Meat avoidance and body weight concerns: nutritional implications for teenage girls

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In a report on vegetarianism recently published by the British Nutrition Foundation (1995) it was noted that, between 1988 and 1994 there was a threefold rise in the proportion of women, aged between 16 and 64 years who avoided eating meat. This dramatic increase in the popularity of meat avoidance has raised many concerns about the adequacy of a meatless diet, in particular for teenage girls because of their high nutritional requirements. The present paper briefly addresses the reasons why teenage girls choose to avoid eating meat and investigates the effects of meat avoidance on Fe status during the teenage years.

REASONS FOR AVOIDING MEAT

There are many reasons why vegetarians decide to avoid eating meat. Most, however, both young and old, say that an abhorrence of cruelty to animals is their main reason and often, a dislike of the taste of meat and perceived health benefits are other common reasons given (Reddy & Sanders, 1990).

Recently a questionnaire survey was carried out on 420 15-year-old Dublin schoolgirls and 34 % (*n* 141) reported that they avoid or would like to avoid eating meat and their reasons are shown in Table 1. 'Eating meat is cruel to animals' was the most popular reason given by the girls (53 %) followed by a dislike of the taste of meat (51 %). Over one-quarter of the girls (29 %) reported that they avoid or would like to avoid eating meat because 'meat is a fattening food'. This finding supports recent evidence which suggests that the increased popularity of meat avoidance by teenage girls may be linked with a desire to reduce body weight (Sanders & Reddy, 1994).

Meat avoidance and slimming among teenage girls

To investigate this hypothesis further the weight concerns of these Dublin schoolgirls (*n* 420) were assessed and, in agreement with the findings of Hill *et al.* (1992) in British teenagers, a high level of dissatisfaction with body weight was found in this study. Of the teenage girls surveyed, 60 % (*n* 247) reported that they were 'not happy with their weight' and 'wanted to be lighter' and 68 % (*n* 286) had 'tried to lose weight in the past'. Furthermore, over three-quarters (*n* 323) of the subjects agreed that 'meat is a fattening food', supporting Thomas's (1990) suggestion that healthy-eating guidelines which encourage a decreased saturated fat intake by reducing consumption of meat and meat products may be misinterpreted by teenage girls leading to the concept that meat is 'fattening'. A comparison of the weight concerns of 'meat eaters' (*n* 279) with 'reduced meat eaters' (subjects (*n* 141) who reported that they avoid or would like to avoid eating meat) showed that the proportion of girls who 'wanted to be slimmer' was higher among

Table 1. *Reasons for avoiding meat from a survey of 15-year-old Dublin schoolgirls who avoid or would like to avoid meat* (n *141*)

Reason	%*
Eating meat is cruel to animals	53
I do not like the taste of meat	51
Meat is a fattening food	29
Vegetarian diets are more healthy	23

*46 % (*n* 65) of the girls gave more than one reason and, therefore, the total percentage does not equal 100.

the 'reduced meat eaters' compared with the 'meat eaters' (75 *v*. 61 %, $P = 0{\cdot}003$) and more of the 'reduced meat eaters' had 'tried to lose weight' (80 *v*. 62 %, $P = 0{\cdot}002$).

Similarly, Nelson *et al.* (1993) showed a higher prevalence of Fe-deficiency anaemia associated with lower dietary Fe intakes in British schoolgirls (*n* 197, aged 12–14 years) who had tried to lose weight compared with those who had not (23 *v*. 7 %, $P = 0{\cdot}002$).

Therefore, considerations of body weight and the general misperception that 'meat is a fattening food' appear to be important influences on meat consumption patterns among teenage girls.

EFFECTS OF MEAT AVOIDANCE ON IRON STATUS DURING ADOLESCENCE

Many factors contribute to a marked rise in the requirement for dietary Fe during the teenage years. The following section briefly describes these factors and examines how males and females differ in their need for Fe during this time.

Iron requirements in males

In males, requirements for Fe include that needed to replace basal losses and to meet the demands of growth (see Fig. 1). Basal losses comprise Fe that is lost with cells shed from the interior and exterior surfaces of the body including skin, intestines, urinary tract and airways. This loss is largely influenced by body size and is estimated to be about 14 µg/kg body weight per d (Hallberg & Rossander-Hulthén, 1991).

In relation to growth requirements, the adolescent growth spurt in boys occurs between the ages of 13 and 14 years, with sexual maturation typically starting 2 years before peak growth and lasting for about 3 years. This sequence of events, however, can take place either much earlier or later and is associated with a sharp increase in the need for absorbed Fe from about 1·0 to 2·5 mg/d. After this period of high Fe requirements, there is a rapid decrease in the rate of growth and consequently in the need for Fe, providing, therefore, an opportunity to recover from the Fe depletion that might have developed during peak growth (Dallman, 1992).

