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Executive Summary

The role of nutrition in promoting public health and in preventing obesity and chronic disease is well established[1] and is recognised in many UK Government health improvement programs including '5-a-day',[2] healthy eating[3] and weight management strategies.[4] Among the public, there is a growing interest in healthier eating and an awareness of the health benefits of a healthier diet, but many people fail to achieve recommended targets, such as '5-a-day', and the average individual eats too little fruit and vegetables, oily fish and whole grains and too much saturated fat, salt and sugar. Moreover, although mean intakes of many vitamins and minerals in the overall population are at or above recommended levels, emphasis on mean intake figures of micronutrients conceals the substantial proportions of people, young and old, whose intakes fall below recommended levels.[5-7] Intakes of minerals and trace elements, including iron, zinc and magnesium are of particular concern in young women and few women of reproductive age consume the recommended intake of folate.[5] Low vitamin D status is of increasing concern throughout the British population, but particularly in the elderly, the housebound, children and those living in the north of the UK.[8,9] In addition to the classic deficiency diseases of rickets in children and osteomalacia in adults, low vitamin D status is increasingly being linked with a range of conditions such as cardiovascular disease, some cancers and osteoporosis.

Encouragement to eat a healthier diet must continue, but dietary transition is a long-term process of cultural and behavioural change. Moreover, recent increases in the price of basic foodstuffs, including meat, milk, fruit and vegetables, will inevitably make it more difficult for some families to buy these foods. Since these foods are a significant source of vitamins and minerals in the UK diet, this may mean that vitamin and mineral intakes do not improve as rapidly as might be hoped.

Executive Summary

Consideration should therefore be given to the potential for food supplements, particularly vitamins and minerals, to help to close this nutritional gap. Government already recognises the need for supplementation in certain population groups, including children,[10] women with heavy periods, pregnant women and those planning a pregnancy, older people, housebound people, people with dark skins and those who cover their skins.[11] In addition, the "Healthy Start" scheme provides free supplements for children and women in disadvantaged groups.

However, it is clear that the population groups targeted by government for dietary supplementation are not the only ones with low intakes of micronutrients. Low intakes of minerals and trace elements are a particular cause for concern in young adults,[5] but low intakes occur throughout the adult,[5] including the elderly population,[7] and also in children[12] and young people[6] with a proportion of individuals, males and females, in all age groups failing to achieve recommended intakes. Less than a third of the UK population regularly take a supplement[13] and those taking supplements may be the ones who already have the highest intakes of micronutrients from food.[14-16] In other words, those who could most benefit from supplementation are likely to be not taking them.

Government could therefore reconsider its approach to supplementation in the UK population and recognise the potential benefits of micronutrient supplementation across a broader cross section of the population, particularly in those groups where dietary intakes of nutrients are not meeting recommended intakes. Daily supplementation with a wide range of vitamins and minerals at RDA (EC) (Recommended Daily Allowance as established by the European Community) levels would help to ensure that fewer individuals have poor intakes of these nutrients.

Overview

- The 5-a-day target for fruit and vegetable intake is not being met.
- In the British National Diet and Nutrition Survey (NDNS) of adults aged 19-64 years, mean fruit and vegetable intake was 2.7 portions for men and 2.9 portions for women.
- A significant proportion of purchased fruit and vegetables is thrown away. Overall, 26.3 per cent (by weight) of purchased fruit, 45.4 per cent of salad, and 19.1 per cent of vegetables is thrown away, therefore showing that although consumers are buying fruit and vegetables, they are not consuming all of what they purchase.
- Although mean intakes of many vitamins and minerals in the overall population are at or above recommended levels, significant numbers of individuals have intakes of vitamins and minerals below the Reference Nutrient Intake (RNI).
- More than 9 in 10 women of childbearing age are taking below the recommended 600µg/day of folic acid (400µg from a supplement and 200µg from food).
- More than 8 in 10 women of reproductive age are taking less than 400µg of folic acid daily and more than one third of women aged 19-34 years consume less than 200µg of folic acid each day.
- Poor vitamin D status is a cause of significant concern in the UK. Low vitamin D status is associated in the literature with conditions such as cardiovascular disease, osteoporosis, diabetes mellitus and cancer.

Introduction

The role of nutrition in promoting public health and in preventing obesity and chronic diseases such as cardiovascular disease, cancer, diabetes mellitus, dental disease and osteoporosis is well established.[1] UK dietary guidelines include recommendations for intakes of both macronutrients (e.g. fat, saturated fat, unsaturated fats and carbohydrates, including sugars and fibre) and micronutrients (i.e. vitamins and minerals).[17] Nutrition is highlighted in many Government health improvement programmes including '5-a-day',[2] healthy eating[3] and weight management strategies.[4]

"It is estimated that 70,000 premature deaths could be prevented each year if diets matched nutritional guidelines."

Although there is a growing public interest in healthier eating and an awareness of the health benefits of a healthier diet,[18] many people fail to achieve recommended targets, and the average British adult eats too little fruit and vegetables, oily fish and whole grains and too much saturated fat, salt and sugar.[19,20]

It is estimated that 70,000 premature deaths could be prevented each year if diets matched nutritional guidelines. This is more than 10 per cent of current mortality and the health benefits of meeting nutritional guidelines have been estimated to be as high as £20 billion each year.[21]

Fruit and Vegetable Intake

Of the 70,000 premature deaths previously mentioned, estimates indicate that 42,000 alone could be saved if the fruit and vegetable recommendations were followed.[21]

However, a substantial proportion of the population does not achieve the '5-a-day' target. Average daily consumption of fruit and vegetables in the British National Diet and Nutrition Survey (NDNS) of adults aged 19-64 years was 2.7 portions for men and 2.9 portions for women[19] (The NDNS surveys are based on food diaries recording what people eat). Only 13 per cent of the men and 15 per cent of the women met the recommendation to consume five or more portions a day, while 21 per cent of men and 15 per cent of women reported eating no fruit at all during the survey week. Mean daily consumption was lowest in the youngest age group (19-24 years) with men consuming 1.3 portions and women 1.8 portions.

"26.3 per cent (by weight) of purchased fruit, 45.4 per cent of salad, and 19.1 per cent of vegetables are thrown away."

Similar patterns of low consumption of fruit and vegetables were found in the Low Income Diet and Nutrition Survey (LIDNS)[22], which included both children and adults. On average males consumed 2.4 portions of fruit and vegetables a day and females 2.5. Only 8 per cent of men and 9 per cent of women met the government recommendations of at least 5 portions a day. Twenty four per cent of men and 21 per cent of women consumed less than one portion of fruit and vegetables, while 36 per cent of men and 28 per cent of women consumed no fruit at all during the time of the survey. Mean fruit and vegetable consumption in children was 1.6 (adult) portions for boys and 2.0 (adult) portions for girls. While boys consumed about half as many portions of vegetables as men, there were no differences in fruit consumption. This pattern was similar in girls and women. A third of boys and a fifth of girls ate no fruit during the surveyed days. This was higher in those aged 11-18 compared with those aged 2-10.

According to the 2005-2006 Family Food Survey,[23] sales of fruit and vegetables are increasing, but daily purchased quantities, including those purchased for consumption outside of the home, still fall short of the target of ≥ 400g a day recommended by the World Health Organisation.[1] In addition, it has recently become clear that huge quantities of fresh produce, including fruit and vegetables, are thrown away uneaten.[24] Overall, 26.3 per cent (by weight) of purchased fruit, 45.4 per cent of salad, and 19.1 per cent of vegetables are thrown away. In households with children, these figures are higher with 37.1 per cent of the fruit, 57.4 per cent of the salad and 24.7 per cent of the vegetables purchased in family households thrown away. Consumption of fruit and vegetables is therefore considerably less than the purchased amounts recorded in this survey.

