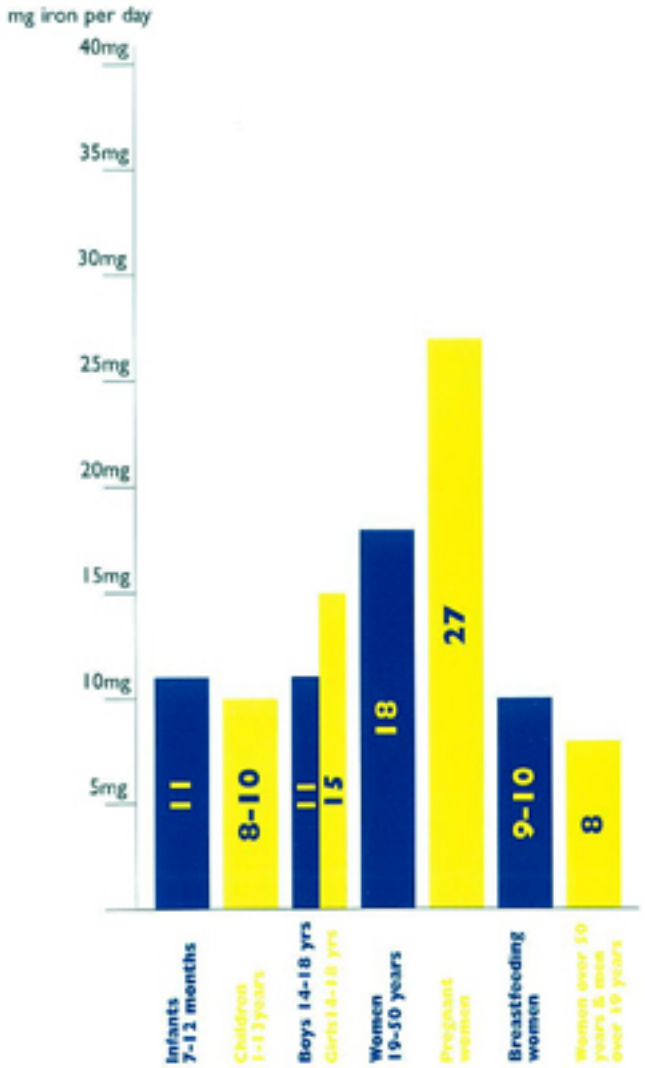
# IRON
## the New Zealand situation

New Zealand research shows iron deficiency is a significant problem, and inadequate iron intakes are common amongst teenage girls and adult women. Infants, pregnant women and athletes are also at particular risk of iron deficiency. The relationship between iron intake and iron status is complex and subject to many variables. The following studies have assessed the iron intake and/or status of specific sub-groups in the New Zealand population.

## RECOMMENDED DIETARY INTAKE FOR IRON (1)




# Iron status in New Zealand

## INFANTS

Iron deficiency is prevalent in developed countries, including New Zealand. Approximately one third of New Zealand children between six months and two years of age are iron deficient. By comparison, less than 10% of American children in the same age group are iron deficient.(2)

The results from a recent population-based study showed iron deficiency (ID) is prevalent in 25% of Auckland children aged 6-23 months. Iron deficiency anaemia (IDA) was present in 10% of the infants. Iron deficiency did not vary with ethnicity.(3)

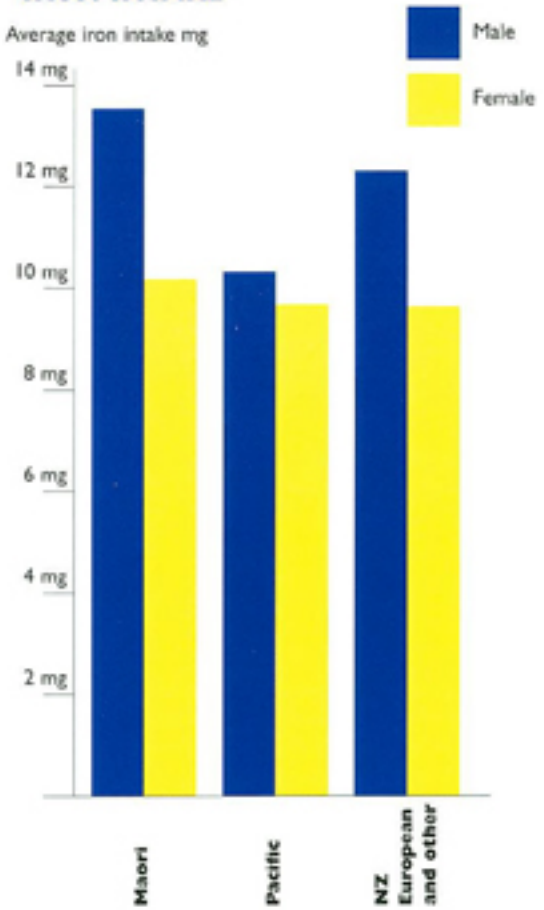
A Starship hospital study in 1999 found 29% of 9-23 month old children had IDA. Sixty nine percent of these had eating habits that may have contributed to their iron deficiency (early introduction of cows' milk, late introduction of meat, or regular consumption of tea).(4) Children from areas of socioeconomic disadvantage were particularly at risk. The introduction of meat after eight months occurred in 63% Europeans, 50% Maori, 25% Samoan, 17% Tongan and 25% other Pacific Islanders.

