

※注意:答案一律寫在答案卷上, 否則不予計分

注意: 可用中文或/和英文作答

閱讀以下論文摘要, 並回答 1 至 9 題。(40 分)

Total and Regional Bone Density in Male Runners, Cyclists, and Control

Male athletes who were runners (N=12), cyclists (N=14), or both (N=13) were compared with non-exercising age-matched controls (N=23) for total and regional bone mineral density (BMD). All athletic subjects had competed for a minimum of 3 yr and trained for a minimum of 4 h·wk⁻¹. Runners undertook no cycling and cyclists undertook no running training. All subjects were scanned for whole body and L1-L4 spine BMD using a Hologic QDR 1000W scanner. There were no differences in age, height, weight, body mass index (BMI), %fat, or hours of training between any of the athletic groups ($p > 0.05$), although compared with controls, runners and cyclists had lower BMI ($p < 0.01$) and all athletic groups had lower %fat ($p < 0.001$). Compared with controls, runners had greater total and leg BMD ($p < 0.05$), cyclists had reduced spine BMD ($p = 0.05$), and athletes of the "both" group had greater total ($p < 0.05$) and arm BMD ($p < 0.01$). Running is associated with increased bone density, particularly in the leg, whereas cycling is associated with a mild decrease in bone density in the spine. In athletes who do both, runner exerts a stronger influence than cycling.

1. BMI 的意義與功用為何? (4 分)
2. 每組實驗人數有多少? (3 分)
3. 運動員的訓練狀況為何? (2 分)
4. 用什麼儀器測量 BMD? 如何測量? (4 分)
5. 哪個身體部位的 BMD 被測量? (3 分)
6. 自由車訓練對 BMD 有何不良影響? (4 分)
7. 解釋 " $p < 0.05$ ". (4 分)
8. 體內哪二個內分泌可增加 bone calcium 與 phosphate? (2 分) 他們對 bone cell 產生什麼作用? (4 分)
9. 本研究結果有利於哪一種慢性疾病的治療, 如何應用本研究結果去幫助治療? (10 分)

閱讀以下論文摘要, 並回答 10 至 16 題。(40 分)

Effect of Respiratory Muscle Training on GLUT-4 in the Sheep Diaphragm

Endurance exercise training is associated with enhanced glucose uptake and hence improvement in carbohydrate metabolism. Glucose transport (GLUT) membrane proteins are regulated by a variety of physiological stimuli, including exercise. In limb muscle, both acute exercise and endurance training enhance the expression of the skeletal muscle transporter, GLUT-4. The purpose of this study is to determine whether chronic loading enhances GLUT-4 expression in the diaphragm. The effect of chronic inspiratory flow resistive (IFR) loading on diaphragm GLUT-4 was studied in a model of respiratory muscle endurance training in sheep. IFR loads (resistance 50-100 cm H₂O·L⁻¹·s⁻¹) were maintained for 3 h·d⁻¹, 5-6 d·wk⁻¹ for 3 wk. Loading was adjusted so that PaO₂ was >60 Torr and PaCO₂ < 45 Torr in room air. Six untrained sheep were used as controls. GLUT-4 protein and mRNA were analyzed by Western and Northern analysis respectively. GLUT-4 protein levels were two-fold greater in trained animals when compared with controls ($p < 0.01$). GLUT-4 mRNA levels in the trained muscles was not significantly different from controls. We conclude that in the sheep diaphragm, chronic IFR loading increases GLUT-4 protein levels. This increase may be one of the mechanism contributing to the improved respiratory muscle endurance previously demonstrated in

this animal model of respiratory muscle training.

10. 解釋 membrane protein transporter 的一般功能。(5分)
11. Glucose 的 membrane transport 機轉為何: (a) 由 blood 進入 skeletal muscle cells? (b) 由 small intestine 進入 blood? (6分)
12. 本研究中採用什麼方法訓練 diaphragm? (6分)
13. Control 組接受哪些實驗操弄? 為何需要 control 組? (5分)
14. 與 control 組比較, trained 組的 GLUT-4 proteins 與 GLUT-4 mRNA 產生哪些變化? (4分)
15. GLUT-4 proteins 的改變如何能提高肌耐力? (10分)
16. 哪一種慢性疾病可應用本研究的結果? (4分)
17. (a) Oxygen uptake 如何測量? (20分)
(b) 運動中 oxygen uptake 增加的生理機轉為何? (20分)
18. 所有型式運動起初的 ATP 供應, 有部分來自無氧路徑, 解釋。(30分)
19. 圖述 aerobic glycolysis 及 ATP moles 重組的數目。(20分)
20. 簡義 (3分 × 10)
 - (a) epinephrine,
 - (b) high density lipoprotein,
 - (c) muscular strength,
 - (d) forced vital capacity in one second
 - (e) motor unit recruitment,
 - (f) isokinetic contraction,
 - (g) Wingate anaerobic power test,
 - (h) kgm,
 - (i) myostatic (stretch) reflex
 - (j) QRS complex