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The North/South Ireland Food Consumption Survey: mineral intakes in 18–64-year-old adults

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Abstract

Objective: To measure mineral intakes and the contribution of different food groups to mineral intakes in adults aged 18–64 years in Ireland. Intakes are reported for Ca, Mg, P, Fe, Cu and Zn. The adequacy of mineral intakes in the population and the risk of occurrence of excessive intakes are also assessed.

Design: Food consumption was estimated using a 7-day food diary for a representative sample ($n = 1379$; 662 men, 717 women) of 18–64-year-old adults in the Republic of Ireland and Northern Ireland selected randomly from the electoral register. Mineral intakes (Ca, Mg, P, Fe, Cu and Zn) were estimated using tables of food composition.

Results: Mean nutrient density of intakes was higher for women than men for Ca and Fe and increased with age for all minerals, except Ca for men and Fe for women. Meat and meat products were the major contributor to mean daily intakes of Zn (38%), P (23%), Fe (18%), Cu (15%) and Mg (13%); dairy products (milk, yoghurt and cheese) to Ca (44%), P (22%), Zn (14%) and Mg (11%); bread and rolls to Fe (21%), Cu (18%), Ca and Mg (17%), Zn (13%) and P (12%); potatoes and potato products to Cu (16%), Mg (14%) and Fe (10%); and breakfast cereals to Fe (13%). In women of all ages nutritional supplements contributed 7.6%, 4.4%, 3.6% and 2.2% of mean daily intake of Fe, Zn, Cu and Ca, respectively, while in men of all ages, nutritional supplements contributed 2.7%, 2.3%, 1.7% and 0.6%, respectively, to mean daily intakes of Fe, Zn, Cu and Ca. Adequacy of minerals intakes in population groups was assessed using the average requirement (AR) as a cut-off value. A significant prevalence of intakes below the AR was observed for Ca, Fe, Cu and Zn but not P. A higher proportion of women than men had intakes below the AR for all minerals. Almost 50% of 18–50-year-old females had intakes below the AR for Fe, while 23%, 23% and 15% of women of all ages had intakes below the AR for Ca, Cu and Zn, respectively. For men of all ages, 11%, 8% and 13% had intakes below the AR for Ca, Cu and Zn, respectively. There appears to be little risk of excessive intake of Ca, Mg, P, Cu or Zn in any age/sex category. However, 2.9% of women of all ages had intakes above the tolerable upper intake level for Fe (45 mg) due to supplement use.

Conclusion: Almost 50% of women aged 18–50 years had Fe intakes below the AR and relatively high proportions of women of all ages had intakes below the AR for Ca, Cu and Zn. With the possible exception of iron intake from supplements in women, there appears to be little risk of excessive intake of minerals in the adult population. Meat and meat products, dairy products (milk, cheese and yoghurt), bread and rolls, potatoes and potato products and breakfast cereals are important sources of minerals; nutritional supplements make only a small contribution to mineral intakes in the population as a whole but may contribute significantly to intakes among supplement users.

Keywords
Mineral intake
Ireland
Food consumption survey
7-day food record

The adequacy of mineral intakes in population groups may be assessed with reference to estimated requirements. Estimated requirements and recommended intakes for minerals have been established by various committees of experts. Dietary Reference Values (DRVs) for minerals were last established for the UK by the COMA panel in 1991[1]. In 1993 the EU Scientific Committee for Food published Population Reference Intakes (PRIs) for the

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European Union[2]. Recommended Dietary Allowances (RDAs) for Ireland were established in 1999 by the Food Safety Authority of Ireland[3]. The reference values for most minerals are similar in these three reports.

Increased use of nutritional supplements and wider consumption of fortified foods have focused attention on possible risks of excessive intakes of some minerals. Recently, tolerable upper intake levels (ULs) have been established for a number of minerals including Ca, Mg and P[4], Fe, Cu and Zn[5].

