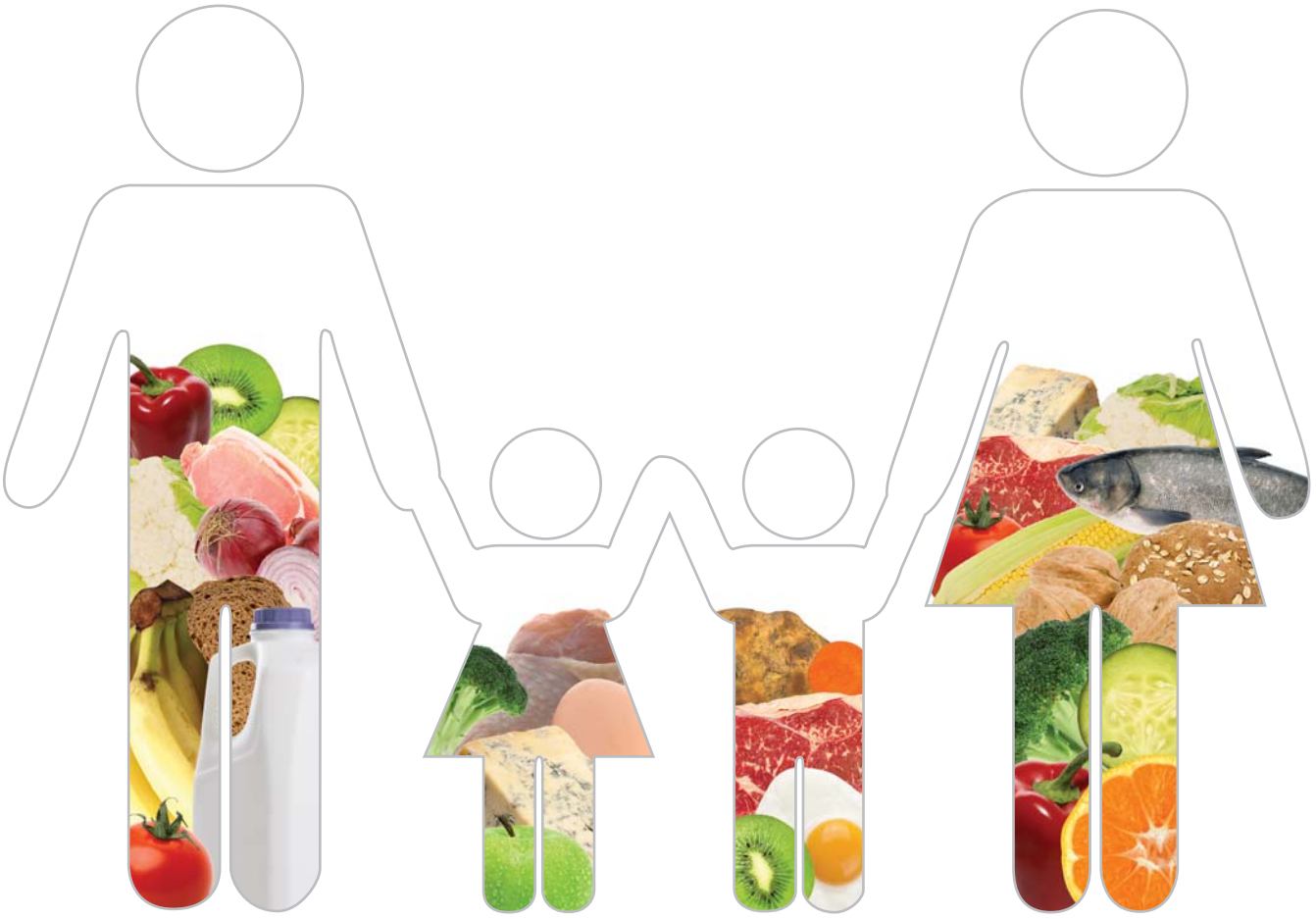
PAGB

Towards a **Healthier Britain** 2010



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Executive Summary

Given the array of nutritious, affordable foods in the shops and the wealth of health information provided by experts, few would expect significant numbers of British adults and children to be at risk of nutrient deficiency. Yet, this is exactly the case, according to the Government's own dietary surveys.

A quarter of women have inadequate intakes of iron, more than 50% lack the antioxidant, selenium, and nearly one in ten men are low in magnesium. Intakes of iron, magnesium, zinc, iodine and selenium are woefully low in adolescent girls. One in five pre-school children have abnormally low iron stores, and significant groups of elderly people are iron deficient. Blood levels of vitamin D are too low to sustain normal bone health in a quarter of adults. Fish intakes have declined in the last decade and are too low to meet recommendations for long-chain omega-3s. More worryingly, given the investment in public health, the situation has improved very little over the last decade.

Experts agree that optimal levels of vitamins and minerals are vital for health and well-being. Indeed, a substantial body of research shows that low levels of specific nutrients increase the risk of chronic conditions, such as heart disease, diabetes, osteoporosis and some cancers. Clearly, dietary intakes need to improve if we are to safeguard the future health of the nation.

Messages about eating a healthy, balanced diet should continue to underpin advice given to the public, but more could be made of the role of supplements in helping people to achieve vitamin and mineral targets. Dietary change takes time and is difficult to achieve for many people as evidenced by the limited progress in fruit, vegetable and oily fish targets. Vitamin and mineral supplements are proven to contribute significantly to recommended intakes and to boost nutritional status. In the cases of vitamin D and long-chain omega-3s, where food sources are limited, supplements have a vital role in helping people to meet recommended levels. Given the evidence on diet inequalities, increased access to supplementation could disproportionately help vulnerable groups in society such as low income women, pregnant adolescents, the elderly and young children.

Better awareness of the role of supplements in supporting a healthy, balanced diet could help to improve nutritional status in the UK. At present, official advice on supplements is contradictory and poorly implemented. There are also misplaced concerns that providing information on supplements is at odds with food-based messages. This is not the case. Leadership from the new Government could significantly improve the quality of dietary advice given to the public and encourage individual responsibility. But information alone is not enough and has to be supported by policies which make healthier choices easier and more attractive. Health professionals, media and industry can all help by ensuring that more unbiased, evidence-based information on supplements is made available to the public.

- Advice about supplements can sit logically alongside advice on healthy eating, and provides additional options for consumers, particularly those unable to make dietary changes immediately
- At present, official advice about supplements is inconsistent. A more joined up approach across all Government communication channels relating to diet would benefit the public
- Dietary advice given by health professionals and carers could be clearer and more effective if Government policy on supplements for vulnerable groups was implemented consistently
- The media remains an important source of information for the public. However, journalists need to keep in mind the primary purpose of supplements, which is simply to help people meet dietary targets
- The industry has a role to play in supporting the work of other stakeholders, e.g. by creating affordable products, providing objective information for the public and ensuring that supplements reflect the latest scientific evidence

Introduction

There is no doubt that nutrition underpins good health, and that eating a healthy, balanced diet is the best way to achieve appropriate amounts of vitamins, minerals and other essential nutrients.

Countless research studies show that there are strong links between intakes of particular nutrients and the risk of chronic disease.[1] For example, low intakes of calcium, magnesium and vitamin D[2] increase the risk of bone disease, poor maternal intakes of folate during pregnancy contribute towards the incidence of foetal neural tube disorders, such as spina bifida, and low intakes of selenium may increase the risk of some types of cancer.[3] Emerging evidence points to a role for certain nutrients in the prevention of heart disease,[4] management of falls in the elderly,[5] and the maintenance of good cognitive function in later life.[6] Given the ageing population in the UK, optimal nutrition will become crucial for ensuring quality of life and helping to control NHS budgets.

The array of foods available today and the wealth of health information provided by experts and the media may encourage us to imagine that diets in the UK have never been better. However, this is not the case for many people. National surveys in adults, children and older people all show the same picture, that significant groups of people do not meet dietary recommendations for many key nutrients.

More worryingly, given the investment in public health, the situation has improved very little over the last decade. Just over a third of adults, but only 15% of children, meet the 5-a-day target for fruits and vegetables.[7] Adolescents eat only a tenth of the recommended amount of oily fish per week and risk missing out on the benefits of long-chain omega-3 fatty acids.[8]

Dietary advice to the public remains essential, with an emphasis on positive messages about the benefits of healthy eating. However, change takes time and, in the meantime, there remains a need for adequate levels of nutrients, particularly in vulnerable groups such as young children, teenagers, low income groups and the elderly. This is where supplementation has an important role to play. As previous Government advice has already recognised, there are significant benefits to giving information about supplementation alongside advice about healthy eating.

This report looks at the evidence from dietary surveys, explores the role of supplements in safeguarding nutrient intakes and nutrient status, and suggests ways to improve how nutritional advice is presented to the public, particularly by public bodies.

