Red meat has an important part to play in ensuring a nutritional, healthy diet for all. That is the true finding of the Scientific Advisory Committee on Nutrition (SACN) review of dietary advice on iron. Unfortunately, this message appears to have been lost in translation in many quarters of the media.

The Department of Health asked SACN to review the dietary evidence on iron and make proposals to ministers. The National Diet and Nutrition Survey (NDNS) has consistently shown that a proportion of the population, particularly young women and children, have low iron intakes relative to recommended reference intakes. This has raised concern that they may be at risk of iron deficiency, which can lead to iron deficiency anaemia and the adverse effects this can have on health.

SACN’s remit was to review dietary intakes of iron in its various forms and to assess the impact of different dietary patterns on the nutritional and health status of the population. It was therefore important to consider both the beneficial and adverse effects of increasing and decreasing iron intakes.

The effect of dietary components on iron absorption and utilisation in the body and the effect of iron deficiency on health and well-being were examined. The potential adverse effects of excess iron, including free radical damage and risk of cardiovascular disease and cancer, were also considered. The association between consumption of red and processed meat and cancer risk was considered, as these foods contain relatively high levels of iron.

**The function of iron**

Iron is an essential nutrient. It is a component of haemoglobin in red blood cells and of myoglobin which respectively distribute oxygen around the body and store oxygen in muscles and tissues. Iron is also a component of enzymes that are integral for energy metabolism, the metabolism of proteins and nucleotides, and the synthesis of proteins, tissues, some hormones and neurotransmitters.

Iron is potentially toxic because it reacts readily with oxygen. Consequently, we have evolved mechanisms to limit the amount of iron that enters the body and to limit and control the chemical reactivity of iron in the body. The body cannot excrete iron, so the amount in the body is controlled by matching the intestinal uptake and transfer of iron to the amount needed to replace adventitious losses of iron (e.g. through blood loss including menstruation, shed skin, hair, sweat, and urine) and the amount needed for growth and
reproduction. Therefore, the principal determinant of the amount of iron that enters the body from the diet is the body’s need for iron to meet these requirements.

**Dietary sources of iron**
A major dietary source of iron in the UK is cereals, including bread (non-haem iron is added by law), which accounts for about half of iron intake for most of the population. Meat and meat products (containing haem iron) and vegetables also make a substantial contribution to total iron intake. Haem iron is between two and six times more available for absorption from the diet than non-haem iron. Meat, especially red meat, is almost exclusively the dietary source of haem iron.

**Safe and adequate intakes of iron**
One of the important challenges for SACN was to ensure that the UK population has a safe and adequate supply of iron. To this end, it is recommended that a public health approach to achieving adequate iron status should emphasise the importance of a healthy balanced diet that includes a variety of foods containing iron. SACN felt that such an approach is more important than focusing on particular inhibitors (e.g. phytic acid found in wholegrains or polyphenols found in tea) or enhancers (e.g. vitamin C) of iron absorption from diets.

While substantial proportions of the UK population appear to have iron intakes below recommended levels, this is not clearly consistent with the low prevalence of poor iron status. It is thought that this might be because there are important uncertainties in the Dietary Reference Values (DRVs) for iron intake which may be too high, particularly for girls and women of reproductive age. SACN recommends that the DRVs for iron should be reviewed when more data become available.

**Iron absorption**
The most important determinant of iron absorption is the body’s need for iron: more is absorbed in a state of iron deficiency and less is absorbed when iron depots are replete. About 95% of the UK population is iron replete, but some groups may be at greater risk of iron deficiency than others. These include toddlers, girls and women of reproductive age (particularly those from low income groups), and adults aged over 65 years. It is recommended that health professionals be alert to the increased risk of iron deficiency in these groups. Those with signs and symptoms suggestive of iron deficiency anaemia should receive appropriate clinical assessment and advice, including dietary advice on how to increase their iron intakes.

**Iron supplements**
The use of iron supplements should be considered if required, but the current evidence does not support the routine iron supplementation of pregnant women unless they have haemoglobin concentrations below 110g/L in the first trimester and 105g/L at 28weeks (NICE 2008). In the UK, the Guidance Level (GL) for supplemental intake of iron (i.e. additional to intakes of food) is 17mg/day for adults. This is based on adverse gastrointestinal effects when consuming higher doses.

Studies suggest that maternal concentrations at either the low or high end of the distribution during pregnancy (usually in the first or second trimester) are makers of increased risks of low birth weight and perinatal mortality. However, a causal relationship between these and iron supply or nutrition is not established.
Studies using iron supplements suggest that iron responsive anaemia is a cause of poor motor development in children in the first three years of life and on cognitive development in older children.