Mineral intakes have been estimated in representative surveys of populations in a number of European countries[6,7]. Current estimates of mineral intakes in Ireland are based on surveys carried out over 10 years ago, i.e. the 1990 Irish National Nutrition Survey[8] in the Republic of Ireland and the 1988 survey on Diet, Health and Lifestyle in Northern Ireland[9].

The North/South Ireland Food Consumption Survey was conducted primarily to establish a database of habitual food and drink consumption in a representative sample of adults aged 18–64 years in Ireland. This paper examines daily intakes of calcium, magnesium, phosphorus, iron, copper and zinc from 7-day food diaries and the contribution made by major food groups to the mean daily intakes of these minerals. Estimates of inadequate intakes in the different age/sex categories are made and the risk of occurrence of excessive intakes is assessed.

Methodology

From 1997 to 1999, the North/South Ireland Food Consumption Survey collected food intake data in a representative sample of 18–64-year-old adults ($n = 1379$; 662 men, 717 women) in the Republic of Ireland and Northern Ireland. Pregnant and lactating women were excluded.

A 7-day food diary was used to measure food intake. Food records were analysed using WISP© (Tinuviel Software, Warrington UK). WISP© uses the food nutrient database in *McCance & Widdowson's The Composition of Foods*, fifth edition[10] (and supplemental volumes[11–19]), along with additional data (manufacturers' data on generic Irish foods, nutritional supplements, and on new products that were commonly consumed) to determine nutrient intakes. Intakes were estimated for Ca, Mg, P, Fe, Cu and Zn. Intakes of Se and I are not reported in this paper owing to the unreliability of the compositional database for these nutrients in a number of foods.

Data manipulation and statistical analysis of the data were conducted using SPSS® for Windows™ Version 9.0 (SPSS Inc., Chicago, IL). The Mann–Whitney test[20] was used to test for differences in means of mineral intakes and nutrient density between men and women in the three different age categories and between men and women of all ages, if intakes were not normally distributed and also if the Levene test for equality of variance was not satisfied. In cases where both of these conditions were satisfied, an independent *t*-test[20] was used. Differences between age groups within each sex were evaluated using a one-way analysis of variance (ANOVA)[20] for multiple comparisons. When statistically significant effects were encountered ($P < 0.01$), comparisons of means were made by using either Tamhane comparisons, if the Levene test for equality of variance was not satisfied, or Scheffe *post hoc*[20] multiple comparisons to ascertain which specific means differed. For variables that did not follow a normal distribution, the Kruskal–Wallis[20] non-parametric test was used for testing differences between age groups. The contribution of major food groups to mineral intakes was calculated. Owing to the large sample size, even a small difference between group means was highly statistically significant. Thus greater emphasis was placed on a descriptive, rather than a formal statistical analysis of these data.

A more detailed account of the methodology of the survey[21] and the sampling procedure[22] is provided in accompanying papers.

Results

The daily intakes of minerals from food sources and supplements by age and sex are shown in Tables 1–6. Daily intakes of minerals expressed per 10 MJ for men and women in the three different age categories, and for men and women of all ages, are shown in Table 7. The

Table 1 Mean daily intake of Ca (mg) from all sources by age and sex

	Men				Women			
	18–35 years $n = 253$	36–50 years $n = 236$	51–64 years $n = 173$	All ages $n = 662$	18–35 years $n = 269$	36–50 years $n = 286$	51–64 years $n = 162$	All ages $n = 717$
Mean	1002[b]	968[b]	845[a]	949	714	763	750	742
SD	374	363	287	354	312	285	301	299
Median	968	933	807	914	683	724	704	701
Percentiles								
5th	441	464	463	460	334	364	350	350
95th	1718	1581	1470	1610	1189	1205	1312	1208

Differences in mean intakes between men and women were significant ($P < 0.01$) for all age groups.
Significant ($P < 0.001$) differences between age groups are denoted by different superscripts.

