - (6) 本研究結果之應用價值為何?(5分)

Krotkiewski et al. Effects of physical training on adrenergic sensitivity in obesity. *J. Appl. Physiol.* 55: 1811-1817, 1983.

Obesity is associated with a number of complications, of which hyperinsulinemia and hypertension are two of the most common and also two of the more serious ones because both are strong risk factors for cardiovascular disease. The explanation of these conditions is not known, although numbers hypotheses have been suggested.

Treatment of obese subjects with a low-energy diet gives a decrease of both hyperinsulinemia and blood pressure after the decrease in body fat. Physical training of obese subjects also has such an effect, although here the decrease of hyperinsulinemia and blood pressure can be seen without a decrease in body fat.

Physical training enhances the activity of the cholinergic nervous system, documented both on circulation and on insulin secretion. The effects on the adrenergic nervous system are less clear, however, although the lower resting heart rates in the physically trained status seems to be associated with a lower tonus of the β -adrenergic system. Norepinephrine uptake and turnover were found to be decreased in hearts of trained animals. Urinary or plasma catecholamine levels at rest have not been found to change with physical training in normal or obese subjects, whereas trained rats had lower urinary excretion rates. In the periphery catecholamine sensitivity has been found to be increased after physical training, as measured on isolated adipocytes or membrane preparations.

The remaining possibility that physical training might affect the sensitivity of the adrenergic nervous system, and thereby produce a decrease in both hyperinsulinemia and hypertension, gives the background to the present work

To examine the possibility that the decrease of hyperinsulinemia and blood pressure in obesity associated with physical training is mediated via adaptations in the adrenergic nervous system, a pure β -adrenergic agonist (isoproterenol) or an α -adrenergic antagonist (phentolamine) was infused before and during an oral glucose tolerance test before and after physical training. A number of circulatory, metabolic, and endocrine factors under adrenergic control were followed. Physical training was associated with an augmented antagonist responses in blood pressure, heart rate, blood glucose, plasma insulin, connecting (C) peptide, and pancreatic polypeptide (PP) but not in plasma glucagons and gastric inhibitory polypeptide. Physical training also resulted in higher values of C-peptide and PP values after α -adrenergic blockage. It was concluded that physical training probably is associated with an augmented sensitivity of the β -adrenergic nervous system. This might also be the case with the α -adrenergic system. It was suggested that this in turn might be due to a decreases firing in the adrenergic nervous system leading secondarily to an increased sensitivity in the effector cells.