Iron requirements in females

Due to the onset of menstruation, the adolescent increase in Fe requirement is distributed over a much longer period in females than in males (see Fig. 2). Peak growth in girls occurs earlier than in boys at a mean of 11·5 years; sexual maturation begins 1 year before this and continues for a total of 4 years, with menarche typically starting about 1 year after peak growth. The mean requirement for absorbed Fe reaches a maximum of about 1·5 mg/d at

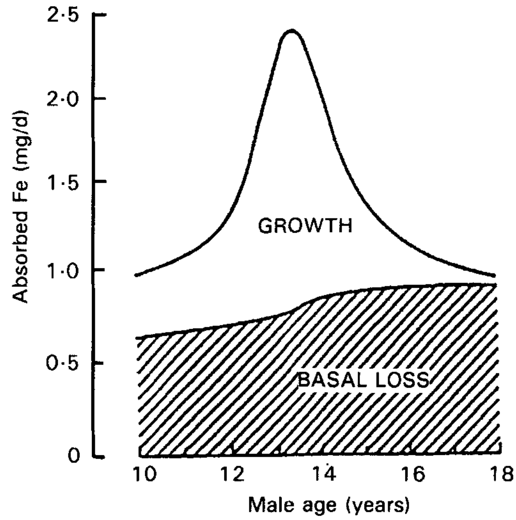

Fig. 1. Iron requirements in males. (From Dallman, 1992; reproduced with the permission of Nestec Ltd.)

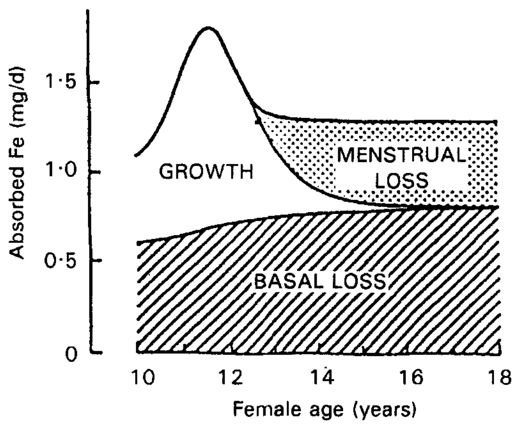

Fig. 2. Iron requirements in females. (From Dallman, 1992; reproduced with the permission of Nestec Ltd.)

peak growth, but does not return to its earlier baseline. Instead, it settles at a higher level of about 1·3 mg/d due to the new requirement to replace menstrual Fe losses (Dallman, 1992).

Fe status in females has been shown to be determined largely by Fe losses during menstruation. In a study examining factors associated with Fe depletion in a group of 446 women, aged between 17 and 50 years, Fogelholm *et al.* (1993) reported that Fe stores were negatively affected by both high frequency of menstruation (high *v.* low frequency groups had serum ferritin levels of 23·3 *v.* 42·5 μg/l respectively; $P < 0{\cdot}05$) and prolonged menstrual bleeding time (> 6 d *v.* 4–5 d corresponded with serum ferritin levels of 22·6 *v.* 29·4 μg/l respectively; $P < 0{\cdot}05$).

Although menstrual blood losses in individual women tend to be constant throughout fertile life there is a marked variation in losses between different women (Hallberg & Rossander-Hulthén, 1991). In a study on 476 Swedish women, Hallberg *et al.* (1966)

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reported that the median monthly blood loss was 30 ml corresponding to a daily Fe loss of 0·5 mg. Women at the 95th centile, however, had losses of up to 118 ml blood per menstrual period, equivalent to 1·9 mg Fe.

Therefore, for Fe balance to be maintained in teenage girls the amount of Fe absorbed daily from the diet must be sufficient to meet the demands of growth and to compensate for daily Fe losses, both basal and especially menstrual losses (MacPhail & Bothwell, 1992).

The regulation of iron balance

Hallberg *et al.* (1995) reported that the body has several systems or adaptive mechanisms which strive to protect Fe status even despite very high physiological requirements for Fe. It is well established that dietary Fe absorption has a key role to play in the maintenance of Fe balance (Hallberg *et al.* 1995). New research, however, indicates that the amount of Fe in stores may be the main factor that controls the quantity of Fe absorbed from the diet. Evidence of this was presented by Hulthén *et al.* (1995) who showed a significant negative correlation ($P < 0.001$) between serum ferritin and Fe absorption (see Fig. 3).

More recently, Antilla & Simes (1996) in an 18-month follow-up study of sixty 11- and 12-year-old males, showed that, as the boys progressed through puberty their serum ferritin concentrations fell. The authors suggest that this does not necessarily indicate Fe depletion but reflects Fe moving from stores for erythropoiesis and that decreasing stores leads to increased Fe absorption supplying most of the Fe needs of the boys.