**Iron and health**
Observational studies of total iron intake/body iron burden and cardiovascular disease (CVD) do not suggest an association. Similarly, there is no substantive evidence that dietary intakes of iron are associated with arthritis or with diabetes mellitus. There is no evidence that dietary iron is associated with neurodegenerative disease.

Most studies on iron and cancer risk have examined the relationship between iron and colorectal cancer (CRC). This is because most dietary iron is not absorbed and luminal exposure to excessive intakes could cause direct oxidative damage to the colorectal lumen. *Overall, there is insufficient data on the association between intakes of total dietary iron or body iron burden and colorectal cancer risk to reach clear conclusions.*

In most studies the association was not statistically significant and methodological inconsistencies between the different studies make comparisons difficult. These include adequacy of the dietary assessment methods to obtain reliable estimates of red and processed meat intake; lack of consistency in the categorisation of red and processed meat; and variability in the reporting of quantities of red and processed meat intake.

**Limitations in the data**
SACN recognised that these limitations in the data make it difficult to quantify a level of red or processed meat intake that may be associated with CRC risk. It is not possible to discern a clear dose-response relationship, or a threshold level of intakes of red or processed meat associated with increased colorectal cancer risk. This is primarily because of the inconsistencies in categorisation and quantification of red and processed meat intake as mentioned above.

A theoretical modelling exercise was conducted to explore the possible effects of a recommendation for adults to lower their consumption of red and processed meat on intakes of iron and zinc. Results indicated that red and processed meat makes a greater contribution to total zinc intake (32% for men; 27% for women) than to total iron intake (12% for men; 9% for women).

The average red and processed meat consumption of adult consumers is approximately 70g/day (88g/day, men; 52g/day, women). Therefore most people in the UK do not have high intakes of meat, but more men fall into the higher consuming bracket than women. It was estimated that those above the 75th percentile of intake consumed over 90g of red and processed meat per day. This amounts to 4 in 10 (42%) of men compared to 1 in 10 (12%) of women. It is suggested that if these high consumers were to reduce their intake to the population average (70g), that it would have little impact on the proportion of the adult population with iron intakes below the Lower Reference Nutrient Intake (LRNI).

The impact of such as population wide reduction would increase the proportion of women having intakes below the LRNI by 1% to 26%. This 1% would equate to 250,000 more UK women with an inadequate intake of iron. In addition, such a reduction would increase the proportion of people with intakes of zinc below the LRNI to 5.5% in men and 3.9% in women. It is however recognised that these estimates are based on NDNS data from 2000/01 and will need to be kept under review.
Nevertheless a precautionary approach has been adopted by SACN suggesting that it may be advisable for adults with relatively high intakes of red and processed meat (>90g/day) to consider reducing their intakes. This is supported by the observation that this may also help reduce intakes of salt and saturated fat, particularly by reducing the consumption of processed meats which tend to contain higher levels of both. There is no scientific evidence presented to support this assumption.

Research recommendation
A plethora of research recommendations are proposed, including a plea for a more co-ordinated approach to research on iron. This should assess the relationship between iron excess and chronic disease, and employ standardised approaches to measuring iron exposure and categorisation of red and processed meat and other sources of organic and inorganic iron. Together with the maintenance and expansion of food composition databases, with particular reference to iron content, this would improve the quality of dietary assessments of iron intake for studies relating to iron and chronic disease.

A role for industry
There are a number of ways in which the red meat industry could choose to interpret this report. There are some negative interpretations, such as the precautionary advice supporting the recommendation that high consumers of red and processed meat (90g/day) should reduce their intakes to around average (70g/day). Co-incidentally this was the figure also proposed by WCRF in their controversial report reviewing the evidence on the subject. Their expert panel also included several SACN members, including the chairman Professor Alan Jackson. However, with average consumption already being around 70g per day, most people need not change their eating habits.

This recommendation is based on the assumption that the beneficial ‘knock on’ effect would help reduce intakes of salt and saturated fat. However, there is no evidence to support the fact that this assumption would in fact confer any health benefits on a population wide basis. So clearly, there is evidence to accrue on this matter.

What can we do?
The report highlights the need for further research on the subject of iron and health and the role that red and processed meat can contribute to this as part of a healthy balanced diet. Clearly this needs to be better understood. However, it seems to have been overlooked that long term trends suggest consumption of red and processed meat is declining in the UK. This does not marry well with the available scientific evidence. Consistently it seems recommendations support the notion that we should be reducing our intake of red and processed meat for precautionary health reasons. Supporting such a view based on limited scientific evidence would be difficult to justify.

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Further information
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