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Table 2 Mean daily intake of Mg (mg) from all sources by age and sex

	Men				Women			
	18–35 years $n = 253$	36–50 years $n = 236$	51–64 years $n = 173$	All ages $n = 662$	18–35 years $n = 269$	36–50 years $n = 286$	51–64 years $n = 162$	All ages $n = 717$
Mean	355	359	344	354	242[a]	265[b]	261	255
SD	107	114	130	116	73	88	85	83
Median	339	349	318	338	237	254	256	248
Percentiles								
5th	210	181	200	199	139	160	136	143
95th	544	547	559	545	370	391	411	389

Differences in mean intakes between men and women were significant ($P < 0.001$) for all age groups.
Significant ($P < 0.01$) differences between age groups are denoted by different superscripts.

Table 3 Mean daily intake of P (mg) from all sources by age and sex

	Men				Women			
	18–35 years $n = 253$	36–50 years $n = 236$	51–64 years $n = 173$	All ages $n = 662$	18–35 years $n = 269$	36–50 years $n = 286$	51–64 years $n = 162$	All ages $n = 717$
Mean	1688	1666	1555	1645	1098[a]	1208[b]	1184	1161
SD	486	479	392	463	292	334	314	318
Median	1629	1631	1492	1611	1080	1175	1157	1137
Percentiles								
5th	989	904	1028	973	663	746	663	703
95th	2562	2403	2270	2493	1593	1733	1712	1678

Differences in mean intakes between men and women were significant ($P < 0.001$) for all age groups.
Significant ($P < 0.001$) differences between age groups are denoted by different superscripts.

Table 4 Mean daily intake of Fe (mg) from all sources by age and sex

	Men				Women			
	18–35 years $n = 253$	36–50 years $n = 236$	51–64 years $n = 173$	All ages $n = 662$	18–35 years $n = 269$	36–50 years $n = 286$	51–64 years $n = 162$	All ages $n = 717$
Mean	14.3	14.8	14.1	14.4	14.3	14.0	14.1	14.1
SD	5.9	5.5	5.0	5.5	19.4	16.5	21.2	18.7
Median	13.2	13.9	13.2	13.4	9.9	10.6	10.1	10.1
Percentiles								
5th	7.1	7.7	7.9	7.6	5.1	6.3	5.1	5.6
95th	26.4	25.8	24.9	25.8	27.2	25.5	24.0	25.5

Differences in mean intakes between men and women were significant ($P < 0.001$) for all age groups.

Table 5 Mean daily intake of Cu (mg) from all sources by age and sex

	Men				Women			
	18–35 years $n = 253$	36–50 years $n = 236$	51–64 years $n = 173$	All ages $n = 662$	18–35 years $n = 269$	36–50 years $n = 286$	51–64 years $n = 162$	All ages $n = 717$
Mean	1.5	1.6	1.6	1.5	1.1	1.3	1.2	1.2
SD	0.7	0.9	0.9	0.8	0.7	0.7	0.6	0.7
Median	1.3	1.4	1.3	1.3	1.0	1.1	1.1	1.0
Percentiles								
5th	0.7	0.7	0.8	0.7	0.5	0.7	0.5	0.6
95th	2.8	3.0	3.4	3.1	2.8	2.7	2.4	2.7

Differences in mean intakes between men and women were significant ($P < 0.001$) for all age groups.

proportion of the population with mean daily intakes below the average requirement (AR)[2] and the lowest threshold intake (LTI)[2] are reported in Tables 8 and 9, respectively.

Calcium

Mean daily intake of Ca was significantly higher in men of all ages than in women of all ages at levels of 949 mg and 742 mg, respectively ($P < 0.001$). In men, mean daily Ca intake was significantly lower in the 51–64-year-old age category than in the other age groups ($P < 0.001$) (Table 1). Milk & yoghurt (34.7%), bread & rolls (16.8%) and cheeses (9.0%) were the main contributors to mean daily Ca intake for men and women of all ages. Nutritional supplements contributed only 0.6% and 2.2%, respectively, to mean daily Ca intake in men and women of all

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Table 6 Mean daily intake of Zn (mg) from all sources by age and sex

	Men				Women			
	18–35 years $n = 253$	36–50 years $n = 236$	51–64 years $n = 173$	All ages $n = 662$	18–35 years $n = 269$	36–50 years $n = 286$	51–64 years $n = 162$	All ages $n = 717$
Mean	11.1	12.0	11.6	11.6	7.8	8.9	9.0	8.5
SD	4.3	4.7	4.1	4.4	4.2	5.9	4.2	5.0
Median	10.2	11.4	10.5	10.8	6.9	7.9	8.0	7.5
Percentiles								
5th	5.5	6.4	6.8	6.1	3.5	4.9	4.4	4.2
95th	19.6	22.1	21.0	21.1	17.2	17.4	20.4	17.4

Differences in mean intakes between men and women were significant ($P < 0.001$) for all age groups.