## YOUNG CHILDREN

Results from the National Children's Nutrition Survey (2002) for children aged between 5-14 years revealed the average iron intake for males ranged from 10mg (5-6 year olds) to 14.1mg (11-14 year olds) and from 8.4mg (5-6 year olds) to 9.9mg (11-14 year olds) for females. Iron status was satisfactory for most children as assessed by both dietary intake and biochemical indices, with the exception of menstruating females.(5)

As the graph below shows, Maori had the highest iron intake amongst males and females.

### IRON INTAKE



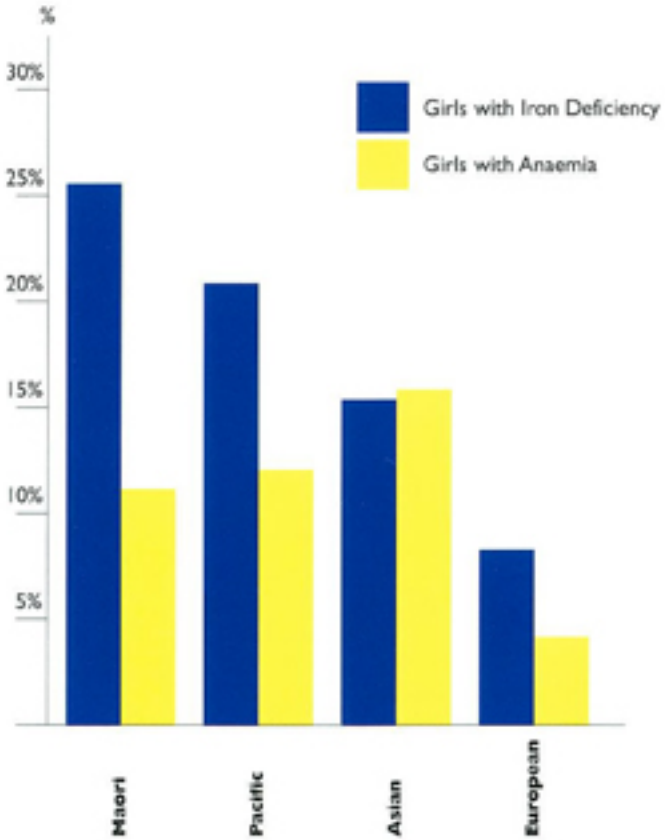

The survey highlighted 6.6% of New Zealand children had an inadequate iron intake. Not surprisingly, 12% were made up of females (including those menstruating) compared to a lower prevalence found in young males (1.6%). It appeared the prevalence of inadequate iron intake increased with age as the 5-6 year olds had the lowest and 11-14 year olds had the highest.

## TEENAGE GIRLS

Although the proportion of New Zealand children (5-14 years) with inadequate iron intake was only 6.6%, this increased to 12% in teenage girls.(5)

In another study of Auckland high school students, iron deficiency and anaemia was found to be 10 times higher in teenage girls than teenage boys.(6) Maori, Pacific Island and Asian females had 2-3 times greater risk of iron deficiency and 3-4 times the risk of anaemia compared with European girls.

### TEENAGE GIRLS IRON STATUS




A Dunedin longitudinal survey studied iron status in the south of New Zealand.(7) It found, for age groups on either side of adolescence, the prevalence of anaemia in a group of predominantly European females (haemoglobin <120g/L) increased from 3.1% at age 11 to 5.8% at age 21 years.

The 1997 National Nutrition Survey was largely a study of adults, but revealed 7% of females 15-18 years had low iron stores, 6% were iron deficient and 6% had iron deficiency anaemia.(8)

## ADULTS

Dietary iron intake and biochemical status of 15-49 year old women was assessed in the 1997 National Nutrition Survey.(9) The results revealed less than 5% of women had iron deficiency anaemia, but 7-13% had sub-optimal iron levels.

