

※ 注意：請於試卷上「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

- 一、編訂台灣地區食品組成份資料庫與膳食營養素參考攝取量(Dietary Reference Intakes)時，有幾種營養素所採用的單位並非單純的重量或濃度單位，例如 RE、 $\alpha$ -TE、NE等，請說明此類單位的意義，以及相關的營養素 (10%)
- 二、已知有許多營養素會影響基因的表現或功能，請簡要說明以下營養素可影響的一種/類基因，以及造成該影響的機制 (10%)
  1. n-3 fatty acids
  2. vitamin A
  3. folate
  4. zinc
  5. iodine
- 三、以下是從 PubMed 檢索獲得的一份關於微量營養素鐵的研究文獻紀錄與摘要。請回答下列的問題。(30%)
  1. 這份文獻的出處為何？您將如何取得全文資料？(5%)
  2. 本研究中提及以下與鐵代謝利用相關的名詞，據您所知之營養生理與生化學知識，請說明各項名詞之意義及其在鐵利用的功能或關係 (20%)
    - i. heme
    - ii. hypoxia
    - iii. erythropoiesis
    - iv. erythroid cells
    - v. hemoglobin
    - vi. myoglobin
    - vii. L-ferritin
    - viii. transferrin receptor
    - ix. HIF
    - x. ferroportin
  3. 根據以下摘要，簡述本項研究的假說與主要發現 (5%)

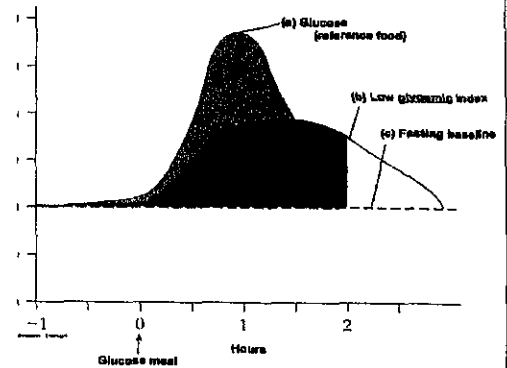
Robach P, Cairo G, Gelfi C, Bernuzzi F, Pilegaard H, Vigano A, Santambrogio P, Cerretelli P, Calbet JA, Moutereau S, Lundby C. Strong iron demand during hypoxia-induced erythropoiesis is associated with down-regulation of iron-related proteins and myoglobin in human skeletal muscle. Blood. 2007 Feb 20; [Epub ahead of print]

#### ABSTRACT

Iron is essential for oxygen transport because it is incorporated in the heme of oxygen-binding proteins hemoglobin and myoglobin. An interaction between iron homeostasis and oxygen regulation is further suggested during hypoxia, where hemoglobin and myoglobin syntheses have been reported to increase. This study gives new insights into the changes in iron content and iron-oxygen interactions during enhanced erythropoiesis by simultaneously analyzing blood and muscle samples in humans exposed to 7-9 days of high altitude (HA) hypoxia. HA up-regulates iron acquisition by erythroid cells, mobilizes body iron and increases hemoglobin concentration. However, contrary to our hypothesis that muscle iron proteins and myoglobin would also be up-regulated during HA, this study shows that HA lowers myoglobin expression by 35% and down-regulates iron-related proteins in skeletal muscle, as evidenced by decreases in L-ferritin (43%), transferrin receptor (TfR) (50%), and total iron content (37%). This parallel decrease in L-ferritin and TfR in HA occurs independently of increased hypoxia-inducible factor 1 (HIF-1) mRNA levels and unchanged binding activity of iron regulatory proteins, but concurrently with increased ferroportin mRNA levels, suggesting enhanced iron export. Thus, in HA, the elevated iron requirement associated with enhanced erythropoiesis presumably elicits iron mobilization and myoglobin down-modulation, suggesting an altered muscle oxygen homeostasis.