Table 7 Daily intakes of minerals per 10 MJ total energy (all sources) for men and women by age

Mineral (units per 10 MJ)	18–35 years			51–64 years			36–50 years			All ages		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
MEN		$n = 253$			$n = 236$			$n = 173$			$n = 662$	
Ca (mg)	866	850	249	888*	844	249	840*	827	200	867*	843	238
Mg (mg)	309^{a}	302	58	331^{b}	319	79	346^{b}	328	130	326*	312	90
P (mg)	1464^{a}	1452	227	1529^{b}	1523	226	1558^{*b}	1522	239	1512	1495	233
Fe (mg)	12.4^{*a}	11.5	4.2	13.8^{b}	13.0	4.9	14.1^{b}	13.2	3.7	13.3*	12.4	4.4
Cu (mg)	1.3^{*a}	1.1	0.5	1.4*	1.3	0.7	1.6^{b}	1.3	0.8	1.4*	1.3	0.7
Zn (mg)	9.6^{a}	9.2	2.9	11.1^{b}	10.5	3.6	11.7^{b}	11.0	3.9	10.7	10.1	3.5
WOMEN		$n = 269$			$n = 286$			$n = 162$			$n = 717$	
Ca (mg)	934	895	391	995*	953	333	1037*	996	309	982*	940	353
Mg (mg)	317^{a}	300	78	347^{b}	334	90	365^{b}	354	90	340*	326	88
P (mg)	1440^{a}	1408	263	1577^{b}	1548	290	1660^{*b}	1624	285	1544	1522	292
Fe (mg)	18.9^{*a}	12.8	26.1	18.4	13.2	22.1	19.7^{b}	13.9	29.8	18.9*	13.2	25.5
Cu (mg)	1.5*	1.3	0.9	1.6*	1.4	0.8	1.7	1.5	0.8	1.6*	1.3	0.8
Zn (mg)	10.3^{a}	8.9	5.6	11.6	10.5	6.1	12.5^{b}	11.3	4.7	11.3	10.1	5.7

Significant ($P < 0.01$) differences in mean intakes between men and women are denoted by *.
Significant ($P < 0.01$) differences between age groups are denoted by different superscripts.

Table 8 Percentage of population groups with mean daily intakes below the average requirement (AR)*

Mineral	AR*	Men				Women			
		18–35 years	36–50 years	51–64 years	All ages	18–35 years	36–50 years	51–64 years	All ages
Ca	550 mg	11.1	10.2	11.0	10.7	26.4	19.6	24.1	23.2
P	400 mg	0	0.4	0	0.2	0.7	0	0	0.3
Fe	7 mg men 10 mg menstruating women 6 mg postmenopausal women	3.6	2.5	0.6	2.4	50.2	45.5	8.0	38.8
Cu	0.8 mg	9.1	7.6	6.4	7.9	26.0	19.2	25.3	23.2
Zn	7.5 mg men 5.5 mg women	15.4	13.6	10.4	13.4	22.3	9.1	11.1	14.5

* Reports of the Scientific Committee for Food, 1993.