A 2008 survey found that consumption of fruit and vegetables has not improved since the gathering of the adult NDNS data. In this latter survey, 88 per cent of British people failed to reach the '5-a-day target', on average eating 2.5 portions a day with significant differences between age groups, gender and social class.[25] Of particular concern are those on low incomes with some two million of the least well off people consuming less than one portion a day. Only 12 per cent of the surveyed population actually met the advised 5-a-day target, with a further 11 per cent managing to reach 4-a-day. People over 65 were the most likely to consume 5-a-day, while men aged 17 to 44 years were the least likely to meet the recommendation. Adult women had the highest average level of intake at 2.7 daily portions, while men consumed slightly less with 2.4 portions per day on average. The conclusions of this survey were that, for fruit and vegetables, consumption levels have remained flat over the past three years for both men and women, suggesting that little effort has been made to increase fruit and vegetable intake.

Wholegrain Consumption

Wholegrains (e.g. rolled oats, porridge, whole barley, whole rye, rye bread and rye crackers, wholewheat, spelt, whole rice and brown rice) are an excellent source of carbohydrate, protein and dietary fibre and also high in vitamins, notably B and E, minerals such as iron, zinc and magnesium and they have high levels of antioxidants. Epidemiological evidence suggests that higher consumption of wholegrain foods can significantly reduce the risk of chronic diseases such as CVD, type 2 diabetes and some cancers[26]. Together with fruit and vegetables they can be considered to be a marker of a healthy diet.

"Epidemiological evidence suggests that higher consumption of wholegrain foods can significantly reduce the risk of chronic diseases such as CVD, type 2 diabetes and some cancers."

Information on wholegrain intakes in the UK is limited. However, using data from the 2000-1 NDNS in adults aged 19-64 years, researchers found that approximately one third of adults failed to consume wholegrains on a daily basis and more than 90 per cent of the study population consumed less than three servings a day.[27,106] Men had a median intake of 2.0 servings a week and women a median intake of 3.0 servings a week. This research also suggested that wholegrain intake had fallen since the previous NDNS survey in 1986-7.

Oily Fish Consumption

Oily fish consumption is well under the recommended intake of 140g a week.[19,22] The Food Standards Agency (FSA) recommends two portions of fish each week, one of which should be oily; this recommendation is equivalent to 450mg of omega 3 long chain polyunsaturated fatty acids each day. Oily fish is consumed by only 27 per cent of the population and their mean intake of omega 3 fatty acids is 270mg daily, half of which comes from oily fish. For the other 73 per cent of the population who do not consume oily fish, mean intake of omega 3 fatty acids is only 147mg daily. Younger adults are eating less fish than older adults. In the 19–24 age group, only 13 per cent of women and 3 per cent of men eat fish,[28] while among 50–64 year olds, 42 per cent of women and 36 per cent of men eat fish. Only 3 per cent of children and 15 per cent of adults from a low income background reported eating oily fish.[22]

Vitamin and Mineral Intakes

There is some evidence from dietary surveys in adults,[5,29] young children,[12] young people[6] and people aged ≥ 65 years[7] that intakes of several micronutrients (vitamins and minerals) are lower than recommended levels.

The NDNS in Adults

The NDNS in adults aged 19-64 years found that many adults, particularly younger people, and especially young women, as well as those in lower socio-economic groups, have low micronutrient intakes in comparison with UK dietary reference values (DRVs) and low levels of some nutritional status indices.

Tables 1 and 2 present the mean daily intakes (for men and women) of vitamins and minerals from food sources as a percentage of the Reference Nutrient Intake (RNI),[1] the percentage of respondents with intakes below the RNI, and the percentage of respondents with intakes below the Lower Reference Nutrient Intake (LRNI).[2]

Table 1: 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.

1. Reference Nutrient Intake (RNI) is the amount of a nutrient estimated to be sufficient for 95 per cent of the population.
2. Lower Reference Nutrient Intake (LRNI) is the amount of a nutrient considered to be sufficient for the few people in a population group who have low needs. Most people will need more than the LRNI and if people consistently consume less, they may be at risk of deficiency of that nutrient.

Table 2: 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.

Vitamin and Mineral Intakes

The NDNS in Adults

Vitamins

Mean intakes of all vitamins were above the RNI in both men and women overall. However, there was evidence of low intakes of vitamin A, thiamin, riboflavin, folic acid and vitamin C in a proportion of individuals across all age groups, but particularly in the younger age groups (19-24 and 25-34 years).

"There was evidence of low intakes of vitamin A, thiamin, riboflavin, folic acid and vitamin C in a proportion of individuals across all age groups."

The mean intakes of vitamin A fell below the RNI for the youngest men and the two younger groups of women. Among the men and women overall, 56 and 59 per cent respectively had intakes of vitamin A below the RNI while 7 and 9 per cent respectively had intakes below the LRNI. In the 19-24 year olds, 16 per cent of men and 19 per cent of women had a vitamin A intake below the LRNI.

Mean intakes were above the RNI for all other vitamins in both men and women of all age groups. However, consideration of mean intakes alone fails to identify individuals with intakes lower than the mean and to distinguish between the intakes of specific groups within the surveyed population.

Thus, 20 per cent of the surveyed men and 28 per cent of the women had intakes of riboflavin below the RNI. In the two younger age groups, the situation was worse in that intakes below the LRNI were found in 8 and 15 per cent of the 19-24 year old men and women respectively and in 10 per cent of the women aged 25-34 years. Vitamin C intakes were below the RNI in 21 per cent of both men and women and in 25 per cent of the two youngest age groups of women.

Folate is of particular concern. The Department of Health recommends that women who could become pregnant take a supplement of 400µg per day of folic acid before conception and until the 12th week of pregnancy in order to minimize the risk of neural tube defects.[30] In the NDNS, 14 per cent of women aged 19-24 years – not an insignificant number - had a folate intake below the RNI of 200 µg/day. Moreover 86 per cent of this same age group of women, 92 per cent of the 25-34 years age group and 84 per cent of the 35-49 years age group – i.e. those of reproductive age - had folate intakes from all sources, including the contribution of supplements, of < 400mg per day.

"The Department of Health recommends that women who could become pregnant take a supplement of 400µg per day of folic acid before conception and until the 12th week of pregnancy in order to minimize the risk of neural tube defects."

Minerals

Mean intakes of all minerals were above the RNI for men overall, but in women mean intakes of some minerals and trace elements fell below the RNI. In women overall, mean intake of iron was 82 per cent of the RNI, mean intake of magnesium was 85 per cent of the RNI and mean intake of copper was 86 per cent of the RNI. As with vitamins, there was evidence of low intakes of minerals in a proportion of both men and women of all ages, but particularly in the younger age groups with intakes in young women of particular concern.

Iron

Mean iron intakes in women were well below the RNI in all but the 50-64 year old age group. In the three youngest age groups (i.e. women between the ages of 19 and 49), at least 90 per cent had intakes below the RNI, while in the two younger groups (19-24 and 25-34 years), more than 40 per cent had intakes below the LRNI.