"Adolescents eat only a tenth of the recommended amount of oily fish per week and risk missing out on the benefits of long-chain omega-3 fatty acids[8]"

Why meeting dietary targets is essential for health

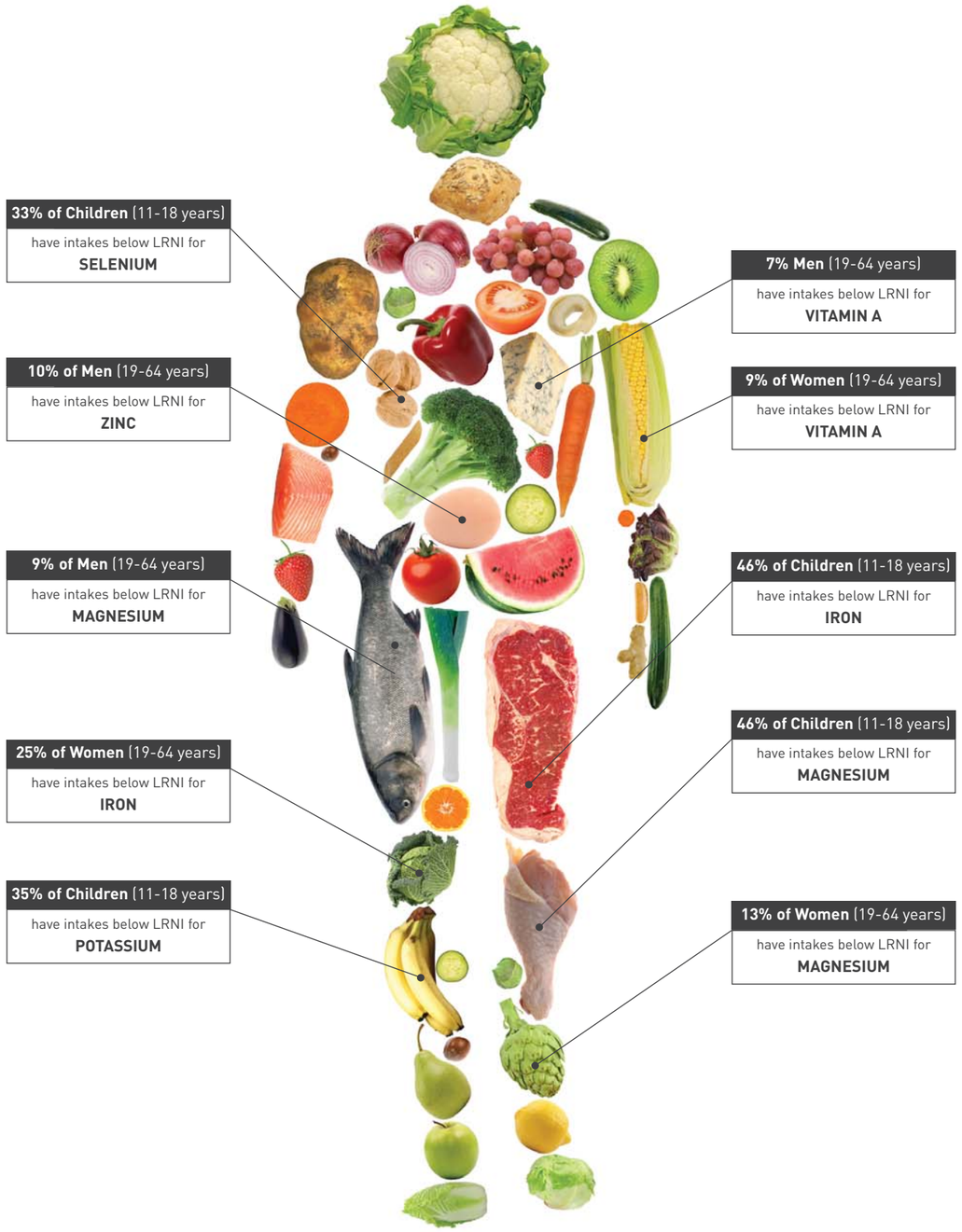
The right levels of vitamins and minerals are required to maintain good health. This reasoning underpins the Dietary Reference Values, recommendations published by the UK Department of Health in 1991.[9] These not only advise on the amount of calories, protein and fat that should be consumed, but give two types of recommendations for vitamin and mineral intakes in order to prevent deficiencies. The first, the Reference Nutrient Intake (RNI), is designed to meet the requirements of most people. The second, the Lower Reference Nutrient Intake (LRNI) can only meet the needs of less than 3% of the population. Thus, intakes which fall below the LRNI are likely to be inadequate. The next section of this report examines how nutrient intakes in the UK match up to the Dietary Reference Values.

"As well as the opinions of expert bodies, such as the Department of Health and EFSA, a considerable body of research studies has highlighted links between inadequate intakes of vitamins and minerals and the risk of poor health"

More recently, the European Food Safety Authority (EFSA) published a series of opinions[10] on the functions of specific vitamins and minerals in the body. This review was carried out to evaluate the evidence for claims about the role of nutrients in maintaining normal health. The opinions of EFSA are presented in Annex 1 and make interesting reading. For example, EFSA accepts there is sufficient proof that calcium, phosphorus, vitamin D and magnesium are essential for normal bone health. There is also enough evidence to show that vitamin A, vitamin B12, vitamin C, copper and zinc support normal immune function, and that iron and pantothenic acid help maintain cognitive/mental function. Several nutrients were established to have antioxidant properties, helping to protect cells from damage, e.g. selenium, vitamin C, zinc and copper.

As well as the opinions of expert bodies, such as the Department of Health and EFSA, a considerable body of research studies has highlighted links between inadequate intakes of vitamins and minerals and the risk of poor health. For example, low intakes of vitamin D and calcium have been associated with the serious bone disease, osteoporosis, and an increased fracture risk.[11] However, calcium and vitamin D are effective at reducing bone loss in post-menopausal women[12] and boosting bone mineral levels in teenage girls.[13] Osteoporosis also affects men.

Who's at risk of deficiency?*



*The Lower Reference Nutrient Intake (LRNI) recommendation can only meet the requirements of a minority of the population (2.5%), so lower intakes suggest a risk of deficiency

Why meeting dietary targets is essential for health

Low intakes of folate, B12 and B6 have been linked with depression.[14] However, folate is better known for its role in helping to prevent neural tube defects, including spina bifida and anencephaly. In the UK, women are advised to take supplements containing 400µg folic acid daily pre-conceptually and in the first trimester of pregnancy in order to influence the neural tube before it closes.[15] Of concern is the fact that only 3% or 4% of women take folic acid supplements as advised, potentially putting their babies at risk.[16,17] Iron-deficiency anaemia is a consequence of low iron intakes and low iron stores, and is particularly prevalent in girls and women.[18] As iron is needed for foetal brain development, deficiency during pregnancy can impact on intelligence and behavioural development in infants.[19] There is evidence that iron deficiency in school-aged children is linked with reduced mental performance.[20] Another mineral, iodine, is also vital for normal foetal development. Iodine deficiency has been associated with small-for gestational age babies[21] and delays in neurological and behavioural development in infants.[22]

In later life, certain nutrients appear important for lowering the risk of chronic conditions, such as cancer and cardiovascular disease. There is emerging evidence that low vitamin D intakes may elevate the risk of breast cancer[23] and bowel cancer.[24] Large observational studies have also reported links between low vitamin D intakes and a higher risk of heart disease and diabetes.[25,26]

As well as vitamins and minerals, intakes of marine omega-3 fatty acids have an important role to play in maintaining health. There is evidence that omega-3s help maintain cognitive function during ageing and may help prevent some types of dementia.[27] During pregnancy, omega-3s are vital for normal development of the brain and retina in the foetus.[28] Additional omega-3s provided during pregnancy and breastfeeding have been shown to boost infant mental performance in some trials.[29,30] Omega-3s have also helped to lower the risk of infant allergies.[31,32] Low blood levels of omega-3s during pregnancy may contribute to a higher risk of post-natal depression.[33] Other types of depression have been associated with habitually low intakes of fish and marine omega-3s.[34,35]

- Adequate intakes of vitamins and minerals are needed to prevent deficiency and meet dietary targets
- Low intakes of nutrients have been linked with a greater risk of poor health, e.g. cancer, heart disease, diabetes and depression
- Marine omega-3s are vital for normal infant development during pregnancy and early life
- Omega-3s also have a role in helping to prevent cognitive decline and depression later in life
- Folic acid during pregnancy is essential for foetal health and development

Are we getting enough of the key nutrients?

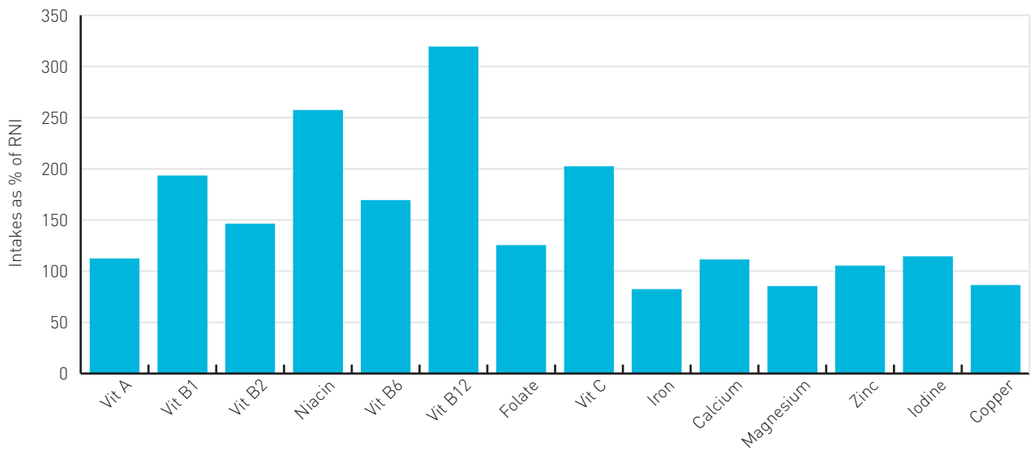
Over the last few decades, the UK Government has collected dietary information regularly using the National Diet and Nutrition Surveys (NDNS). Evidence from these on adults,[8,36-39] young children,[8,40,41] young people[8,36,42] and people aged 65 years and over[43] suggests that intakes of several vitamins and minerals are lower than recommended levels. Complete tables for the following data are provided in Annex 2 of this report.

