haemoglobin >120 g/l, iron supplementation increased serum concentrations of ferritin but not haemoglobin.**4** We also have to ask how the iron intake of all these women would be increased. A recent dietary intervention study showed that highly motivated people with mild iron deficiency can improve iron status through diet but that supplements are a more practical option.**5** Supplements do, however, produce unpleasant side effects in a notable proportion of individuals, and any programme entailing the use of supplements is likely to have a detrimental effect on the wellbeing of a notable number of women.

We believe that there is no evidence to support reclassification of haemoglobin and serum concentrations of ferritin in women to normal values for men. Furthermore, we are unable to see how such a move could result in a positive outcome for women's health and welfare with no adverse effects.

Footnotes

- a annelouise.heath@bbsrc.ac.uk

References

1.Rushton DH, Dover R, Sainsbury AW, Norris MJ, Gilkes JJH, Ramsay ID.Why should women have lower reference limits for haemoglobin and ferritin concentrations than men?*BMJ*2001;**322**: 1355–1357. (2 June.)

2.Jackson HA, Carter K, Darke C, Guttridge MG, Ravine D, Hutton RD, et al.HFE mutations, iron deficiency and overload in 10,500 blood donors.*Br J Haematol*2001;**114**:474–484.

3.Jacobs A, Worwood MWorwood M.Serum ferritin. In: Jacobs A, Worwood M eds.*Iron in biochemistry and medicine II*.London: Academic Press,1980.

4.Zhu YI, Haas JD.Response of serum transferrin receptor to iron supplementation in iron-depleted, nonanemic women.*Am J Clin Nutr*1998;**67**:271–275.

5.Heath A-LM, Skeaff CM, O'Brien SM, Williams SM, Gibson RS.Can dietary treatment of pre-anemic iron deficiency improve iron status?*J Am Coll Nutr* 2001 (in press).

Differences in haemoglobin concentrations reflect physiological differences

Ian M Morison, haematologist (ian.morison@sclabs.co.nz**), Elaine L Ferguson, lecturer**

Nutrition and Consumer Science Division, Institute of Food Research, Norwich Research Park, Colney, Norwich, NR4 7UA

Department of Haematology, University of Wales College of Medicine, Cardiff, CF14 4XN

Southern Community Laboratories, Dunedin, New Zealand 9001

Department of Human Nutrition, University of Otago, Dunedin, New Zealand 9005

School of Pharmacy and Biomedical Sciences, University of Portsmouth, Portsmouth PO1 2DT

Imperial Cancer Research Fund, London WC2A 3PX

Institute of Zoology, Zoological Society of London, London NW1 4RY

Lister Hospital, London SW1W 8RH

EDITOR—Rushton et al argued that a high prevalence of iron deficiency among women has resulted in the use of haemoglobin reference ranges that are lower than ideal, and that male reference ranges

should be used when assessing the iron status of women.[1]

We have used two independent sources of data to show that sex differences in haemoglobin concentrations reflect real physiological differences rather than the prevalence of iron deficiency. We have used specific exclusion criteria (ferritin, age, pregnancy) to ensure that the two groups were comparable and iron replete. The first data set, extracted from our community laboratory database, consists of 612 men and 1327 women aged 20-45 years, all of whom have a serum ferritin value within the narrow range of 80-100 µg/l (indicating adequate iron status). The 10th, 25th, 50th, 75th, and 90th centiles for men and women were 139, 146, 152, 157, 163, and 123, 129, 135, 141, 146 g/l, respectively.

To confirm that these differences also existed in a community based population, we provide data from a random nutrition survey of 4636 New Zealand adults.[2] From the survey population we selected all non-pregnant participants aged 20-45 years with a ferritin concentration of 50-100 µg/l and a normal concentration of C reactive protein (to exclude participants with anaemia due to chronic inflammatory conditions). The 10th, 25th, 50th, 75th, and 90th centiles for men and women were 140, 146, 150, 157, 160 (n=110) and 127, 131, 138, 142, 147 g/l (n=252), respectively. These results confirm our conclusion that the distribution of haemoglobin concentrations is substantially lower in women than in men.

This analysis also shows that, depending on the choice of the lower limit of haemoglobin for men (usually 130-135 g/l), 25-50% of women would be incorrectly classified as anaemic if a male reference range was used. This would have a profound public health impact owing to indiscriminate diagnosis of poor iron status in women.

With respect to ferritin concentrations, we agree that marked sex differences in ferritin distributions in a “normal” population occur because the iron requirements of menstruating women are higher and intakes lower than their male counterparts, resulting in lower iron stores among women.[3] For ferritin, the lower limit of the reference range is more difficult to extract from population studies and should perhaps instead be based on biological definitions of iron deficiency, which include depletion of bone marrow iron stores. The appropriate ferritin cut-off value to use for defining iron deficiency is under debate,[3-5] but most would agree that sex specific cut-off points are inappropriate for ferritin when defining iron deficiency.

References

1.Rushton DH, Dover R, Sainsbury AW, Norris MJ, Gilkes JJ, Ramsay ID.Why should women have lower reference limits for haemoglobin and ferritin concentrations than men?*BMJ*2001;**322**: 1355–1357. (2 June.)

2.Russell D, Parnell W, Wilson N, Faed J, Ferguson E, Herbison P, et al.*NZ Food: NZ People. Key results of the 1997 National Nutrition Survey.* Wellington: Ministry of Health, New Zealand Government,1999.

3.Looker AC, Dallman PR, Carroll MD, Gunter EW, Johnson CL.Prevalence of iron deficiency in the United States.*JAMA*1997;**277**:973–976.

4.Ferguson EL, Morison IM, Faed JM, Parnell WR, McKenzie J, Wilson NC, et al.Dietary iron intakes and biochemical iron status of 15–49 year old women in New Zealand: is there a cause for concern?*N Z Med J*2001;**114**:134–138.

5.Hallberg L, Hulten L, Lindstedt G, Lundberg PA, Mark A, Purens J, et al.Prevalence of iron deficiency in Swedish adolescents.*Pediatr Res*1993;**34**:680–687.