Calcium

Mean intakes of calcium for men and women overall were above the RNI, but 18 per cent of men and 42 per cent of women had intakes below the RNI. The youngest group of women had a mean calcium intake just below the RNI and 34 per cent of men and 56 per cent of women in the youngest group had intakes below the RNI while 5 per cent of men and 8 per cent of women in this age group had intakes below the LRNI.

Magnesium

Mean intakes of magnesium for men were above the RNI, but for women were only 85 per cent of the RNI. Of the men and women, 50 per cent and 74 per cent respectively had intakes below the RNI and 9 and 13 per cent respectively had intakes below the LRNI. More than 75 per cent of men between the ages of 19 and 49 years had magnesium intakes below the RNI and 17 per cent of the youngest group of men had intakes below the LRNI. In women, among both the 19-24 year olds and the 25-34 year olds, intakes fell below the LRNI in 22 per cent and 20 per cent respectively.

Zinc

For zinc, mean intakes fell below the RNI in the youngest men and the two youngest groups of women. Intakes below the RNI were seen in more than half of the youngest men and women and intakes below the LRNI were seen in 7 per cent of the youngest men and 5 per cent of the youngest women.

Iodine

Mean iodine intakes fell below the RNI in the 19-24 year old group of women; 63 per cent had intakes below the RNI and 12 per cent had intakes below the LRNI. Of the men, 41 per cent aged 19-24 years had iodine intakes below the LRNI.

Copper

Mean copper intakes fell below the RNI across all age groups in women and in men aged 19-24 years. The youngest women had a mean intake of 76 per cent of the RNI; 78 per cent of young women and 62 per cent of men in this age group had copper intakes below the RNI.

Vitamin and Mineral Intakes

The NDNS in Adults

Nutritional Status Indices

The results of the analysis of nutritional status indices in the NDNS blood samples showed that while indices for most nutrients were within normal ranges, for some nutrients, particularly iron, vitamin D and vitamin C, and in women, iron and folate, a proportion had levels below thresholds for poor status.[29] Of the men and women, 3 and 8 per cent respectively overall had haemoglobin levels below the World Health Organisation (WHO) thresholds for anaemia (130g/l for men and 120g/l for women). There was no evidence of an age trend. Of the men and women, 4 and 11 per cent respectively had serum ferritin levels below the normal range (20-300µg/l for men and 15-150µg/l for women), indicating low iron stores, increasing to 16 per cent in 19-24 year old women.

"NDNS blood samples showed that while indices for most nutrients were within normal ranges, for some nutrients, particularly iron, vitamin D and vitamin C, and in women, iron and folate, a proportion had levels below thresholds for poor status."

Low vitamin D levels were found in a substantial proportion of the blood samples, particularly those for the youngest age group and those taken in the winter months. Levels of plasma 25-hydroxyvitamin D (25-OHD) < 25nmol/l, the threshold currently used to indicate low vitamin D status,[31] were found in 14 per cent of men and 15 per cent of women. In the youngest group, 24 per cent of the men and 28 per cent of the women had levels < 25nmol/l. Given that sunlight is a significant source of vitamin D, it is not surprising that the proportion with low vitamin D status was higher in the winter months (January-March) than in the summer months (July-September). Approximately one quarter of the blood samples collected in January-March had 25-OHD levels < 25nmol/l.

Considering blood status indices of other vitamins, of the men and women, 5 per cent had an erythrocyte folate concentration < 350nmol/l, which is indicative of marginal status with increased risk of deficiency; this increased to 8 per cent of the women and 13 per cent of the men in the 19-24 year old age group. In addition, 5 per cent of men and 3 per cent of women had plasma vitamin C levels indicating biochemical depletion (<11µmol/l).

Adults in Households Receiving Benefits

In this survey of adults aged 19-64 years, those living in households in which someone was receiving state benefits had lower mean daily intakes of the majority of vitamins and almost all minerals compared with those in non-benefit households. For example, 22 per cent of the women in the benefit group had intakes of vitamin A below the LRNI compared with 9 per cent in the non-benefit group; 19 per cent had intakes of riboflavin below the LRNI, compared with 8 per cent in the non-benefit group; 27 per cent had intakes of magnesium below the LRNI compared with 13 per cent in the non-benefit group. Over half the women aged 19-50 years in the benefit group had iron intakes below the LRNI compared with around one third of women in non-benefit households.

There was also some evidence of a lower micronutrient status for the benefit group. For men and women living in benefit households mean levels of vitamin C, erythrocyte folate, vitamin E and selenium, and for women, mean levels of vitamin D and carotenoids were lower than those for non-benefit groups.

Vitamin and Mineral Intakes

Diet and Nutrition Surveys in Children

Similar to the adult survey, the NDNS in pre-school children[12] and the equivalent survey in older children[6] showed that mean daily intakes of some micronutrients were at or above the RNI, but intakes of some vitamins and minerals fell below recommended levels.

Vitamins

About half of the pre-school children had average daily intakes of vitamin A which fell below the RNI value of 400µg. Eight per cent of children under 4 years and 7 per cent of children aged 4 years and over had intakes of vitamin A below the LRNI.

On average the mean daily intakes for thiamin, riboflavin, niacin, vitamin B_6, B_{12} and folate were above RNI values. None of the children under 4 years had intakes below the LRNI for niacin and B_{12} and 1 per cent or less had intakes below the LRNI for thiamin, riboflavin, vitamin B_6 and folate. Similarly, none of the children over 4 years had intakes below the LRNI for niacin and vitamin B_{12}. One per cent of the over 4s had intakes below the LRNI for thiamin, riboflavin and folate and 5 per cent had intakes below the LRNI for vitamin B_6. Vitamin C intakes varied widely, and 1 per cent of all children had intake levels below the LRNI.

Average daily intakes of vitamin D from food were low (1.2µg in both the youngest and middle age groups and very slightly higher in the 3½ to 4½ years group (boys 1.4µg, girls 1.3µg). The RNI at age 1 to 3 years is 7µg, a level met by only 5 per cent of the children aged under 4 years.

Minerals

Average daily intakes of iron were well below the RNI, with 84 per cent of those under 4 years of age and 57 per cent of those aged 4 years and over falling below the RNI. Of those children under 4 years, 16 per cent had intakes of iron below the LRNI, which increased to 24 per cent in those aged 1½ to 2½ years. One in eight in the youngest group was anaemic (defined by haemoglobin concentrations < 110g/l) and one in 12 of all children was anaemic. Low ferritin levels also implied that a proportion of children had poor iron status with 20 per cent of all children having ferritin levels below 10µg/l and 5 per cent having levels below 5µg/l. Other haematological measurements, such as mean

"Of those children under 4 years, 16 per cent had intakes of iron below the LRNI, which increased to 24 per cent in those aged 1½ to 2½ years."

corpuscular volume (MCV), haematocrit, mean cell haemoglobin (MCH), mean cell haemoglobin concentration (MCHC) and zinc protoporphyrin all supported the haemoglobin and ferritin results to confirm that iron deficiency occurred commonly and that it was more prevalent in the youngest age group.

"A greater proportion of children aged 4 years and over had zinc intakes below the RNI (89 per cent) and LRNI (37 per cent) values."

Zinc intakes were generally below reference intakes. Seventy two per cent of those aged under 4 years had intakes less than 5.0mg (the RNI for this age group) and 14 per cent had mean intakes below 3.0mg (the LRNI). A greater proportion of children aged 4 years and over had intakes below the RNI (89 per cent) and LRNI (37 per cent) values. For copper, 36 per cent of children < 4 years and 68 per cent of those > 4 years had intakes below the RNI.