Women

Data from the 2000-01NDNS,[44] together with the 2009-10 NDNS rolling programme[7] (which had a smaller sample size) shows that intakes of vitamins have not improved, with the exception of vitamins A and C. Intakes of thiamin (B1), riboflavin (B2), niacin, folic acid and vitamin D remained static or fell slightly. Fruit and vegetable intakes improved between surveys but nearly 70% of women are still not achieving the recommended 5-a-day intake of fruit and vegetables. Average intakes are just over 4 portions a day.

Figure 1 below presents vitamin and mineral intakes in UK women from the 2000-01 NDNS. The figures are expressed as a percentage of the Reference Nutrient Intake (RNI), which is designed to meet the needs of around 98% of the population. It is noteworthy that average intakes of iron, magnesium and copper fell below the RNI. While intakes of the other nutrients look relatively high, these are averages which will hide low intakes in some groups of the population.

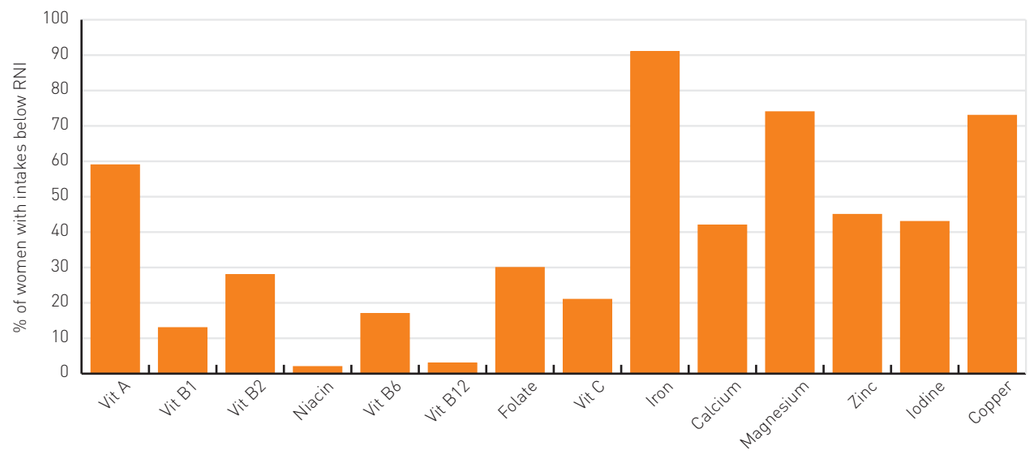
Figure 1: Intakes in UK women as a percentage of Reference Nutrient Intakes (RNI) 2000-01 data



"It can be seen that over 90% of women had iron intakes below the RNI"

A more in-depth approach looks at the percentage of women whose intakes fall below the RNI (Figure 2) and may not be optimal for some individuals. It can be seen that over 90% of women had iron intakes below the RNI, while more than half of women had lower intakes of vitamin A, magnesium and copper. Given the important role of folate in pregnancy, it is worrying that intakes were below the RNI in more than one in ten women. Indeed, around 90% of women of reproductive age had total folate intakes, i.e. food plus supplements, below 400 µg/day, which is the recommended supplemental level for preventing neural tube defects in pregnancy.

Figure 2: Percentage of UK women with intakes below Reference Nutrient Intakes (RNI) 2000-01 data

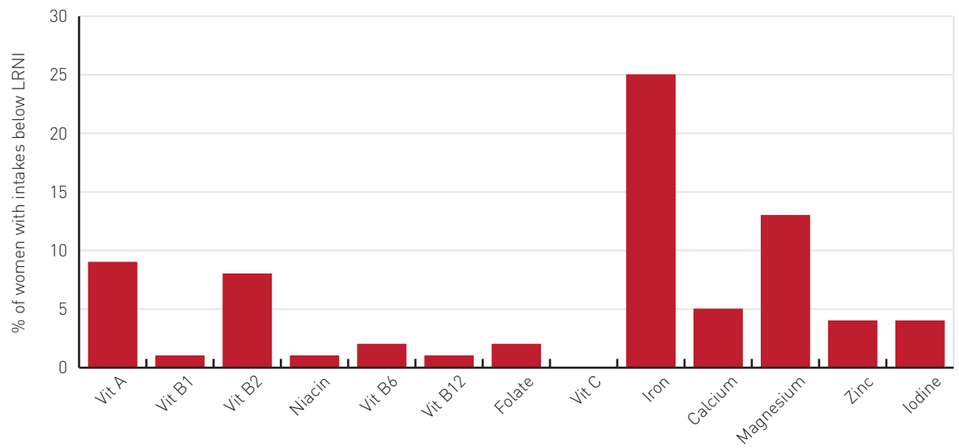


Are we getting enough of the key nutrients?

Women

Finally, we look at the percentage of women whose intakes were below the Lower Reference Nutrient Intake (LRNI). This recommendation only meets the requirements of a minority of the population (2.5%) so lower intakes suggest a risk of deficiency. Figure 3 shows that a quarter of women were at risk of iron deficiency, while significant proportions of women had inadequate intakes of vitamin A, vitamin B2 (riboflavin) and magnesium. In data provided for the first time by the 2009-10 NDNS, more than half of women had intakes of selenium which fell below the LRNI. Selenium is an important antioxidant and has been associated with cancer prevention.[45]

Figure 3: Percentage of UK women with intakes below Lower Reference Nutrient Intakes (LRNI) 2000-01 data

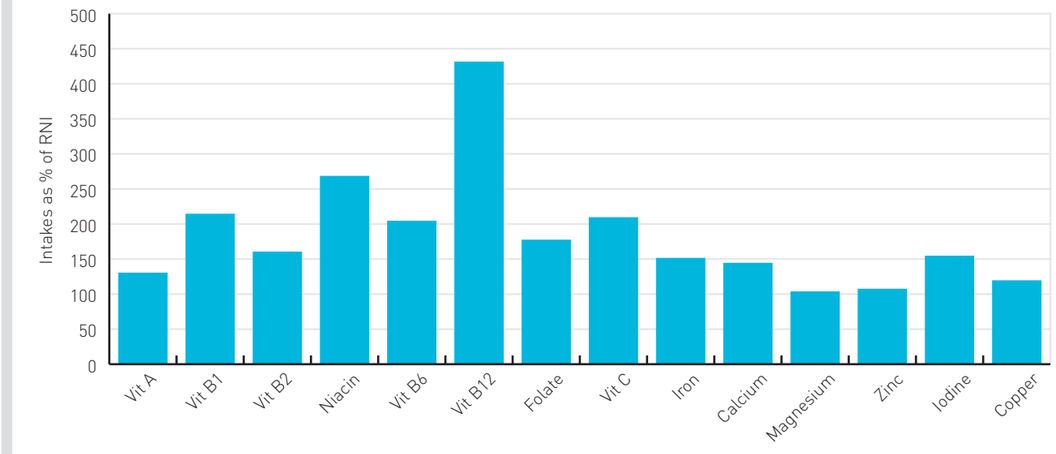


The NDNS in 2000-01 also provided data on blood levels of nutrients, i.e. markers of nutritional status. While indices for most nutrients were within normal ranges, a proportion of women had low levels of iron, folate, vitamin C and vitamin D.[46] Haemoglobin levels were below the World Health Organisation thresholds for anaemia in 8% of women, while 11% of women had lower than normal serum ferritin levels, indicating poor iron stores. This figure rose to 16% in women aged 19-24 years. A low vitamin D status was seen in a substantial proportion of women, particularly when blood samples were collected during the winter months. On average 15% of all women (or 28% of younger women) had a vitamin D status below the required level for normal bone health (i.e. plasma 25-hydroxyvitamin D below 25nmol/l). This figure rose to 25% of all women in the winter months which indicates that women are not getting enough dietary vitamin D to compensate for low sunlight levels at this time of the year.

Men

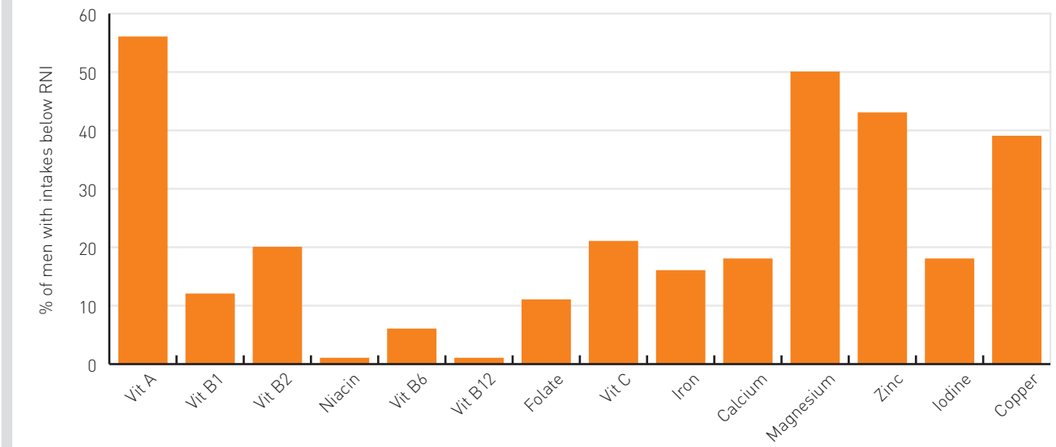
Data on men from the 2000-01 NDNS shows that average intakes of all nutrients were on or above the RNI (Figure 4).