Table 9 Percentage of population groups with mean daily intakes below the lowest threshold intake (LTI)*

Mineral	LTI*	Men				Women			
		18–35 years	36–50 years	51–64 years	All ages	18–35 years	36–50 years	51–64 years	All ages
Ca	400 mg	4.0	2.1	2.3	2.9	9.3	7.3	8.6	8.4
P	300 mg	0	0	0	0	0	0	0	0
Fe	5 mg men 7 mg menstruating women 4 mg postmenopausal women	0.8	0.8	0	0.6	17.5	8.7	0.6	10.2
Cu	0.6 mg	0.8	1.3	1.7	1.2	8.9	2.8	9.9	6.7
Zn	5 mg men 4 mg women	2.8	0.8	0.6	1.5	5.9	1.7	1.2	3.2

* Reports of the Scientific Committee for Food, 1993.

ages. Intakes of Ca were below the AR in 23.2% of women and 10.7% of men (Table 8), and below the LTI in 8.4% of women and 2.9% of men (Table 9).

Magnesium

Mean daily intake of Mg was significantly higher in men of all ages than in women of all ages at levels of 354 mg and 255 mg, respectively ($P < 0.001$). In women, mean daily Mg intake was lower in 18–35 year olds than in 36–50 year olds ($P < 0.01$) (Table 2). A number of food groups contribute to Mg intake, with the largest proportions coming from bread & rolls (16.8%), potatoes & potato products (13.6%) and meat & meat products (12.8%).

Phosphorus

Mean daily intakes of P were significantly higher in men of all ages than in women of all ages at levels of 1645 mg and 1161 mg, respectively ($P < 0.001$). In women, mean daily intake was significantly lower in the 18–35-year-old age category than in the 36–50-year-old age category ($P < 0.001$) (Table 3). The largest contributors to P intake were meat & meat products (23.1%), milk & yoghurt (17.3%) and bread & rolls (12.5%). Only a negligible proportion of men and women had P intakes less than the AR (Table 8) and no individual had a P intake less than the LTI (Table 9).

Iron

Mean daily intakes of Fe were similar in men and women at levels of 14.4 mg and 14.1 mg, respectively. The median intake in females was considerably lower than the mean, indicating that a small proportion of high consumers (probably supplement users) strongly influences the mean value (Table 4). The main food groups contributing to Fe intake in men and women of all ages were bread & rolls (20.7%), meat & meat products (17.8%) and breakfast cereals (12.8%). Nutritional supplements contributed 7.6% of total intake in females and 2.7% in males. Mean daily Fe intakes were below the AR of 10 mg per day for menstruating women in 50.2% of 18–35-year-old women and 45.5% of 36–50-year-old women. Only 2% of men of all ages had intakes below the AR for Fe (Table 8). Intakes of Fe were below the LTI in 10% of women and 0.6% of men (Table 9).

Copper

Mean daily intakes of Cu were significantly higher in men of all ages than in women of all ages at levels of 1.5 mg and 1.2 mg, respectively ($P < 0.001$) (Table 5). Bread & rolls (18.5%), potatoes & potato products (16.0%), meat & meat products (14.9%) and fruit, juice, nuts & seeds, herbs & spices (12.1%) were the main food groups contributing to total intake. Nutritional supplements contributed 1.7% and 3.6%, respectively, to mean daily intake of Cu in men and women of all ages. Intakes of Cu were below the AR in 23.2% of women and 7.9% of men (Table 8) and below the LTI in 6.7% of women and 1.2% of men (Table 9).

Zinc

Mean daily intakes of Zn were significantly higher in men than in women at levels of 11.6 mg and 8.5 mg, respectively ($P < 0.001$) (Table 6). Meat & meat products (38.2%), bread & rolls (13.2%) and milk & yoghurt (11.2%) were the main contributors to total intakes. Nutritional supplements contributed 2.3% and 4.4%, respectively, to mean daily Zn intake in men and women of all ages. Intakes of Zn were below the AR in 14.5% of women and 13.4% of men (Table 8) and below the LTI in 3.2% of women and 1.5% of men (Table 9).

Nutrient density

Nutrient density of intakes was higher for women of all ages than for men of all ages for Ca and Fe and increased with age for all minerals, except Ca for men and Fe for women (Table 7).