The range of intakes for calcium and magnesium was wide. The proportions of children with calcium intakes below the RNI were 11 per cent for children under 4 years and 24 per cent for those over 4 years. Equivalent figures for magnesium were 7 and 34 per cent. The proportion of children with calcium and magnesium intakes below the LRNI were small (1 per cent for children < 4 years and 2 per cent for children > 4 years).

A similar nutritional survey of older children (4-18 years)[6] found low intakes for several vitamins and minerals. Thus, depending on age, 8-13 per cent of boys and 6-20 per cent of girls had intakes of vitamin A below the RNI. Among 7-10 year olds, 5 per cent of boys and 10 per cent of girls had zinc intakes below the RNI.

In the older groups, low intakes were more prevalent. Among 11-18 year olds, 6 per cent of boys and 21 per cent of girls had riboflavin intakes below the RNI. Among 11-14 year olds, 45 per cent of girls had intakes of iron below the RNI; this increased to 50 per cent in 14-18 year olds. In addition, anaemia was present in 1.5 per cent of boys and 5 per cent of girls with respective totals of 13 per cent and 27 per cent having low serum ferritin – an indication of iron deficiency.

Intakes below the RNI for calcium were seen in 12 per cent of boys and 24 per cent of girls aged 11-14 years and in 9 per cent of boys and 19 per cent of girls aged 14-18 years. Magnesium intakes fell below the RNI in 28 per cent of boys and 58 per cent of girls aged 11-14 and in 18 per cent of boys and 53 per cent of girls aged 14-18 years. In the case of zinc, 14 per cent of boys and 37 per cent of girls aged 11-14 and 9 per cent of boys and 10 per cent of girls aged 14-18 had intakes below the RNI.

More recent nutritional surveys in British children have shown similar findings to the NDNS. A survey of 18 month old children in the South West of England found poor intakes of iron, zinc and vitamin D,[32] while in a dietary survey of 3-year olds, mean intakes of iron and vitamin D were below the RNI[33] and in a survey of 7-year olds, median intakes of iron and zinc were below the RNI.[34]

Vitamin and Mineral Intakes

The NDNS in Older People

The National Diet and Nutrition Survey of people aged 65 years and over[7] also demonstrated nutritional deficits in some individuals. See Table 3. (NB: this survey evaluated free-living and institutionalized people separately).

Table 3: Intakes of selected vitamin and mineral intakes (from all sources) by age in people > 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			
	% 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
Vitamin A (retinol equivalents; µg)	43	35	4	1	42	35	6	1	41	23	2	0	44	23	3	0
Thiamin (mg)	7	8	0	1	11	11	1	2	15	15	1	2	8	9	0	0
Riboflavin (mg)	29	29	3	3	29	29	3	3	22	22	2	2	12	12	0	0
Niacin equivalents (mg)	1	1	0	1	2	3	1	1	8	8	0	3	1	1	0	0
Vitamin B6 (mg)	10	23	0	0	18	19	1	0	28	21	0	1	19	19	0	0
Vitamin B12 (µg)	1	0	0	0	1	0	0	0	0	2	0	0	1	0	0	0
Folic acid (µg)	20	43	0	4	34	38	1	5	36	41	4	4	43	49	3	1
Vitamin C (mg)	25	35	1	0	34	40	3	0	44	37	2	2	29	39	1	0
Vitamin D (µg)	92	98	*	*	94	98	*	*	98	98	*	*	97	100	*	*
Iron (mg)	24	42	0	4	31	40	2	5	35	41	4	5	49	57	4	4
Calcium (mg)	32	26	4	0	39	16	5	0	45	22	2	1	52	26	8	1
Magnesium (mg)	55	80	8	14	67	79	11	15	79	80	20	14	82	96	19	16
Zinc (mg)	59	64	6	14	67	66	12	12	70	65	15	13	61	49	3	1
Iodine (µg)	29	30	1	1	30	25	2	2	41	28	4	1	52	32	6	1
Copper (mg)	68	85	*	*	77	88	*	*	87	86	*	*	85	90	*	*

* No LRNI established. F - Free-living. I - Institutionalized.

	Women 75-84 years				Women 85 and over			
	% below RNI		% below LRNI		% below RNI		% below LRNI	
	F	I	F	I	F	I	F	I
	45	22	5	0	43	23	4	0
	14	15	0	0	22	23	1	1
	12	12	0	0	16	17	6	6
	2	2	0	0	7	7	1	0
	23	23	1	0	31	31	6	0
	1	0	0	0	4	0	0	0
	53	55	6	8	62	53	11	5
	44	55	0	1	46	48	3	0
	95	99	*	*	98	99	*	*
	58	66	6	8	67	62	10	6
	63	30	10	1	62	28	15	1
	91	96	27	27	95	96	34	22
	66	63	7	5	70	57	10	3
	53	51	4	1	54	42	7	1
	94	91	*	*	94	91	*	*

Vitamins

For vitamin A, overall, 30 per cent of men and 23 per cent of women had intakes below the RNI. Among free-living individuals, 5 per cent of men and 4 per cent of women had intakes from food below the LRNI.

For riboflavin, 25 per cent of free-living men and 31 per cent of free-living women had intakes below the RNI while 6 per cent of women aged 85 years and over had intakes below the LRNI. Folate intake fell below the RNI in 25 per cent of free-living men, 41 per cent of institutionalized men, 48 per cent of free-living women and 53 per cent of institutionalized women; 11 per cent of free-living women aged 85 years and over had intakes of folate below the LRNI. Vitamin C intakes were below the RNI in 28 per cent of free-living men and 36 per cent of free-living women and in 29 per cent of institutionalized men and 38 per cent of institutionalized women.

Average daily intake of vitamin D from food sources for men was 4.07µg and for women, 2.92µg. Intakes of vitamin D from food decreased with age in both men and women. The mean intake of vitamin D from food sources in free-living men and women was 41 per cent and 29 per cent of the RNI respectively which is set at 10µg/day for those over 65 years. Ninety seven per cent of participants had intakes below the RNI. In institutions, men had an average daily intake of vitamin D from food sources of 3.79µg and women 3.31µg. Almost all participants living in institutions (99 per cent) had intakes below the RNI for vitamin D.

"Almost all participants living in institutions (99 per cent) had intakes below the RNI for vitamin D."

Vitamin and Mineral Intakes

The NDNS in Older People

Minerals

Like vitamins, there was also evidence of low intakes of minerals. For example, 43 per cent of free-living and 57 per cent of institutionalized men and women overall had iron intakes below the RNI, while 10 per cent of free-living women over the age of 85 years had iron intakes below the LRNI. Equivalent figures for calcium were 47 per cent, 27 per cent and 30 per cent.

Mean intakes for magnesium were below the RNI (85 per cent of the RNI for free-living men and 73 per cent for free-living women). Seventy five per cent of free-living men and women and 92 per cent of institutionalized individuals had intakes of magnesium below the RNI. Overall, 21 per cent of men and 23 per cent of women had intakes below the LRNI, a proportion that increased significantly with age to 36 per cent of men and 34 per cent of women in the oldest age group. In institutions, average intakes of magnesium were 72 per cent of the RNI for men and 70 per cent for women. Thirty nine per cent of men and 22 per cent of women had intakes below the LRNI.