Figure 4: Intakes in UK men as a percentage of Reference Nutrient Intakes (RNI) 2000-01 data



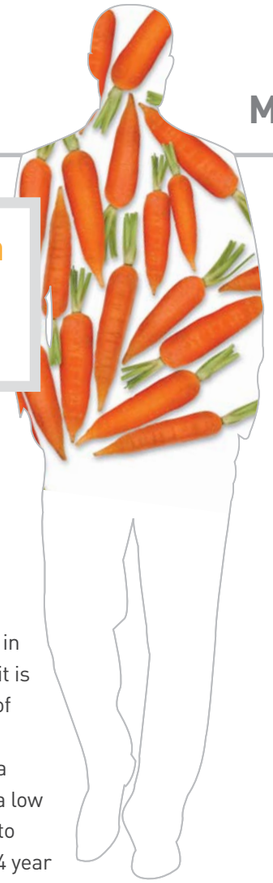
However, as with women, it is important to look beyond average intakes and examine the proportion of men with intakes below the RNI. Figure 5 shows that more than 50% of men had vitamin A intakes below the RNI, while more than 40% had lower intakes of zinc and magnesium.

Figure 5: Percentage of UK men with intakes below Reference Nutrient Intakes (RNI) 2000-01 data



Are we getting enough of the key nutrients?

Men



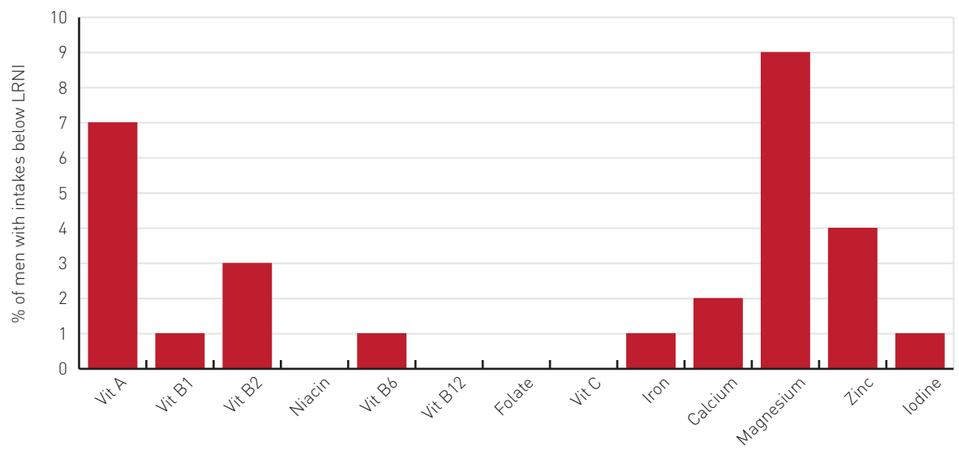
While men's nutrient intakes were generally better than women's, a significant proportion of men had intakes of key vitamins and minerals which fell below the LRNI (Figure 6). Magnesium, a bone health mineral, was inadequate in 9% of men, while 7% of men had low intakes of vitamin A. Zinc, a mineral which supports immune function and sperm production, was low in 4% of men. Using the 2009-10 NDNS data, it was found that selenium intakes fell below the LRNI in more than 20% of men.

"...more than 50% of men had vitamin A intakes below the RNI"

Turning to nutritional status, the 2000-01 NDNS found that 3% of men had low haemoglobin levels indicative of anaemia, while 4% of men had low serum ferritin levels, suggesting low iron stores. As with women, vitamin D blood levels were of concern for significant numbers of men. In general, 14% of all men (24% of younger men) had a poor vitamin D status. This rose to 25% in the winter months. Vitamin D is vital for normal bone health and, with calcium, helps to prevent bone loss in middle age.[12]

More recent data from the 2009-10 NDNS highlighted that fruit and vegetable intakes were still below the 5-a-day recommendation in 63% of men. Overall, men consumed 4.4 portions of fruit and vegetables a day with a range of 2.5 to 10.2 portions per day. Fruit and vegetables are rich in folate and vitamin C so it is not surprising that 5% of men exhibited a poor vitamin C status, while a similar proportion had a low folate status. This rose to 13% of men in the 19-24 year age group which had the lowest intakes of fruit and vegetables.

Figure 6: Percentage of UK men with intakes below Lower Reference Nutrient Intakes (LRNI) 2000-01 data



Children

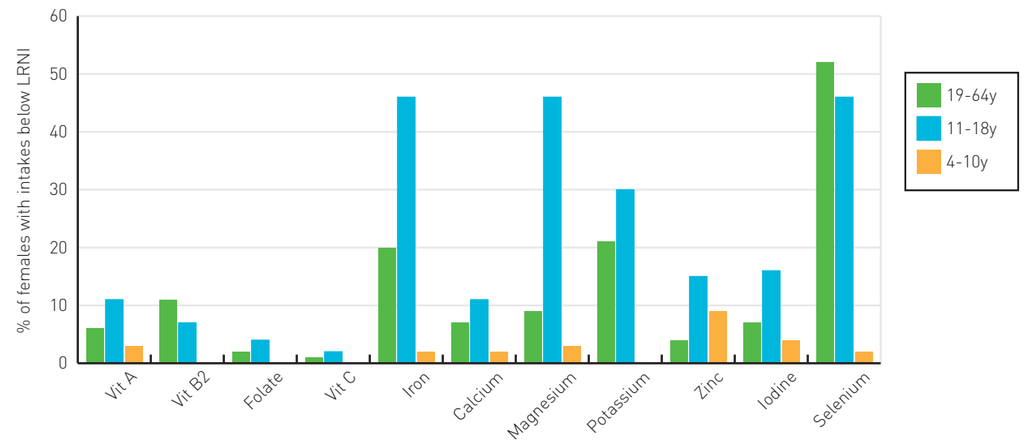
Similar to the adult survey, the NDNS in pre-school children[47] showed that average daily intakes of most nutrients were at or above the RNI, but intakes of some vitamins and minerals fell below recommended levels.

Key findings for pre-school children were that:

- Average intakes of iron were below RNI for 84% of children and below LRNI for 16% of children (24% in toddlers). Iron is vital for normal mental development
- More worryingly, one in eight toddlers was iron deficient, while low iron stores were seen in one in five pre-schoolers
- Around 50% of children had intakes of vitamin A below RNI, while 8% risked deficiency by having intakes below LRNI. Vitamin A is important for growth and eye development
- Average intakes of vitamin D were very low, at around 1.2µg compared with the RNI of 7µg. Indeed, only 5% of pre-school children met the recommendation, risking a poor vitamin D status which can hinder normal bone development
- Other bone nutrients, such as calcium and magnesium were low in some groups of children. Over 10% of pre-schoolers had calcium intakes below RNI, while the figure for magnesium was 7%
- Zinc intakes were below RNI for 72% of children, while 14% had intakes below LRNI. Zinc supports growth and normal immune function

Looking at school-aged children, the latest NDNS provides an interesting comparison with adult nutrient intakes showing that teenagers have the worst diets in terms of vitamins and minerals. Figure 7 shows the proportion of girls and women with vitamin and mineral intakes lower than the LRNI. Few nutrients were of concern in younger school-aged girls (e.g. zinc, vitamin A, magnesium). However, more than 40% of teenage girls had inadequate intakes of iron, magnesium and selenium, while more than 10% risked deficiency in vitamin A, calcium, potassium, zinc and iodine. Many of these nutrients are vital in pregnancy for normal foetal development suggesting that teenage pregnancy creates a double risk of nutrient deficiency for mother and baby.

Figure 7: Percentage of UK females by age with intakes below Lower Reference Nutrient Intakes (LRNI) 2010 data

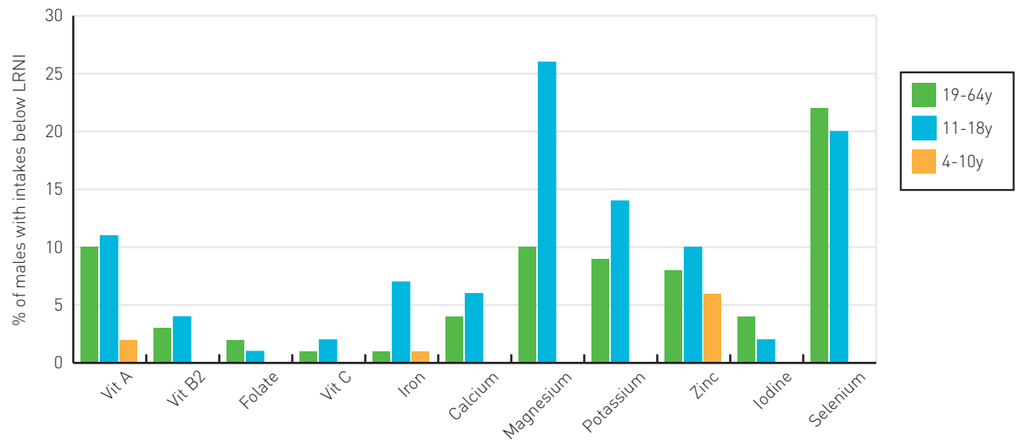


Are we getting enough of the key nutrients?