Discussion

The problem of assessing the adequacy of nutrient intakes at a population level has been a long-standing one[23]. The RDA for a nutrient overestimates the prevalence of inadequacy in a population. The use of the AR as a cut-off to assess the prevalence of inadequacy in a population has been described in detail and has been shown to be effective[23]. Using this approach, an estimate of the prevalence of inadequate intake of a mineral in a particular population group is obtained by determining the percentage of individuals in that group whose usual intakes are less than the AR. The AR is the daily intake value that is estimated to meet the requirement, as defined by a specified indicator of adequacy, in 50% of a life-stage or gender group[4]. This estimate of inadequate intake is most accurate if intakes and requirements are independent, if the standard deviation (SD) of intakes is at least twice as large as the SD of requirements, and if the requirements are symmetrically (but not necessarily normally) distributed. The estimate of intake should represent habitual intake. Misreporting of intakes can affect the estimate of inadequate intakes[4,23].

Mineral intakes and requirements are independent, and mineral requirements are generally assumed to be normally distributed except for Fe. The distribution of Fe requirements of women is skewed due to a high Fe requirement in a proportion of menstruating women[2]. The SD of mean intakes was generally high (25–150% of the mean) relative to the SD of the requirement, which is generally assumed to be of the order of 15% of the mean[2]. In this survey, nutrient intakes were estimated using a 7-day food diary. Bingham *et al.*[24] reported that there were no significant differences between mean daily nutrient intakes estimated using an open-ended 7-day food diary and a 16-day weighed record, which was validated by 24-hour urinary excretion of nitrogen. A 7-day food diary was thus considered a useful measure of habitual intake with respect to minerals. As with any dietary survey where food intake is self-reported, there is evidence of misreporting and, in particular, underreporting in the present survey[25]. Underreporting is likely to lead to an overestimate of the prevalence of inadequate intakes.

Of the minerals for which ARs are established (Ca, P, Fe, Cu, Zn), a significant prevalence of intakes below the AR was observed in a number of population groups for Ca, Fe, Cu and Zn, but not P. A higher proportion of women than men had intakes below the AR for these minerals. This difference was most obvious for Fe, particularly among 18–50-year-old females, with almost 50% of this group having intakes below the average requirement of 10 mg day^{-1} for menstruating women. Intake of iron at levels less than an individual's requirement will lead over time to reduced iron stores and possibly iron deficiency. Iron deficiency is a frequently identified nutritional deficiency among women in developed countries. One in three Irish women have inadequate iron stores and about one in 30 have iron deficiency anaemia, which exists when the blood haemoglobin levels are reduced below optimal levels[26].

A significant proportion (23%) of women had Ca intakes that were below the AR. Inadequate Ca intake may contribute to reduced bone mass and increase susceptibility to osteoporosis[27]. According to the World Health Organization[28], one in four women in Europe at or over the age of 50 has osteoporosis. In women, dietary Cu and Zn intakes were below the AR for 23% and 15%, respectively, of the population, while in men 8% and 13%, respectively, of the population had mean daily intakes below the AR for Cu and Zn. At present, there are no reliable indices of nutritional status for Cu and Zn, which makes it difficult to establish whether deficiency occurs in the population.

The LTI for a nutrient (the intake below which nearly all individuals will be unable to maintain metabolic integrity according to the criterion used for each nutrient[2]) is sometimes used as a cut-off value to assess the prevalence of nutrient inadequacy. However, while the LTI can be used to detect individuals with a very high probability of inadequate intakes, it is of limited value for assessing the prevalence of nutrient inadequacy in populations. Comparison of the percentage of the population with intakes below the AR (Table 8) with that with intakes below the LTI (Table 9) shows that much lower estimates of the prevalence of inadequacy were obtained using the LTI as a cut-off value.