Intakes of zinc and copper were also a cause for concern. Though intakes of zinc were 93 per cent of the RNI for free-living men and 98 per cent of the RNI for women, in the oldest age group 15 per cent of men and 10 per cent of women had intakes below the LRNI. For copper, average intakes in free-living men were 93 per cent of the RNI and 73 per cent of the RNI for women, in institutions, mean intakes were 79 per cent of the RNI for men and 70 per cent for women.

Nutritional Status Indices

Eleven per cent of men had a haemoglobin concentration below the WHO lower limit (for iron deficiency anaemia) of 130g/l and 9 per cent of women had a concentration below the WHO lower limit for women of 120g/l. In those aged 85 years and over, 37 per cent of men and 16 per cent of women had low haemoglobin concentrations. In institutions, the picture was worse in that 52 per cent of men and 39 per cent of women had low haemoglobin concentrations.

Fourteen per cent of men and 13 per cent of women in the free-living group had plasma vitamin C concentrations indicating biochemical depletion. Equivalent figures for men in institutions were 44 per cent and for women 38 per cent. Low serum folate concentrations were found in 15 per cent of free-living participants and 39 per cent of those in institutions.

"43 per cent of free-living and 57 per cent of institutionalized men and women overall had iron intakes below the RNI."

The UK Low Income Diet and Nutrition Survey

The Low Income Diet and Nutrition Survey (LIDNS)[22] evaluated the food and nutrient intake of 3,728 people from 2,477 households from the bottom 15 per cent of the population in terms of material deprivation. Patterns of vitamin and intake in this group were found to be broadly similar to that of the general population.

Vitamins

Average daily intakes fell below the RNI for vitamin A in older children aged 11-18 and younger adults aged 19-34. A high proportion of adults and children in all age groups had intakes of vitamin A below the LRNI (ranging from 7-18 per cent), particularly older children and younger adults. For the two age groups in the LIDNS with RNIs set for vitamin D, mean daily intakes were 22 per cent of the RNI for children aged 2-3, and 34 per cent and 26 per cent of the RNI for men and women (respectively) aged 65 and over. There was evidence of low intakes of riboflavin (particularly among older children aged 11-18, men aged 19-34 and women aged 19-49) and folate (particularly among boys aged 11-18 and women aged 19-64).

Minerals

Average (mean and median) intakes of total iron fell below the RNI for women aged 19-49 and girls aged 11-18. Half of the women aged 19-49 and 39 per cent of the girls aged 11-18 had intakes of total iron below the LRNI. Over one-quarter of adults had intakes of magnesium below the LRNI, as did 33 per cent of boys and 46 per cent of girls aged 11-18. There was evidence of low intakes of calcium and iodine in men aged 19-34, women in all age groups and children aged 11-18. Between 8 and 21 per cent of adults and children in all age groups had intakes of zinc below the LRNI. Children aged 11-18 were more likely to have low intakes of minerals than those aged 2-10 years.

"Over one-quarter of adults had intakes of magnesium below the LRNI."

Vitamin and Mineral Intakes

Irish Food Consumption Survey

Similar results have emerged from Ireland in that a proportion of the population in the North/South Ireland Food Consumption Survey of adults aged 18-64 years had intakes of vitamins and minerals below the average requirement (AR).[35] The Irish survey estimated food consumption using a 7-day food diary in 1,379 men and women in Northern Ireland and the Republic of Ireland selected randomly from the electoral register. Adequacy of vitamin and mineral intakes in population groups was assessed using the adequate requirement (AR) as a cut-off value.

Vitamins

Mean daily intake of vitamin A was below the AR in 20.2 per cent and 16.6 per cent of men and women respectively and mean daily intake for riboflavin was below the AR in 12.5 per cent and 20.6 per cent of men and women respectively. A high proportion of the population had a low dietary vitamin D intake and is largely dependent on sunlight to fulfill vitamin D requirements.[14,35]

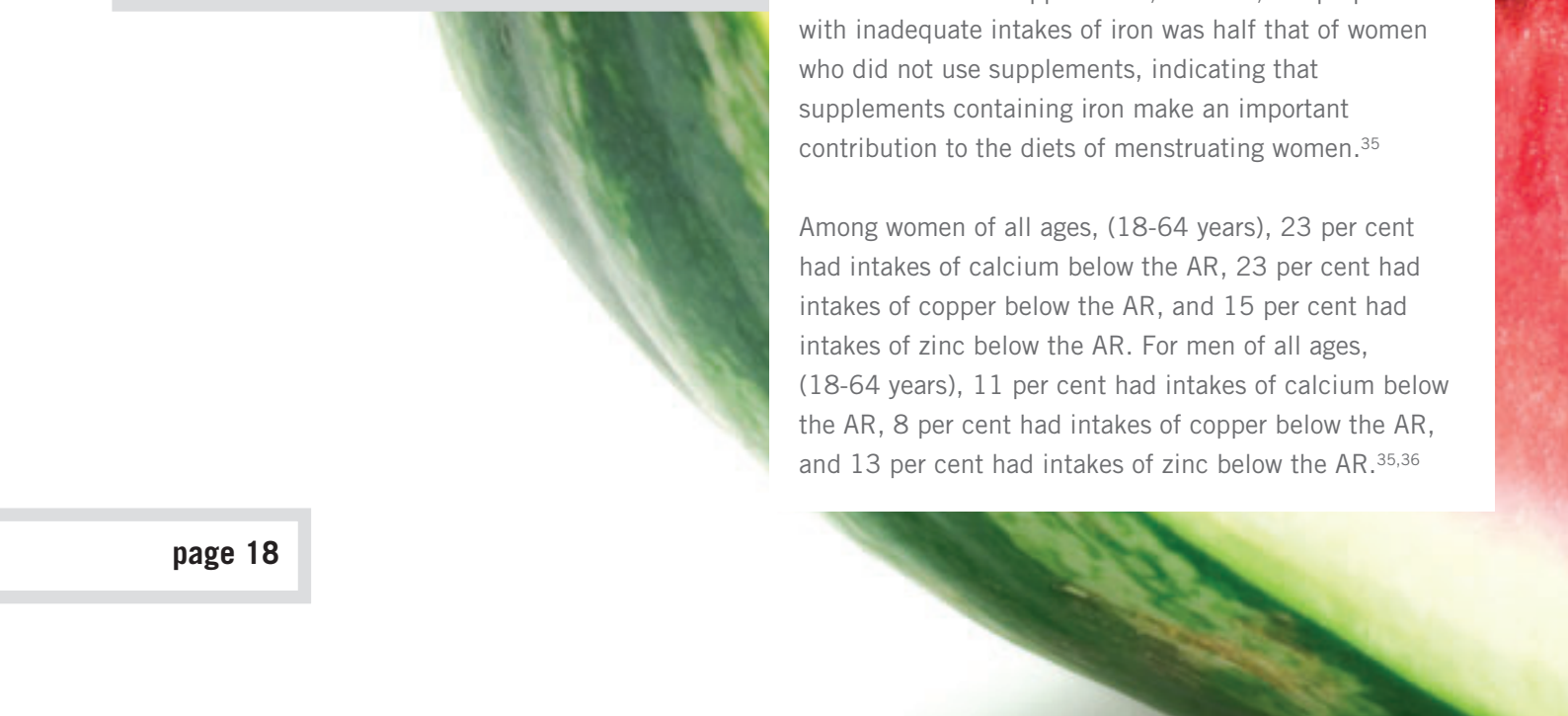
"Only 2.2 per cent of women aged 18-35 years and 35-60 years achieved the recommended folate intake of 600µg/day in women of reproductive age for the prevention of neural tube defects."