四、請針對右圖回答問題：(10%)

1. 請寫出適當之圖標題。
2. 請分別寫出(a), (b), (c)三條線所代表的意義。
3. 由此圖可求得 glycemic index，如何求得 glycemic index？



五、下列與膽固醇代謝有關之名詞，解釋並簡述其生理功能。(10%)

1. LDL receptor
2. HMG CoA reductase
3. ACAT
4. apoB-100
5. familial hypercholesterolemia

六、下圖為調查分析 290 位 25~30 歲和 288 位 60~65 歲女性的葉酸攝取量和血液同半胱胺酸濃度的結果，請回答以下問題：(20%)

1. 分別簡述 Figure 1 和 Figure 2 的結果。(6%)
2. 作者為何要分別以 Figure 1 和 Figure 2 作圖，兩者有何不同？(2%)
3. 作者為何要分年齡層來探討，有何重要結論？(5%)
4. 以生化代謝的觀點，解釋為何葉酸攝取量與同半胱胺酸濃度有關。(5%)
5. 除了葉酸，還有哪些維生素缺乏也可能會造成高同半胱胺酸血症？(2%)

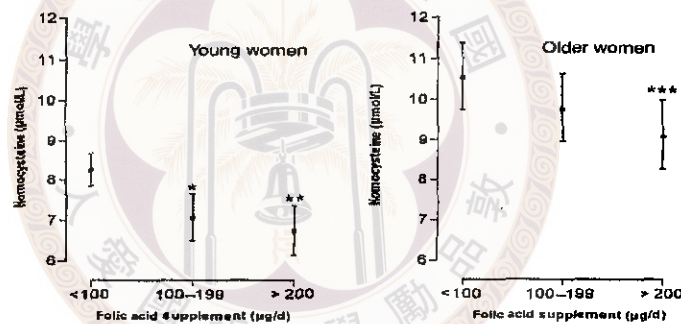


FIGURE 1. Adjusted geometric mean homocysteine concentrations in the young (25-30 y) and older (60-65 y) age groups in relation to folic acid intake from supplements.  $n = 199, 47$ , and  $38$  younger women and  $152, 65$ , and  $51$  older women with folic acid intakes of  $<100, 100-199$ , and  $>200 \mu\text{g/d}$ , respectively. \*\*\*Significantly different from lowest folic acid intake group (Student's  $t$  test): \* $P = 0.002$ , \*\* $P < 0.001$ , \*\*\* $P = 0.017$ .

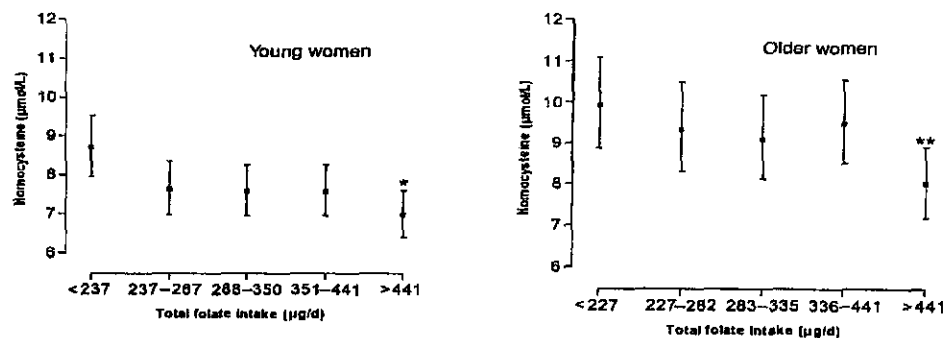


FIGURE 2. Adjusted geometric mean homocysteine concentrations in the young (25-30 y) and older (60-65 y) age groups in relation to total folate intake (intake from diet and supplements). \*\*\*Significantly different from lowest intake quintile (Student's  $t$  test): \* $P < 0.005$ , \*\* $P < 0.01$ .

七、簡答題：(10%)

1. 何謂「膳食纖維」？「可溶性膳食纖維」與「不可溶性膳食纖維」的生理功能有何差異？
2. 維生素 C 缺乏導致何種病症？其致病的原因主要是哪些生化反應無法進行？
3. 維生素 B<sub>12</sub> 缺乏可由哪些原因所造成的？
4. aldosterone 的重要性為何？
5. 為何有些鈣片添加維生素 K？