Furthermore, studies have shown that, although the incidence of Fe-deficiency anaemia in vegetarians is not significantly different from that of 'meat eaters', their Fe stores are frequently reduced (Helman & Darton-Hill, 1987; Reddy & Sanders, 1990; Alexander *et*

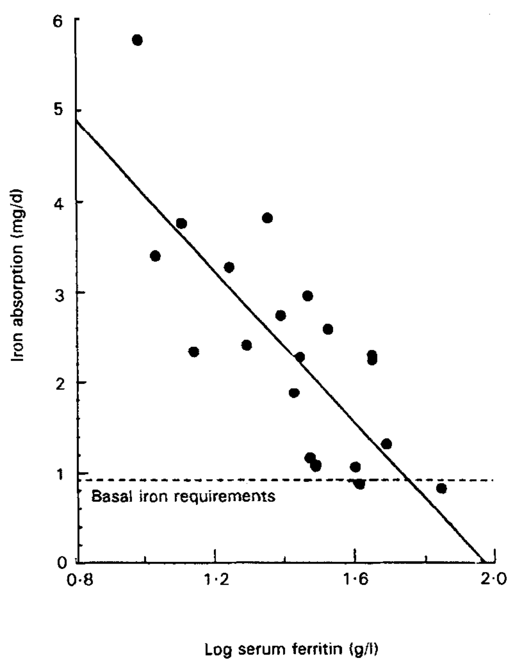

Fig. 3. Relationship between iron stores and iron absorption. (From Hulthén *et al.* 1995; reproduced with the permission of Macmillan Press Ltd.)

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Table 2. *Factors that influence dietary iron absorption* (From Craig, 1994)

Enhancers	Inhibitors
Ascorbic acid	Phytates (bran)
Meat, fish and poultry	Polyphenols (tannins)
Citric, malic and other organic acids	Zn and other divalent cations
Fermented foods	Soyabean proteins
	Ca

al. 1994). It is possible that this may be an adaptive response in vegetarians, similar to that described in adolescent boys and facilitates maximum absorption of the less-available non-haem-Fe, assisting in the regulation of Fe balance.

In addition, results from surveys which have examined the Fe status of menstruating women have found that between 16 and 30 % have low Fe stores; however, the prevalence of Fe deficiency anaemia is much lower, ranging between 2 and 5 % (Hallberg, 1995). A finger-prick blood sample was used to assess the Fe status of a subgroup of 201 Dublin schoolgirls who participated in the questionnaire survey. Low Fe stores (serum ferritin ≤ 15 μg/l) were identified in 42 % of the girls, only 3 %, however, were found to be Fe deficient (haemoglobin < 120 g/l). Although the higher the prevalence of low Fe stores in a population the greater the risk of Fe deficiency anaemia, in the majority of cases, low Fe stores do not appear to predict the development of Fe-deficiency anaemia.

In summary, these findings seem to suggest that low Fe stores may not be a cause for concern; declining serum ferritin concentrations may reflect a 'normal' physiological response that has a part to play in maintaining Fe homeostasis. There is, however, a limit to this adaptive process and Hallberg *et al.* (1995) have recently defined what they described as a 'a critical point' at which insufficient amounts of dietary Fe are absorbed to balance Fe losses. At this point, the serum ferritin concentration falls to below 15 μg/l, Fe begins to disappear in bone-marrow smears and the haemoglobin concentration starts to decrease. The point at which this limit is reached is determined largely by the characteristics of the diet consumed or, more specifically, by its haem and non-haem-Fe content and by the balance between factors present in the diet that enhance or inhibit Fe absorption. These factors are summarized in Table 2.

In vegetarians, although non-haem-Fe is much less absorbable than haem-Fe (2–20 % *v.* 15–35 %; Craig, 1994), the presence of enhancing factors, when consumed at the same meal will greatly increase, perhaps by fourfold the amount of non-haem-Fe absorbed (Monsen, 1988).

CONCLUSIONS

Although requirements for Fe are high in teenage girls, an appropriately-planned and varied vegetarian diet is compatible with an adequate Fe status. Knowledge of dietary factors that enhance non-haem-Fe absorption is important to enable young meat avoiders to make sensible, healthy food choices (Craig, 1994). However, the link between meat avoidance and a 'desire to be thinner' suggests that some teenagers may choose to avoid meat and other foods also perceived as fattening solely to lose weight, and, in contrast to those committed to a lifetime of meat avoidance for moral or health reasons, may fail to adequately compensate for the lack of haem-Fe and other nutrients in their 'meatless' diet, greatly increasing the risk of nutrient deficiencies.

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