These results represent approximately 130,000 – 240,000 New Zealand women having sub-optimal iron status. The situation appears to be **"a public health concern given the potential negative functional consequences associated with even mild iron deficiency"**. (9)

The iron status of New Zealand women does, however, compare favourably to women in other Western countries.

The estimated prevalence of inadequate iron intake among women is 26%, but this may be an over-estimation among menstruating females when compared to their iron stores. Reasons for this may include misjudgement of menstrual blood loss, under-reporting of food intake and better than estimated absorption of dietary iron.(8)

A Danish study by Bendtsen showed an intake of meat and fish was associated with changes in haemoglobin concentration (red blood cell pool, which is low in late stages of iron deficiency).(10) The study compared the iron status of women on a vegetable-based diet to women on a meat-based diet. Study changes were observed within 20 weeks of intervention, and underlined a vegetable diet was not adequate for fertile women with respect to maintaining iron status. The overall observation in the study showed iron bioavailability was the determining factor for the development of the women's iron status.

Meat is a source of haem iron, which is more bioavailable so absorbed at higher rates than non-haem iron found in plant foods. In New Zealand women, a high intake of animal tissue, such as lean red meat, is associated with lower risk of iron deficiency, although only in women without high menstrual losses.(11)

The estimated intake for older adults over the age of 65 years showed just 3% of women and 1% of men had an inadequate iron intake.(8)

## PREGNANT WOMEN

During pregnancy, iron requirements double or even triple, especially at about 20 weeks. There are adaptive mechanisms to increase iron absorption and these compensate to some extent. Lowered iron stores are considered to be physiologic among pregnant women, but status must be continually monitored.(12)

It has been suggested absorption of up to 66% of non-haem iron occurs during the third trimester and it is assumed haem iron absorption also increases up to 50% during pregnancy.(13) National nutrition guidelines advise pregnant women to choose haem iron foods such as red meat, fish and poultry as well as foods that enhance non-haem iron absorption such as red meat, fruit and vegetables. Pregnant women should avoid consuming tea with meals as tannins in tea interferes with non-haem iron absorption.(14)

## BREASTFEEDING

It appears many breastfeeding women have an adequate iron intake (11.8mg/d), (15) although this level is only just above the RDI of 9-10mg/day.

Although iron losses in milk during six months of exclusive breastfeeding are equivalent to approximately 14% of the average woman's iron stores, this is only about half that ordinarily lost through menstruation. Thus, unless there was excessive blood loss at delivery, the total demand for iron during breastfeeding is reduced while the woman is still amenorrhoeic (without menstrual bleeding). Once menstruation resumes, breastfeeding women may then have increased needs for dietary iron.(14)

## VEGETARIANS

Ninety four percent of the adult population in New Zealand eat an omnivorous diet.(8) The recent children's nutrition survey found 95% of 5-14 year olds ate a mixed diet, rising to 99% of children living in rural areas.(5)

The haemoglobin and serum ferritin levels of New Zealand vegetarians have been shown to be similar to non-vegetarians.(16) It was reported the dietary iron intake of the female vegetarians was slightly higher than the non-vegetarians. Not surprisingly, the vegetarians gained a greater proportion of iron from vegetables and fruits than non-vegetarians. Due to the lower rate of absorption from these plant foods (5%) than animal foods (25%), vegetarians are recommended to consume about 80% more dietary iron to meet their requirements.(1)

## ATHLETES

A number of physiological and dietary factors are associated with iron deficiency in athletes. High iron requirements and losses of iron induced by strenuous exercise, maturational age and growth requirements, sub-optimal intakes and low bioavailability of dietary iron are all implicated. A decrease in performance capacity and recovery is related to the function of iron and its role in oxygen transport and energy metabolism.

International studies show long distance runners, vegetarians and teenage female athletes are at risk of iron deficiency.

There is little data available on the iron status of New Zealand athletes but in one small study, 36% had an impaired iron status, all of which were female.(17) 29% of the subjects with impaired iron status had depleted iron stores.

## 3 STAGES OF ADULT IRON DEFICIENCY(18)

These are the 3 stages of iron deficiency. A blood test will check for three indicators: serum ferritin (storage iron), haemoglobin (red blood cell pool) and % transferrin saturation (transport iron). A person with normal iron levels (yellow) will be within the healthy range for all three. As the iron deficiency stages progress, these indicators fall out of healthy ranges (blue).

| STAGE | SERUM FERRITIN ug/L (storage iron) | % TRANSFERRIN SATURATION (transport iron) | HAEMOGLOBIN g/L (red cell pool) |
|---|---|---|---|
| Normal | 20-160 F, 20-250 M | 20-40 F, M | 115-160 F, 175 M |
| 1 Depleted iron stores | < 30 F, M* | 20-40 F, M | 115-160 F, 175 M |
| 2 Iron deficiency | < 12 F, M | <16 F, M | 115-160 F, 175 M |
| 3 Iron deficiency anaemia | < 10 F, M | <16 F, M | <120 F, <140 M |