Mean daily intakes of folate were below the AR in 11.2 per cent and 6.6 per cent of women aged 18-35 years and 36-50 years respectively. Only 2.2 per cent of women aged 18-35 years and 36-50 years achieved the recommended folate intake of 600µg/day in women of reproductive age for the prevention of neural tube defects. All of the women who met the recommendation were using folate containing supplements. In women aged 18-50 years who consumed supplemental folate (14 per cent, n=80), mean intakes of folate were 480 µg (233 µg from food and 248 µg from supplements), suggesting a reduced risk of NTD in this group. Of the women who did not take supplements, none had mean intakes that approached this level.[35]

Minerals

A substantial proportion of people had intakes below the AR for iron, calcium, copper and zinc. Similar to the British survey, a higher proportion of women than men had low intakes of minerals. Almost 50 per cent of 18-50 year old women had intakes below the AR for iron. In women who used supplements, however, the proportion with inadequate intakes of iron was half that of women who did not use supplements, indicating that supplements containing iron make an important contribution to the diets of menstruating women.[35]

Among women of all ages, (18-64 years), 23 per cent had intakes of calcium below the AR, 23 per cent had intakes of copper below the AR, and 15 per cent had intakes of zinc below the AR. For men of all ages, (18-64 years), 11 per cent had intakes of calcium below the AR, 8 per cent had intakes of copper below the AR, and 13 per cent had intakes of zinc below the AR.[35,36]

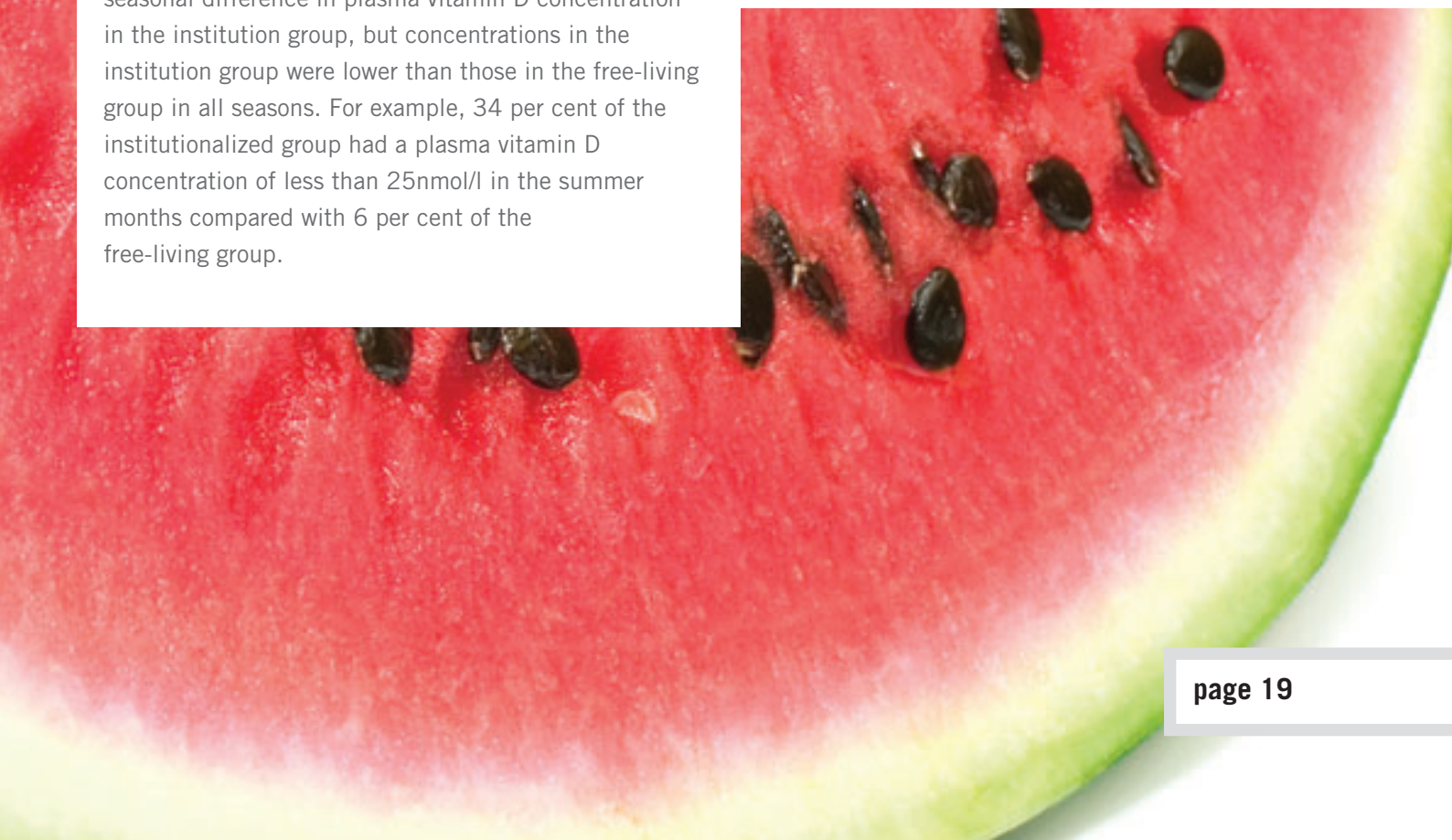


Vitamin D

Several studies have highlighted the emerging problems of low levels of vitamin D in both the elderly and the non-elderly populations of the UK.

In the NDNS in people of 65 years and over,[7] plasma levels of vitamin D < 25nmol/l, a figure used in the UK to indicate low vitamin D status,[37] were found in 6 per cent of free-living men and 10 per cent of free-living women. In the free-living group, a higher proportion of women, and of the older age groups, had a low plasma vitamin D concentration. For example, 20 per cent of free-living women aged 85 years and over had plasma vitamin D below 25nmol/l compared to 13 per cent of men in the same age group and 6 per cent of women aged 65 to 74 years. In institutions, 38 per cent of men and 37 per cent of women had plasma vitamin D concentrations below 25nmol/l. Unlike in the free-living group, no trend was observed in plasma vitamin D concentration with age. Mean plasma vitamin D concentration varied by season of blood sample collection in the free-living group, but not the institutional group. In free-living participants, plasma vitamin D concentration was lowest in January to March and highest in July to September. There was little seasonal difference in plasma vitamin D concentration in the institution group, but concentrations in the institution group were lower than those in the free-living group in all seasons. For example, 34 per cent of the institutionalized group had a plasma vitamin D concentration of less than 25nmol/l in the summer months compared with 6 per cent of the free-living group.

More recently, a study involving 1,766 participants of 65 years and older, living in private households or institutions in England, as part of the Health Survey for England (HSE) 2000, also found that the prevalence of vitamin D deficiency was higher and mean serum vitamin D levels were significantly lower among both men and women living in institutions than among those in private households. Regression analyses showed that women were more likely to be vitamin D deficient than men (odds ratio (OR) 2.1) and deficiency was associated with limiting longstanding illness (OR 3.57), manual social classes (OR 2.4), poor general health (OR 1.92) and body mass index <25 kg/m2 (OR 2.02), and was 67 per cent more likely among informants in the winter/autumn. Overall, these more recent findings show no significant improvements in vitamin D status in comparison to the NDNS findings in people ≥ 65 years.