Children

Figure 8 shows the proportion of boys and men in the latest NDNS with intakes lower than the LRNI. Although boys' diets are better than girls', in terms of vitamins and minerals, some intakes are still of concern. For example, more than 25% of adolescent boys have inadequate intakes of magnesium, while over 10% have poor intakes of vitamin A, potassium and zinc.

Figure 8: Percentage of UK males by age with intakes below Lower Reference Nutrient Intakes (LRNI) 2010 data



Elderly people

The NDNS of people aged 65 years and over[36] provides evidence of low intakes of vitamins and minerals in elderly people. The survey looked separately at free living people and those living in institutions, such as care homes.

Looking at elderly people living in institutions, Figure 9 examines the proportion with intakes below LRNI. This recommendation is designed to meet the needs of only 2.5% of the population so intakes below this are likely to be inadequate. Nutrients of most concern were magnesium, zinc and iron. Magnesium is important for normal bone health, yet around a quarter of women aged over 75 years had potentially inadequate intakes. This is worrying given the risk of osteoporosis in this particular age group.

Elderly people

Figure 9: Percentage of elderly people living in UK institutions with intakes below Lower Reference Nutrient Intakes (LRNI) 1998 data

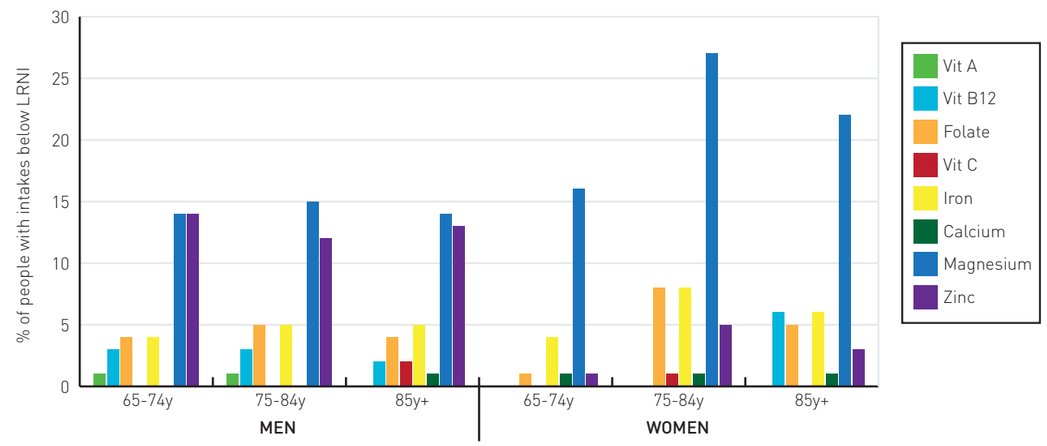
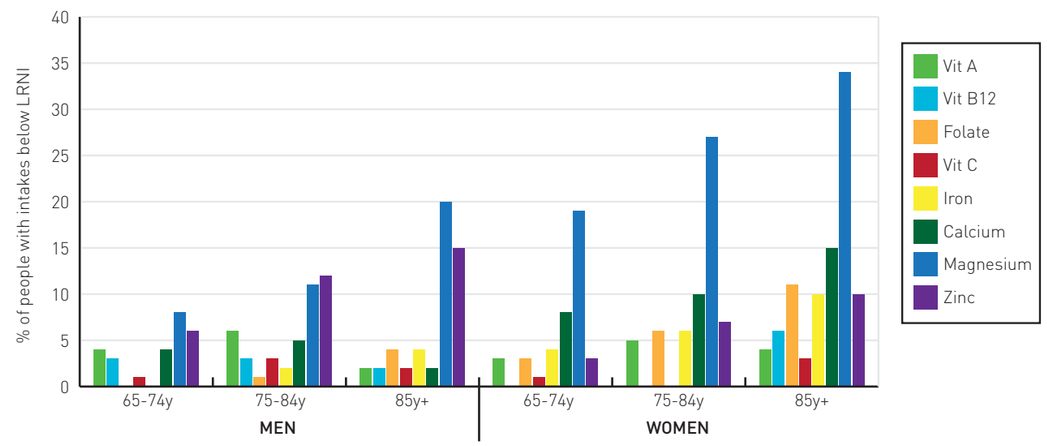


Figure 10 considers the proportion of free-living elderly people with intakes below the LRNI. It is interesting that the diets of free-living elderly people were worse, in terms of vitamins and minerals, when compared with those living in institutions. The risk of inadequate intakes was higher in women and tended to rise with age.

Nutrients of most concern were magnesium, calcium and zinc, while iron was a particular issue in older women. Magnesium and calcium are important for bone health. Iron is essential for normal cognitive function, while zinc supports normal immune function.

Figure 10: Percentage of free-living elderly people with intakes below Lower Reference Nutrient Intakes (LRNI) 1998 data



Are we getting enough of the key nutrients?

Elderly people

"97% of elderly people had vitamin D intakes which fell below the RNI"

Vitamin D is worth a special mention as it is vital for bone health and there is currently no LRNI for this nutrient. Average intakes of vitamin D in free-living elderly were 4.07µg in men and 2.92µg in women, which is poor compared with the RNI of 10µg. Indeed, 97% of elderly people had intakes which fell below the RNI. Average intakes in people living in institutions were lower in men but similar in women. However this group of elderly would have less opportunity to go outdoors which is significant given that most of the vitamin D in our bodies is made in response to sun exposure.

The low intakes were reflected in the blood markers of vitamin D status with 6% of free-living men and 10% of free-living women having an inadequate vitamin D status. This figure rose to 20% in women aged over 85 years. In people living in institutions, the picture was far bleaker with nearly 40% of elderly people having an inadequate vitamin D status. This is despite the fact that the Government advises care homes to use vitamin D supplements to help maintain normal vitamin D status in elderly people.[48] Emerging evidence suggests that the risk of falls in elderly people can be reduced by giving additional vitamin D[5]. Therefore, elderly people living in institutions could potentially benefit if the Government's own recommendations on vitamin D supplementation were properly implemented.

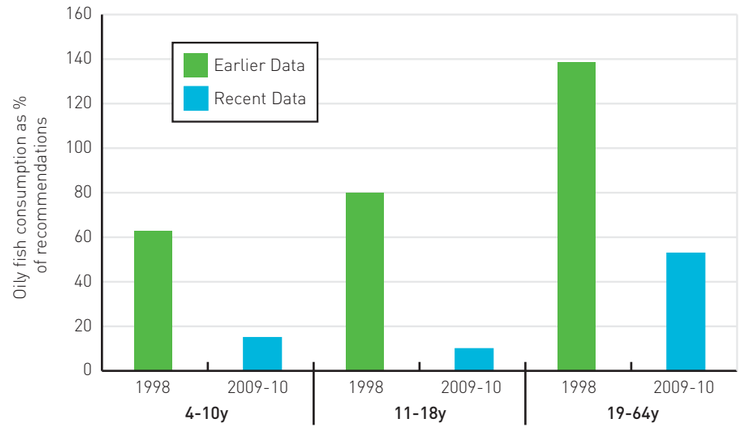
Other blood indices in elderly people from the NDNS revealed a poor nutritional status for iron, folate and vitamin C. Around one in ten free-living elderly people had inadequate haemoglobin concentrations, indicative of iron deficiency, with a greater proportion found in the over 85 age group. The picture was much worse in institutions with 52% of men and 39% of women having low haemoglobin concentrations. These results highlight a significant problem with iron deficiency anaemia in elderly people.

Omega-3s and fish intakes

An important nutrient not addressed by the NDNS is long-chain omega-3s from marine sources. At present, the Government advises that people of all ages consume two portions of fish a week, one of which should be oily fish.[49] However, intakes of oily fish have fallen dramatically in the last decade. As Figure 11 shows, average intakes of oily fish used to be close to the recommended 140g portion per week[8,44] but, in the most recent NDNS,[7] intakes have fallen to around 50% of this in adults and only 10% in adolescents. Younger school-aged children now consume less than 20% of the oily fish they need.

This is reflected in intakes of omega-3s which are only 244mg per day in UK adults, just over half of the recommended intake of 450mg per day.[50] Data for omega-3 intakes in children are not yet available from the NDNS.