F = Females, M = Males, *may vary between studies

# SOURCES OF IRON IN THE NEW ZEALAND DIET

There are two sources of dietary iron:

### Haem Iron

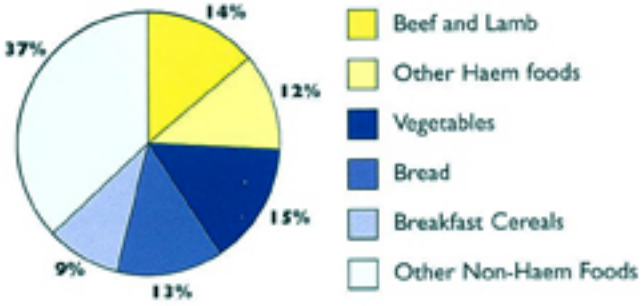
Haem iron is only found in animal products. It is easily absorbed and used by the body. On average, 25% of haem iron is absorbed, depending on iron stores. The body will absorb more haem iron if iron stores are low. Generally the redder the meat, the higher the iron content. Beef and lamb are two of the richest sources of haem iron.

### Non-Haem Iron

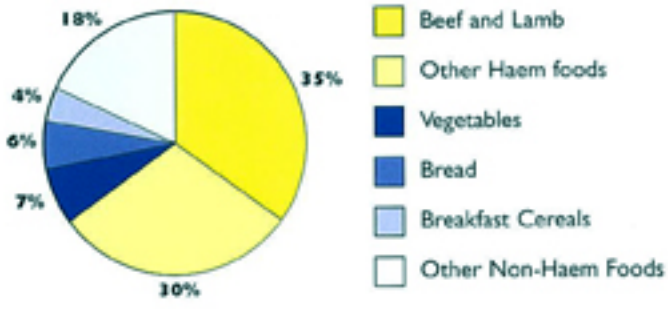
Non-haem iron is found in both animal and plant products. It is poorly absorbed and used by the body, about 5%. Consumption of animal proteins (meat, fish or poultry) and vitamin C can boost absorption of non-haem iron. Tannins in tea and coffee, phytates in wholegrain cereals, oxalates in some vegetables (eg spinach) and some types of fibre can inhibit absorption of non-haem iron. Iron absorption from plant foods can be increased up to four times by combining with meat in a meal.

The dietary intake of haem iron has been estimated to be just under one third of the total intake but this increases to around two thirds when absorption rates are considered.(8)

## FOOD SOURCES OF IRON




## ACTUAL CONTRIBUTION TO IRON INTAKE




When looking at total iron intake, it is important to note the proportions of both haem and non-haem iron because of the significant difference in bioavailability. RDIs assume a mixed diet with 18% of total iron being absorbed.(1)

New Zealand women eat on average 39 grams of beef and lamb per day while New Zealand men eat about 74 grams. This excludes the beef and lamb in sausages and pies.(19) National nutrition guidelines recommend at least one serving of lean meat, poultry, seafood, eggs or alternatives a day.(20)

New Zealand children derive 8% of the iron in their diet from beef and lamb.(5) Although breakfast cereals and bread provided the greatest proportion of total iron, these contain the less well absorbed non-haem iron. In comparison, beef and lamb provide the highest proportion of the better absorbed haem iron.

# WHAT DOES THIS MEAN FOR HEALTH PROFESSIONALS?

- Look at both dietary and biochemical data when investigating iron status.
- Focus on groups at risk of inadequate iron intake, for example infants and young children, young women, athletes, pregnant women and vegetarians.
- Be aware of the large absorption difference between haem and non-haem iron.
- It is important to take into consideration not only the total content of dietary iron, but also the composition of the diet and bioavailability of the iron, ie absorption promoters and inhibitors.
- Fertile women can be recommended to increase their daily intake of lean meat, both to improve their intake of the easily absorbed haem iron, but also to facilitate the absorption of the not-so-easily absorbed non-haem iron.
- Keep up-to-date with emerging results from current New Zealand studies on both iron intake and iron status. Be aware results can vary greatly depending on the method used in the study, ie dietary intake or biochemical tests. When comparing studies, check reference values are comparable, ie haemoglobin, ferritin and RDIs.

For additional nutrition resources, available free of charge, contact:
New Zealand Beef and Lamb Marketing Bureau
Freephone 0800 733 466
or visit **www.nzbeeflamb.co.nz**

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