Vitamin and Mineral Intakes

Vitamin D

A more recent study in people 45 years of age found that low vitamin D status is also widespread among middle-aged people.[38] In this survey, blood samples were obtained from 7,437 white people. The prevalence of low vitamin D status was highest during the winter and spring, when plasma vitamin D concentrations of < 25, < 40 and < 75 nmol/l were found in 15.5 per cent, 46.6 per cent and 87.1 per cent of participants respectively. The proportions were 3.2 per cent, 15.4 per cent and 60.9 per cent respectively during the summer and autumn. Women had lower vitamin D concentrations, on average, than did men during the summer and autumn, but not during winter and spring. The effect of latitude was also apparent in this study. The highest rates of low vitamin D status were observed in Scottish participants. Vitamin D concentrations were significantly higher in participants who used vitamin D supplements or consumed oily fish than in those who did not, but only 13 per cent of men and 20 per cent of women were using supplements in this study. Plasma vitamin D concentrations below 40nmol/l were twice as likely in the obese as in the non-obese and in Scottish participants as in those from other parts of Great Britain.

"low vitamin D status is also widespread among middle-aged people."

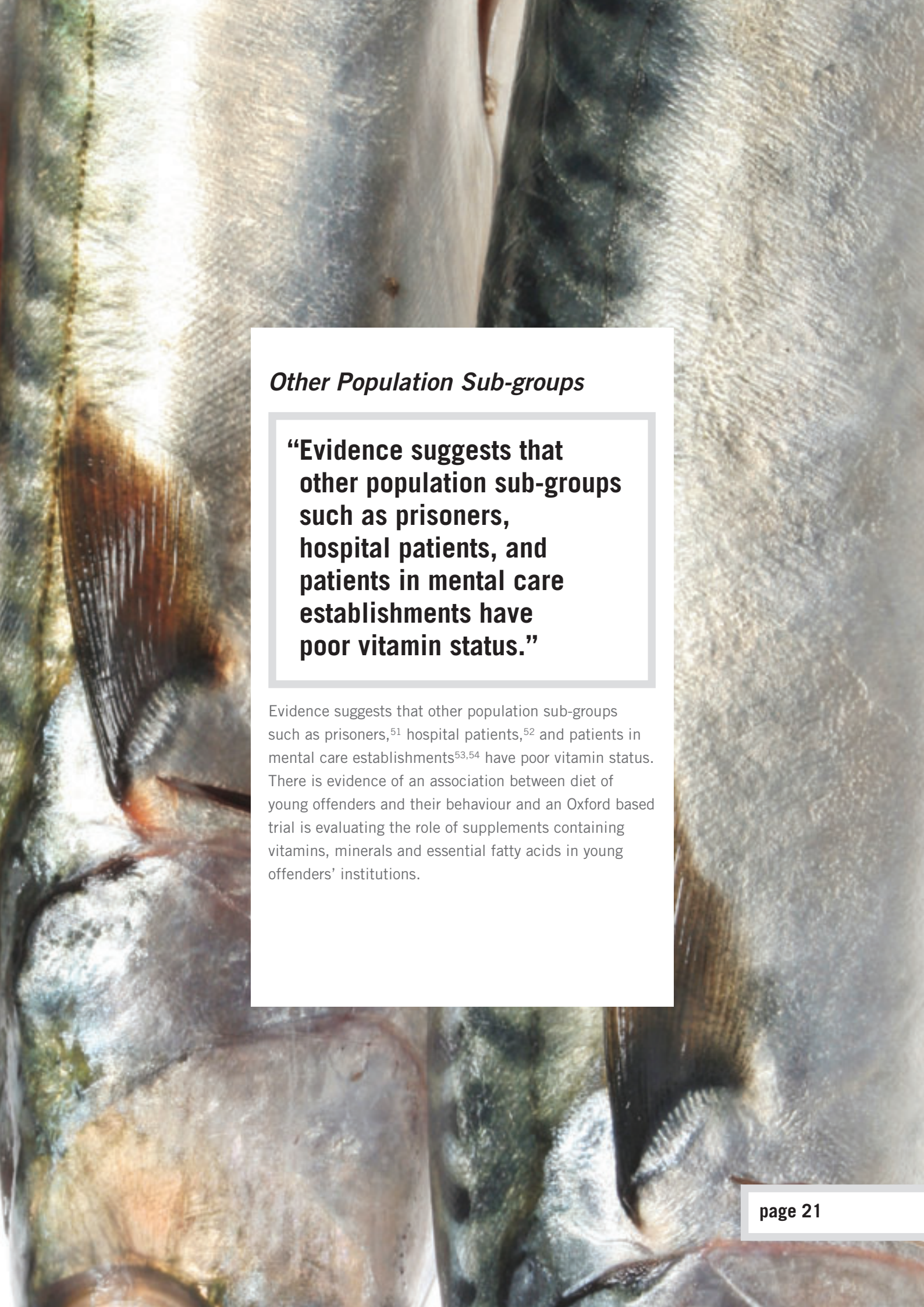
"Vitamin D concentrations were significantly higher in participants who used vitamin D supplements or consumed oily fish."

Results from this study are confirmed by findings in the 35-49 year olds in the NDNS (where mean concentrations for men and women 48 nmol/l). In the NDNS, plasma vitamin D concentrations below 25nmol/l were found in 15 per cent of women and 12 per cent of men in the 35-49 year old age group.

Poor vitamin D status has also been observed in ethnic minority groups in the UK,[39-43] including children.[44] Evidence from Irish studies indicates that poor vitamin D status, particularly during winter time, is common in postmenopausal women,[45-47] elderly women and adolescents.[48]

This high prevalence of hypovitaminosis D in the UK is not surprising. The UK is located between 50º and 60ºN, which corresponds to the latitude of Canada up to the southern tip of Alaska. As latitude increases, the amount of vitamin D UV decreases dramatically, particularly during the winter months.[49] North of London, no skin synthesis occurs in December and January and even during the remainder of the year, cloud cover blocks up to 99 per cent of vitamin D production.[50]

"Poor vitamin D status has also been observed in ethnic minority groups in the UK."



Other Population Sub-groups

"Evidence suggests that other population sub-groups such as prisoners, hospital patients, and patients in mental care establishments have poor vitamin status."

Evidence suggests that other population sub-groups such as prisoners,[51] hospital patients,[52] and patients in mental care establishments[53,54] have poor vitamin status. There is evidence of an association between diet of young offenders and their behaviour and an Oxford based trial is evaluating the role of supplements containing vitamins, minerals and essential fatty acids in young offenders' institutions.

The Role of Supplementation

Encouragement to eat a healthier diet must continue, but dietary transition is a long-term process of cultural and behavioural change. Moreover, recent increases in the price of basic foodstuffs, including meat, milk, fruit and vegetables, will inevitably make it more difficult for some families to buy these foods. Since these foods are a significant source of vitamins and minerals in the UK diet, this may mean that vitamin and mineral intakes do not increase as rapidly as might be hoped and could even fall.

"Encouragement to eat a healthier diet must continue, but dietary transition is a long-term process of cultural and behavioural change."

Consideration should therefore be given to the potential for food supplements, particularly vitamins and minerals, to help to close this nutritional gap. Studies in adults have shown that supplement use can make a significant contribution to vitamin and mineral intake. The National Diet and Nutrition Survey (NDNS) in British adults found that supplement users had higher intakes of vitamins and minerals and were less likely to have intakes below the Reference Nutrient Intake (RNI) than non-supplement users.[5] Similar findings have been shown in Ireland,[14] Germany,[55,56] the US[57-59] and Canada.[60] In younger people too, food supplements have been shown to make a substantial contribution to the intakes of vitamins and minerals in toddlers[61,62] and teenagers.[15,16,63,64] Several studies[58,65-73] have also shown that supplementation with vitamin and minerals can improve plasma levels of micronutrients and reduce the prevalence of suboptimal plasma concentrations.