Figure 11: Weekly Oily Fish Consumption by age group as a percentage of recommendations – 1998/2001 compared with 2009-10



Key Findings

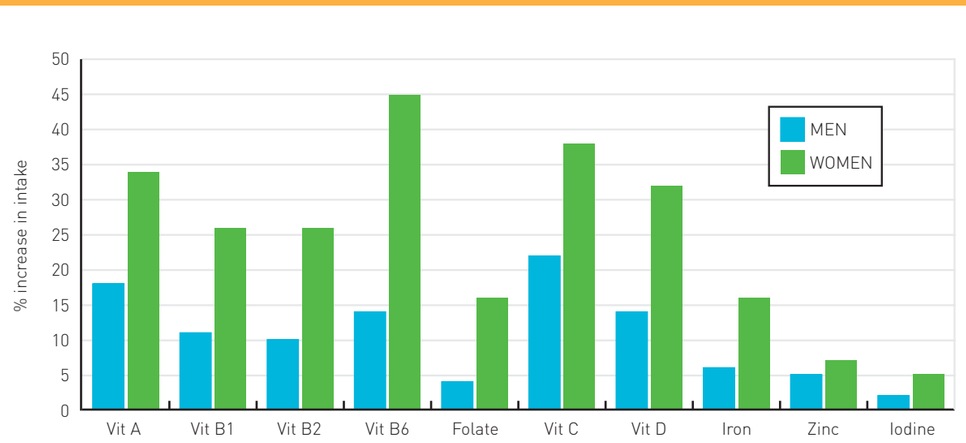
- Average intakes of vitamins and minerals are on or above the Reference Nutrient Intake but this hides significant groups within the population with low intakes
- Nutrients of concern in women are vitamin A, vitamin B2 (riboflavin), iron, magnesium and selenium. There is evidence of iron deficiency in a significant proportion of women
- Nutrients of concern in men are vitamin A, magnesium and zinc
- Nutrients of concern in children, particularly adolescents, are vitamin A, iron, magnesium, selenium, potassium and zinc
- In elderly people, vitamin and mineral intakes decline with age and are lowest in free-living women over 85 years
- Iron, magnesium and vitamin D are the nutrients most likely to be inadequate in elderly people. There is evidence of iron deficiency in a significant proportion of elderly people, particularly those living in institutions
- Fish intakes have declined in the last decade and are too low to meet recommendations for long-chain omega-3s

The role of supplements in boosting nutrient intakes

Supplements are nutrients or other food-sourced substances taken orally for the purpose of boosting dietary intakes. In recent years, misplaced beliefs have been expressed that supplements could prevent disease, treat disease or even take the place of a healthy diet. However, the primary role of supplementation is simply to address gaps between individual dietary intakes and requirements, whether this relates to vitamins, minerals or other dietary components. There is no conflict whatsoever between taking supplements and following a healthy, balanced diet.

Indeed, there is much evidence suggesting that regular users of supplements are more likely to meet dietary recommendations for vitamins and minerals than those who do not use supplements. In the 2000-01 NDNS, supplement use boosted vitamin intakes by up to 45% as shown in Figure 12. Yet overall intakes remained well within safe limits. Vitamin D intakes were boosted by 14% in men and 32% in women when supplements were taken, while iron intakes were boosted by 6% and 16% respectively in men and women. This shows that nutrients of concern can be increased towards dietary recommendations by the regular use of supplements. The latest NDNS did not provide this type of analysis.

Figure 12: Percentage increase in nutrient intakes due to the contribution of supplements 2000-01 data

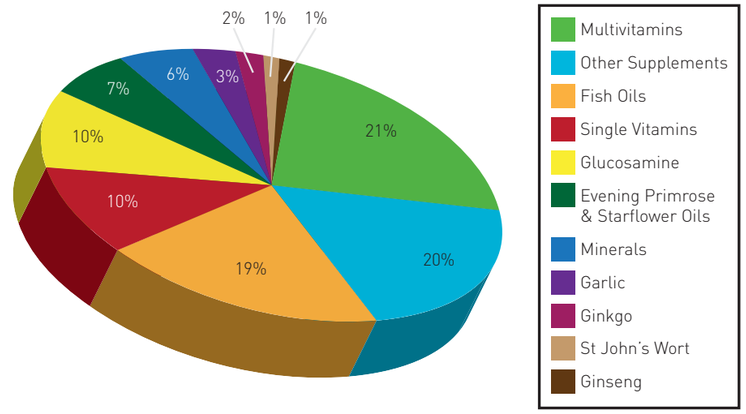


Markers of nutritional status give a more accurate picture than nutrient intakes. In the NDNS, lower blood levels of vitamins and minerals tended to be found in people who did not use supplements. An analysis by SACN[51] found a positive relationship between reported use of supplements and nutritional status for the vitamins B1, B2, B6, B12, folate, C and D. A survey of British adults reported a better vitamin D status in those who consumed oily fish or who used vitamin D supplements.[52]

Who uses supplements?

The main supplements purchased by UK consumers are multivitamins and fish oils as shown in Figure 13 below. [53]

Figure 13: UK Supplements Market Share



In the 2001 NDNS,[54] it was reported that 60% of adults did not use supplements. Regular users of supplements tended to be female and in the 50-64 years age group. Cod liver oil and other fish oil based supplements, multi-vitamins and multi-minerals were the most commonly used types. In the latest NDNS,[7,55] a slightly higher proportion of adults had not used supplements in the previous year; 66% on average. As with the earlier NDNS, the most commonly used supplements were cod liver oil or fish oil, and multinutrient products.

A 2008 expert panel report[55] examined supplement use in other age groups. Only 20% of children took supplements, mainly vitamins A, C and D, or multivitamins. Among people aged over 65 years, 31% of the free-living group took supplements compared with only 7% in the group living in institutions. The most commonly-used supplement in older people was cod-liver oil or related products. Interestingly, despite Government advice which encourages vitamin D supplementation in care homes and other institutions, only 3% of elderly people living in institutions were given additional vitamin D. The figure in free-living elderly was much higher at 16%. There are concerns, supported by dietary surveys, that those who could most benefit from supplements do not use them.

The role of supplements in boosting nutrient intakes

Attitudes to supplements' use

Reasons for taking supplements are often complex, combining social, psychological, educational and economic factors. According to several surveys,[56-59] the main reasons underpinning supplement use are:

- Taking control over one's own health
- Problems eating a balanced diet or a desire to improve dietary balance
- Aching joints
- Having a "hectic lifestyle"
- Preventing colds and viruses
- Menstrual problems
- Heart health
- Feeling run down

Multivitamins and multivitamins with minerals were most commonly taken to help balance the diet, while vitamin C, vitamin E and garlic were perceived as being "good for you". Advice from friends or relatives was most influential in the decision to purchase supplements, followed by media articles and health professional advice. Reasons given for not using supplements included supplements being perceived as expensive, beliefs that some claims for supplements were exaggerated, and general scepticism about the benefits likely to accrue from using supplements.

"Reasons for taking supplements are often complex, combining social, psychological, educational and economic factors."

- Average intakes of key vitamins and minerals are boosted by up to 45% when dietary supplements are taken, yet remain within safe limits
- Lower blood levels of vitamins and minerals tend to be seen in people who do not use supplements
- The most commonly used supplements are multivitamins, multiminerals and fish oils
- Women and older people are most likely to take supplements
- Reasons for taking supplements include being more in control of health, compensating for a hectic lifestyle, and helping to improve dietary balance

Most vulnerable could benefit from supplementation

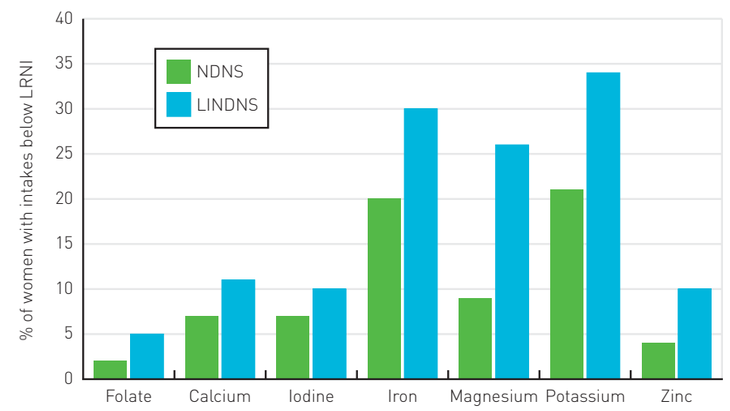
One of the most important roles for Government is tackling inequalities in health. Since diet strongly influences wellbeing and the risk of future chronic disease, current inequalities in nutrient intakes between different groups in society cannot be ignored.

In the 2001 NDNS of British adults, intakes of most vitamins and minerals were significantly lower when someone in the household received state benefits. For example, over half of women receiving benefits had inadequate iron intakes compared with a third of women in the higher income groups. The figures for vitamin A were 22% of women receiving benefits compared with 9% of higher income women. There was also evidence of a worse nutritional status in people receiving benefits. For women, average blood levels of vitamin C, folate, vitamin E, selenium, vitamin D and carotenoids were lower in the group receiving benefits compared with higher income women.

A poor nutritional status in women, if maintained during pregnancy, can influence infant development and child health. Thus, the nutritional disadvantages experienced by lower income women could be passed on to the next generation. Pregnancy places increased demands on the mother's stores of vitamins and minerals, particularly iron, calcium, vitamin D and long-chain omega-3s. Several UK surveys of pregnant women[60-63] have found evidence of poor nutrient intakes with the greatest risk of low nutrient intakes seen in pregnant adolescents[64] and women from ethnic minority groups.[65]

Further analysis of socio-economic differences has been provided by the Low Income NDNS[16] which evaluated dietary intakes in nearly 4000 people from UK households with the greatest material deprivation. Patterns of vitamin and mineral intakes in the Low Income NDNS were broadly similar to general population. However, when women were considered separately, several inequalities in diet were revealed. Figure 14 presents the proportion of women from the Low Income NDNS with intakes below LRNI for key nutrients and compares this against the standard 2000-01 NDNS. The differences between socio-economic groups were most marked for iron, magnesium and potassium.