The tolerable upper intake level (UL) is defined as the maximum level of daily intake of a nutrient that is unlikely to pose risks of adverse effects to almost all individuals in a specified life-stage group[4]. The 95th percentile intake for iron was almost 26 mg for both men and women of all ages. Almost 3% of women, but no men, had intakes above the UL for Fe (45 mg)[5], which is due to supplement use[29]. Gastrointestinal side effects are the critical adverse effects on which the UL for Fe is based. The 95th percentile of intakes for all groups was less than the UL for Ca (2500 mg)[4], Cu (10 mg)[5] Zn (40 mg)[5] and P (4000 mg)[4]. No intakes above the UL were reported for P or Cu, and less than 0.3% of the population had intakes above the UL for Ca and Zn. All reports of adverse effects of excess Mg intake concern Mg taken in addition to that consumed from food sources, with a UL for supplemental Mg of 350 mg[4]. On average, Mg intake from supplemental Mg was only 1.3% of total dietary Mg[29].

The lower mean nutrient density of Ca and Fe in men of all ages than in women of all ages, and the increase in nutrient density for most minerals with age, reflect differences in consumption of particular food groups as well as different patterns of supplement use. Further analysis of the database will be required to explain the age and sex differences in nutrient density.

For men and women of all ages, meat and meat products made significant contributions to mean daily intakes of a number of minerals including Zn (38%), P (23%), Fe (18%), Cu (15%) and Mg (13%); dairy products (milk, yoghurt and cheese) to Ca (44%), P (22%), Zn (14%) and Mg (11%); bread and rolls to Fe (21%), Cu (18%), Ca (17%), Mg (17%), Zn (13%) and P (12%); potatoes and potato products to Cu (16%), Mg (14%) and Fe (10%); and breakfast cereals to Fe (13%).

The overall contribution of nutritional supplements to mean daily mineral intakes of the different age/sex categories was small, particularly in men. In women of all ages 7.6% of mean daily intake of Fe came from supplements, while supplements contributed 4%, 4% and 2%, respectively, to mean daily intakes of Zn, Cu and Ca in this group. However, supplements do contribute significantly to intakes of some minerals in supplement users[29].

Direct comparison of mineral intakes from this survey with those observed in earlier studies in Ireland is difficult, because of the different methodologies used for food intake measurement. In the 1990 Irish National Nutrition Survey (INNS)[8], a diet history method along with a food atlas was used and in the 1988 survey of Diet, Health and Lifestyle in Northern Ireland[9], a 7-day weighed intake was the method of data collection employed. However, comparison between the three surveys of mineral intakes per 10 MJ energy consumed show some important differences. In women of all ages, estimates of mean daily intake of Fe per 10 MJ energy were higher in the present survey (18.9 mg) than in the INNS survey[8] (13.6 mg) and the Northern Ireland survey[9] (14.5 mg). This may be partly due to the fact that iron intake from supplements was included in the present survey. An increase in Fe intake from certain foods (e.g. fortified foods) may also have occurred over the past 10 years. Estimates of mean daily intake of Ca per 10 MJ of energy were lower in the present survey, 867 mg in men and 982 mg in women, compared with 1004 mg and 1117 mg in men and women, respectively, in the INNS survey.

Conclusions

A significant prevalence of intakes below the AR was observed for Ca, Fe, Cu and Zn, but not P. A higher proportion of women than men had intakes below the AR for these minerals. Almost 50% of 18–50-year-old females had intakes below the AR for Fe, and 23%, 23% and 15% of women of all ages had intakes below the AR for Ca, Cu and Zn, respectively. For men of all ages, 11%, 8% and 13% had intakes below the AR for Ca, Cu and Zn, respectively. There appears to be little risk of excessive intakes of Ca, P, Mg, Cu or Zn in any group. However, almost 3% of females had intakes above the UL for Fe, due to supplement use. Meat and meat products made a significant contribution to mean daily intakes of Zn, P, Fe, Cu and Mg; dairy products (milk, yoghurt and cheese) to Ca, P, Zn and Mg; bread and rolls to mean daily intakes of Fe, Cu, Ca, Mg and Zn; potatoes and potato products to Cu, Mg and Fe; and breakfast cereals to Fe. Nutritional supplements did not contribute significantly to mean daily intakes of minerals, especially in men. They contributed 7.6%, 4.4%, 3.6% and 2.2%, respectively, to mean daily intakes of Fe, Zn, Cu and Ca in women of all ages.

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