There is some evidence from observational studies that use of multivitamins is associated with reduced risk of chronic disease. For example, reduced risk of cardiovascular disease has been demonstrated in users of multivitamins.[74,75] Use of multivitamin supplements has also been associated with reductions in C-reactive protein concentrations[76,77] (elevated C-reactive protein levels are associated with the risk of cardiovascular disease and diabetes).

"Food supplements have been shown to make a substantial contribution to the intakes of vitamins and minerals in toddlers and teenagers."

Use of multivitamins has also been associated with reduced risk of cancer in some studies. Thus, in the Cancer Prevention Study II cohort, past multivitamin use (> 10 years before enrolment), but not recent (< 10 years before enrolment) was associated with modestly reduced risk of colorectal cancer,[78] but a small increase in prostate cancer.[79] In the Health Professionals' Follow-up Study, men who reported folate consumption from multivitamins for > 10 years had a 25 per cent reduction in colon cancer risk,[80] and in the Nurses' Health Study, women who reported multivitamin use (with folate) ≥ 15 years had a 75 per cent reduction in colorectal cancer risk.[81] Regular use of vitamin E supplementation for > 10 years has been associated with reduced mortality from bladder cancer.[82] Reduced risk of renal cell carcinoma has been demonstrated in women taking vitamin E or calcium supplements, and in men taking vitamin E or iron supplements for more than 5 years.[83] Vitamin and mineral supplementation has been associated with reduced risk of rectal cancer in women, but not men[84] and with reduced colon cancer in women.[85] However, in a pooled analysis of 8 prospective studies, use of multivitamins and specific vitamin supplements was not significantly associated with lung cancer risk.[86]

"There is some evidence from observational studies that use of multivitamins is associated with reduced risk of chronic disease."

Use of multivitamin supplements has also been associated with reduced risk of cataract.[87-90] The influence of vitamin use on development of infection has also been studied. Evidence is conflicting with some studies showing benefit and two systematic reviews/meta-analyses, one in elderly people[91] and one in adults of all ages[92] also concluded that the evidence base was inconsistent and does not point to a benefit of vitamin supplements in preventing infection.

Discussion

The government already recognises the need for supplementation in certain population groups. Children between the ages of 6 months and 5 years are recommended to take a supplement containing vitamins A and D.[10] Iron supplementation is recommended in women with heavy periods, and women who are pregnant or planning to become pregnant are advised to take 400µg per day of folic acid. Older people, people who cover their skins when outside, people who rarely get outdoors and people of Asian origin are advised to consider taking a supplement containing 10 µg per day of vitamin D.[11] In addition, the "Healthy Start" scheme provides free supplements for children and women in disadvantaged groups. Moreover, the National Institute for Health and Clinical Excellence (NICE) recommends 1g daily of omega-3 fatty acids (either from 2-4 portions of oily fish each week or 1g daily of omega 3 fatty acids from a supplement) in the secondary prevention of heart attack.

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However, it is clear that the population groups targeted by government for dietary supplementation are not the only ones with low intakes of micronutrients. Low intakes of several vitamins and minerals occur throughout the adult population[5] particularly young women, and also the elderly population,[7] children[12] and young people[6] with a significant proportion of individuals failing to achieve recommended intakes.

Low vitamin D intakes and poor vitamin D status are of increasing concern. There is growing evidence that vitamin D insufficiency is involved in the development of a number of other conditions including osteoporosis,[93] poor muscle function,[94] cancer,[95] cardiovascular disease,[96,97] diabetes mellitus,[98] multiple sclerosis, rheumatoid arthritis and other autoimmune conditions.[99] Furthermore, vitamin D supplementation has been shown to reduce mortality.[100]

In the UK, poor vitamin D status is defined as a 25(OH)D level of < 25nmol/l. However, some experts suggest that a desirable 25(OH)D concentration is ≥ 75 nmol/litre (30ng/ml). Achieving this blood level could require a daily vitamin D intake of 20-25 µg, with some experts saying that the current recommendations are too low.[101]

"Low vitamin D intakes and poor vitamin D status are of increasing concern. There is growing evidence that vitamin D insufficiency is involved in the development of a number of other conditions including osteoporosis, poor muscle function, cancer, cardiovascular disease, diabetes mellitus, multiple sclerosis, rheumatoid arthritis and other autoimmune conditions."

"Less than a third of the population regularly takes a dietary supplement."

Such levels of vitamin D intake could not readily be achieved by diet and given the low exposure to sunlight experienced by many people in the UK,[9] vitamin D supplementation could be used to improve vitamin D status.

Oily fish consumption and omega 3 intakes are lower than recommended levels and low intakes of omega 3 fatty acids have been associated with a range of conditions, particularly cardiovascular disease.[102] Given the current low intakes and concerns relating to the sustainability of advice to increase consumption of oily fish, supplementation with omega 3 fatty acids (most of which is a by-product of the fishing industry and represents a small proportion of the fish or fish liver oil obtained within that industry) could help to improve intakes.

Less than a third of the population regularly takes a dietary supplement.[13] Evidence suggests that there is considerable lack of knowledge among the public about supplements and they do not appear to study available information about these products. A recent survey[13] found that 47 per cent of supplement users had never received advice or looked up information about which supplements they should or should not take, 31 per cent of vitamin and mineral consumers claimed never to look at the information on the label of supplements and 24 per cent have never looked at the recommended daily allowances on the supplements they take. Knowledge of the supplements they are taking and their potential effects seems to be low.

Furthermore, those taking supplements may be the ones who already have the highest intakes of micronutrients. Intakes of fruit and vegetables[103-105] and micronutrients from food[14-16] have been found to be higher in supplement users. In the NDNS in adults aged 19-64 years, supplements increased the mean intakes of most vitamins and minerals, but had no effect on the proportion of the survey population with intakes below the LRNI, suggesting that those taking supplements had adequate micronutrient intakes from food.[5] People who could most benefit from supplementation are therefore likely not taking them.

Conclusion

Government could reconsider its approach to supplementation in the UK population and recognise the potential benefits of micronutrient supplementation across a broader cross section of the population, particularly in those groups where dietary intakes of nutrients are not meeting recommended intakes.

Glossary

Lower Reference Nutrient Intake (LRNI)
The amount of a vitamin or mineral or protein considered to be sufficient for the few people in a group who have low needs. Most people will need more than the LRNI and if people consistently consume less they may be at risk of deficiency of that nutrient.

Reference Nutrient Intake (RNI)
The amount of a vitamin or mineral or protein sufficient for almost every individual. This level of intake is much higher than many people need.

National Diet and Nutrition Survey (NDNS)
This is a programme of dietary surveys aiming to provide detailed information on the diet and nutritional status of the British population. The programme is split into four surveys of different population age groups conducted at approximately three-yearly intervals. Food consumption is assessed using a 7-day weighed-intake dietary record. Nutritional status is assessed by analyzing various levels of nutrients and nutrient related indicators in blood and urine and by measurement of height, weight, waist and hip circumference.

RDA (EC)
Recommended daily amount (or allowance), which is the daily amount of vitamin or mineral that the average healthy person needs to prevent deficiency. EC is an abbreviation for European Community, which refers to the RDA levels established for the EC.

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