Figure 14: Percentage of UK women with intakes below Lower Reference Nutrient Intakes (LRNI) - Comparison between NDNS and Low Income NDNS (LINDNS)



Most vulnerable could benefit from supplementation

Vulnerable groups who could benefit from increased use of dietary supplements include:

- Women in receipt of state benefits, particularly those in their child-bearing years
- Pregnant women
- Pre-school children
- Adolescents
- Elderly people
- For vitamin D, people with limited access to the outdoors (prisoners, housebound people) or those who cover their skin for cultural or religious reasons

"A poor nutritional status in women, if maintained during pregnancy, can influence infant development and child health."

Other vulnerable groups in the population with lower than recommended vitamin and mineral intakes include prisoners,[66,67] hospital patients,[68] and patients in mental health institutions.[69,70]

Government policy already promotes vitamin supplementation for vulnerable groups, e.g. Healthy Start, folic acid and vitamin D supplementation during pregnancy, vitamin supplements for young children, and vitamin D for elderly housebound people.[71] However, uptake of Healthy Start vitamins has been lower than expected,[72] and evidence from dietary surveys suggests that the messages about supplementation have not been acted upon fully.

Given the proven benefits of vitamin and mineral supplementation, in terms of improvements to nutritional status and meeting recommendations, the diets of the most vulnerable in society could be improved by ensuring greater awareness of supplementation and increased access.

Supplement awareness is needed

Previous Government initiatives have focussed on informing individuals, e.g. Change 4 Life and 5-a-day, but this has not delivered significant behavioural change. Evidence from the 2000-01 and 2009-10 NDNS gives a picture of fairly static nutrient intakes with the majority of people failing to eat enough oily fish, fruit, vegetables and fibre.

New concepts, such as the nudge theory originating from the US, advocate making the more beneficial lifestyle choices easier to access and adopt through joined-up approaches.[73] These should involve a number of stakeholders, e.g. health professionals, industry, voluntary sector, not just Government (see Figure 15). The potential gains from improving dietary advice to the public could be considerable, given the important role that diet plays in determining the risk of chronic diseases such as heart disease, stroke, diabetes and cancer.

In a country such as the UK, with an abundance of affordable foods, it is shocking that significant groups in society are iron deficient and have inadequate intakes of nutrients which are vital for maintaining normal bone health, cognitive function, immune function and growth. Given the resources available to previous Governments, it is frustrating that policies relating to supplementation have not been implemented more fully, particularly in vulnerable groups which could have benefited from the additional nutrients. This needs to be addressed in future by Government, in partnership with other key stakeholders.

Call to Action

A simple first step would be to review the consistency of advice given on Government websites. While some, such as those published by the Department of Health, advise circumstances where supplementation could have an important role to play, other websites suggest that supplementation is irrelevant, or are generally silent on the issue. This gives the impression that some Government agencies are not in favour of supplementation, or that eating a balanced diet is the only way to achieve recommended levels of vitamins and minerals. Of course, in an ideal world, everyone would be eating a balanced diet and supplementation would not be required by the majority of people. However, as the Government's own dietary surveys show, the reality is far from ideal.

This raises the question, is it better for the health of the nation to include discussion of supplementation within general dietary advice, or continue to ignore supplements in the hope that messages about fruit, vegetables and oily fish will eventually have an impact? It could be argued that the former approach is more logical, and indeed ethical, as it promotes individual choice and responsibility. At the end of the day, it is surely more important for individuals to meet dietary recommendations regardless whether this was achieved by eating more of particular food or taking a supplement.

"Messages about foods and supplements are not mutually exclusive because the role of supplements is to boost nutrient intakes, not to replace healthy foods."

An example of the limitations in current policy is the advice for improving intakes of long-chain omega-3s. The expert group, which reviewed the evidence on oily fish, omega-3s and health, provided recommendations for both grams of omega-3s (3g per week or 0.45g per day) and weekly fish portions.[49] However, when this was translated into public health messages, only the fish advice was given and there was no mention of the fact that non-fish eaters could achieve the recommended amount of omega-3s by taking a suitable fish oil supplement. This makes the advice far less achievable for the two thirds of the public who do not eat oily fish. Leadership on this issue from the new Government could make significant improvements to the quality and effectiveness of official dietary advice.

Supplement awareness is needed

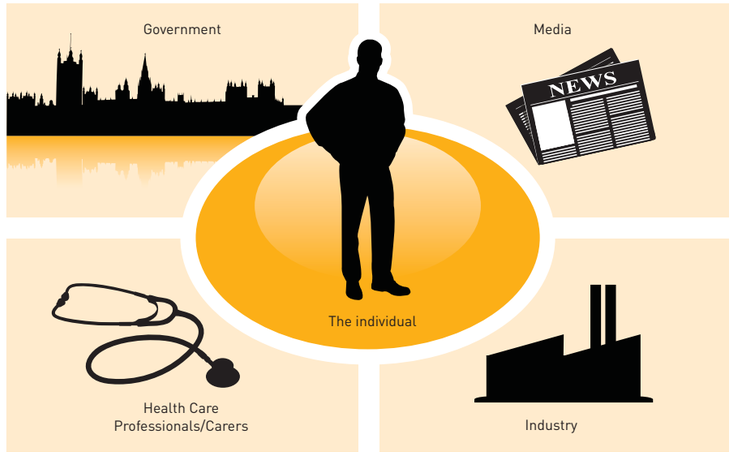
Call to Action

While publicly-funded websites and other communication channels should not be expected to promote supplements in isolation, or to give advice on brands, they could do much more to offer integrated dietary advice to the public. Messages about foods and supplements are not mutually exclusive because the role of supplements is to boost nutrient intakes, not to replace healthy foods. Thus, the 5-a-day message can sit logically alongside advice about multivitamins, and promotion of oily fish can include mention of fish oil supplements for those who want to meet omega-3 targets but are still reluctant to eat more oily fish.

The media, too, has a role to play in ensuring fair reporting of research into supplements. Occasionally studies are published which use high dose supplements to try to prevent or cure chronic diseases, such as cancer, heart disease or diabetes. While these may make sensational reading, they ignore the primary role of supplementation which is to bridge any gaps between individual dietary intakes and requirements. The majority of supplements available on the UK market provide nutrients at levels close to the European recommended daily allowances (RDA).

Health professionals and carers can also improve the consistency of dietary advice to the public by including mention, where appropriate, of the role of supplements in safeguarding nutrient intakes. Some health professionals take the view that supplementation is an 'easy option' which will discourage people from making long-term changes to their diets and lifestyles. However, this is not borne out by the evidence which shows that supplement users tend to have healthier diets overall compared with non-users of supplements.[74] This shows that using supplements does not prevent people from taking on board messages about healthy eating. Areas of work where health professionals might consider mentioning the role of supplements includes pregnancy, dieting (since low calorie diets can lack vitamins and minerals), long-term illness (which can limit healthy eating) and old age. Carers and professionals working with elderly people could make a difference by advocating vitamin D supplementation, in line with the Government's own advice.

Figure 15: Taking responsibility for promoting good nutritional health



Finally, industry has a role to play in supporting other stakeholders who are working to improve the nation's diets. This includes continuing to meet the strict safety standards which apply to all European food supplements, providing choice for consumers, creating affordable products and ensuring that supplements are designed according to scientific evidence. Through a variety of channels, including leaflets, websites (e.g. www.hsis.org), health professional training and media briefings, the industry can also provide information about the role of supplements in a balanced diet.

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Annex 1:

Opinions of the European Food Safety Authority on the function of vitamins and minerals in the body

Nutrient	Function in the body
Vitamin A	Function of the immune system, maintenance of normal skin and vision
Thiamin (Vitamin B1)	Supports heart function and function of the nervous system, psychological function
Riboflavin (Vitamin B2)	Metabolism of iron, skin and mucous membranes, normal red blood cells, vision, protection of cells (antioxidant), reduction of tiredness and fatigue, function of the nervous system
Niacin	Function of the nervous system, maintenance of normal skin and mucous membranes, reduction of tiredness and fatigue, psychological function
Vitamin B6	Nervous system functioning, red blood cell formation, function of the immune system, homocysteine metabolism, cysteine synthesis, regulation of hormonal activity, reduction of tiredness and fatigue, psychological function
Vitamin B12	Red blood cell formation, function of the immune system, neurological and psychological function, homocysteine metabolism
Folate	Blood formation, function of the immune system, normal cell division and tissue growth during pregnancy, reduction of tiredness and fatigue, psychological function
Vitamin C	Collagen formation, function of the nervous system and immune system (particularly after strenuous exercise), improves iron absorption, protection of cells (antioxidant), reduction of tiredness and fatigue, psychological function
Vitamin D	Bones and teeth, absorption of calcium and phosphorus
Vitamin E	Protection of cells (antioxidant)
Vitamin K	Bone health, normal blood coagulation
Pantothenic acid	Supports normal mental performance, reduction of tiredness and fatigue
Calcium	Bones and teeth, muscle function, normal blood coagulation, function of digestive enzymes, cell division and differentiation
Calcium and vitamin D	Taken together, maintains normal bone
Magnesium	Electrolyte balance, muscle function including heart muscle, maintenance of bones and teeth, nerve function, reduction of tiredness and fatigue, psychological function
Iron	Formation of red blood cells and haemoglobin, oxygen transport, function of the immune system, normal cognitive function, reduction of tiredness and fatigue
Zinc	Function of the immune system, protection of cells (antioxidant), maintenance of bone, cognitive function, fertility and reproduction, maintenance of normal vision
Iodine	Supports thyroid function and production of thyroid hormones, maintenance of skin, cognitive and neurological function
Copper	Function of the immune and nervous systems, normal skin and hair pigmentation, protection of cells (antioxidant)
Selenium	Function of the immune system, normal spermatogenesis, protection of cells (antioxidant), normal nails
Biotin	Maintenance of normal skin and hair, function of the nervous system, psychological function
Potassium	Muscular and neurological function, maintenance of normal blood pressure
Phosphorus	Maintenance of normal bone and teeth

Source: EFSA opinions (2010) www.efsa.europa.eu/en/ndaclaims/ndaclaims13.htm

Annex 2:

Table 1: Average daily vitamin and mineral intakes from food sources by age in women in the British National Diet and Nutrition Survey 2000-1

Nutrient	19-64 years			19-24 years			25-34 years			35-49 years			50-64 years		
	Mean intake as % RNI	% below RNI	% below LRNI	Mean intake as % RNI	% below RNI	% below LRNI	Mean intake as % RNI	% below RNI	% below LRNI	Mean intake as % RNI	% below RNI	% below LRNI	Mean intake as % RNI	% below RNI	% below LRNI
Vitamin A (retinol equivalents; µg)	112	59	9	78	81	19	98	68	11	112	54	8	136	46	5
Thiamin (mg)	193	13	1	181	18	0	194	18	2	190	11	1	200	10	1
Riboflavin (mg)	146	28	8	126	45	15	131	38	10	151	22	5	159	8	6
Niacin equivalents (mg)	257	2	1	246	4	2	240	1	0	263	2	1	270	1	0
Vitamin B6 (mg)	169	17	2	165	21	5	158	24	1	170	15	2	177	13	2
Vitamin B12 (µg)	319	3	1	266	5	1	264	2	1	325	3	1	378	1	0
Folic acid (µg)	125	30	2	114	40	3	117	36	2	128	28	2	134	25	2
Vitamin C (mg)	202	21	0	170	25	1	181	25	0	200	24	0	236	12	0
Vitamin D (µg)	2.8*	*	*	2.3*	*	*	2.4*	*	*	2.8*	*	*	3.5*	*	*
Iron (mg)	82	91	25	60	96	42	62	93	41	69	90	27	125	38	4
Calcium (mg)	111	42	5	99	56	8	104	47	6	114	38	6	118	36	3
Magnesium (mg)	85	74	13	76	85	22	77	84	20	87	71	10	91	66	7
Zinc (mg)	105	45	4	98	58	5	96	60	5	108	39	4	112	33	3
Iodine (µg)	114	43	4	93	63	12	103	56	5	116	38	4	127	31	1
Copper (mg)	86	73	#	76	78	#	83	74	#	89	74	#	89	70	#

* Mean (absolute) Vitamin D intake; No RNI/LRNI established for vitamin D. # No LRNI established for copper.

Table 2: Average daily vitamin and mineral intakes from food sources by age in men in the British National Diet and Nutrition Survey 2000-1

Nutrient	19-64 years			19-24 years			25-34 years			35-49 years			50-64 years		
	Mean intake as % RNI	% below RNI	% below LRNI	Mean intake as % RNI	% below RNI	% below LRNI	Mean intake as % RNI	% below RNI	% below LRNI	Mean intake as % RNI	% below RNI	% below LRNI	Mean intake as % RNI	% below RNI	% below LRNI
Vitamin A (retinol equivalents; µg)	130	56	7	80	74	16	103	62	7	141	54	5	164	42	4
Thiamin (mg)	214	12	1	160	26	2	232	11	0	204	10	0	230	10	1
Riboflavin (mg)	160	20	3	129	40	8	163	18	1	168	17	2	169	15	3
Niacin equivalents (mg)	268	1	0	232	2	0	272	0	0	270	2	0	279	1	0
Vitamin B6 (mg)	204	6	1	189	12	0	211	4	0	216	5	2	201	7	1
Vitamin B12 (µg)	431	1	0	296	4	1	395	1	0	465	1	0	485	0	0
Folic acid (µg)	177	11	0	151	14	2	173	9	0	171	10	0	181	10	0
Vitamin C (mg)	209	21	0	162	39	0	185	22	0	221	19	0	236	16	0
Vitamin D (µg)	4.2*	*	*	3.0*	*	*	4.1*	*	*	4.2*	*	*	4.9*	*	*
Iron (mg)	151	16	1	131	25	3	150	15	0	157	15	1	156	14	1
Calcium (mg)	144	18	2	123	34	5	145	20	2	149	14	2	147	14	2
Magnesium (mg)	103	50	9	86	76	17	86	50	9	83	45	7	106	44	9
Zinc (mg)	107	43	4	95	57	7	108	49	2	111	36	4	109	41	3
Iodine (µg)	154	18	1	119	41	2	154	16	1	158	17	2	164	12	1
Copper (mg)	119	39	#	95	62	#	114	40	#	128	33	#	126	34	#

* Mean (absolute) Vitamin D intake; No RNI/LRNI established for vitamin D. # No LRNI established for copper.

Annex 2:

Table 3: Intakes of selected vitamin and mineral intakes (from all sources) by age in people over 65 years in the National Diet and Nutrition Survey

Nutrient	Men 65-74 years				Men 75-84 years				Men 85 and over				Women 65-74 years				Women 75-84 years				Women 85 and over			
	% below RNI		% below LRNI		% below RNI		% below LRNI		% below RNI%		% below LRNI		% below RNI		% below LRNI		% below RNI		% below LRNI		% below RNI		% below LRNI	
	F	I	F	I	F	I	F	I	F	I	F	I	F	I	F	I	F	I	F	I	F	I	F	I
Vitamin A (retinol equivalents; µg)	43	35	4	1	42	35	6	1	41	23	2	0	44	23	3	0	45	22	5	0	43	23	4	0
Thiamin (mg)	7	8	0	1	11	11	1	2	15	15	1	2	8	9	0	0	14	15	0	0	22	23	1	1
Riboflavin (mg)	29	29	3	3	29	29	3	3	22	22	2	2	12	12	0	0	12	12	0	0	16	17	6	6
Niacin equivalents (mg)	1	1	0	1	2	3	1	1	8	8	0	3	1	1	0	0	2	2	0	0	7	7	1	0
Vitamin B6 (mg)	10	23	0	0	18	19	1	0	28	21	0	1	19	19	0	0	23	23	1	0	31	31	6	0
Vitamin B12 (µg)	1	0	0	0	1	0	0	0	0	2	0	0	1	0	0	0	1	0	0	0	4	0	0	0
Folic acid (µg)	20	43	0	4	34	38	1	5	36	41	4	4	43	49	3	1	53	55	6	8	62	53	11	5
Vitamin C (mg)	25	35	1	0	34	40	3	0	44	37	2	2	29	39	1	0	44	55	0	1	46	48	3	0
Vitamin D (µg)	92	98	*	*	94	98	*	*	98	98	*	*	97	100	*	*	95	99	*	*	98	99	*	*
Iron (mg)	24	42	0	4	31	40	2	5	35	41	4	5	49	57	4	4	58	66	6	8	67	62	10	6
Calcium (mg)	32	26	4	0	39	16	5	0	45	22	2	1	52	26	8	1	63	30	10	1	62	28	15	1
Magnesium (mg)	55	80	8	14	67	79	11	15	79	80	20	14	82	96	19	16	91	96	27	27	95	96	34	22
Zinc (mg)	59	64	6	14	67	66	12	12	70	65	15	13	61	49	3	1	66	63	7	5	70	57	10	3
Iodine (µg)	29	30	1	1	30	25	2	2	41	28	4	1	52	32	6	1	53	51	4	1	54	42	7	1
Copper (mg)	68	85	*	*	77	88	*	*	87	86	*	*	85	90	*	*	94	91	*	*	94	91	*	*

F – Free Living I – Institutionalised * No LRNI established

Authors' Notes

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Carrie Ruxton, PhD, is a registered dietitian and public health nutritionist with more than 15 years post-registration experience. Formerly, she has worked as an academic, hospital dietitian and industry nutritionist before becoming freelance in 2004. She has published widely in scientific journals, textbooks and magazines on a range of topics, including obesity, vitamin D, omega-3s and tea. She has also written obesity strategies and audits for the public sector. As well as working in a freelance capacity with a range of companies and organisations, Carrie is Reviews Editor for the Journal of Human Nutrition and Dietetics and serves on the Scottish Food Advisory Committee.

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Pamela Mason is both a registered nutritionist and pharmacist. She qualified as a pharmacist in 1976 and practised as a community pharmacist during which time she developed an interest in nutrition. She completed her MSc and PhD in nutrition at King's College, London. Currently, she writes articles and open learning programmes on nutrition-related topics for health professionals, including pharmacists. She also teaches undergraduate nutrition on an occasional basis at various academic institutions in the UK. Her interest in food supplements developed mainly as a result of her dual qualification in pharmacy and nutrition. She is the author of two books: "Dietary Supplements", now in its third edition, published by the UK Pharmaceutical Press and "Nutrition and Dietary Advice in the Pharmacy" published by Blackwell Science.

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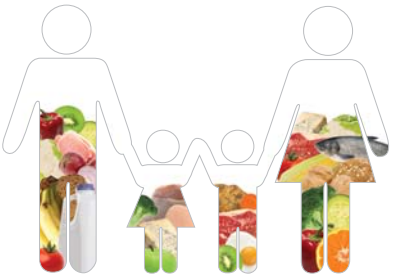

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