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ABSTRACT

Background The aim of this observational study was to measure food, macronutrient and micronutrient intakes of women presenting for antenatal care and assess compliance with current nutritional recommendations.

Methods Women were recruited in the first trimester of pregnancy. Maternal weight and height were measured and body mass index (BMI) calculated. Body composition was measured using bioelectrical impedance analysis. Maternal energy and nutrient intakes were estimated using a validated Willett Food Frequency Questionnaire and misreporting of energy intakes (EI) determined.

Results Plausible EIs were reported in 402 women. Mean age, weight and BMI were 30.8 years, 67.1 kg and 24.6 kg/m^2 respectively. Median EIs were 2111 kcal, and median protein, carbohydrate and fat intakes were 17.3, 48.1 and 36.2 g/MJ/day, respectively. More than 90% of women exceeded the recommended daily allowance for saturated fat. Nearly all of the women (99%) did not meet estimated average requirements (EAR) for vitamin D. One in three women failed to achieve a dietary folate intake of 400 µg/day. Over one in five women failed to meet the EAR for iron, and 14% failed to achieve the EAR for calcium.

Conclusions Our findings highlight concerning deficits in nutrient intakes among women and will help guide professional dietary advice to women attending for future obstetric care in Ireland.

Introduction

There is a large body of evidence linking nutritional deficits *in utero* and in early life to disease in adulthood.[1] It has been established that micronutrient deficits in pregnancy are associated with unfavourable neonatal outcomes, for example, low iron status in pregnancy has been linked to low birth weight and impaired cognitive development, while low maternal vitamin B_{12} status has been linked with increased risk of small for gestational age infants and insulin resistance in childhood.[2–5] Low vitamin D status has been associated with a wide range of adverse maternal and offspring health outcomes such as impaired glucose tolerance, low birth weight and poor foetal skeletal development.[6–9]

Dietary intakes of pregnant women have been shown to comply poorly with country-specific energy and macronutrient intake recommendations.[10] In addition, maternal folate, iron and vitamin D intakes in pregnancy are below national nutrient intake recommendations in many regions of the world.[11] While pregnant women in Ireland have previously been shown to comply poorly with national food intake recommendations, to date there are no reports on the macronutrient and micronutrient intakes in a normal population booking for prenatal care in pregnancy.[12] Overall nutrient intake analyses in pregnancy in Ireland to date have focused mainly on specific population subgroups such as multigravidae at high risk of gestational diabetes mellitus (GDM).[13]

The purpose of this observational study, therefore, was to measure the food, macronutrient and micronutrient intakes

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of women presenting for antenatal care in Ireland, and to assess their compliance with current national nutrient intake recommendations.

Methods

The Coombe Women and Infants University Hospital (CWIUH) is one of the largest maternity hospitals in the EU and cares for women from all socio-economic groups and from across the urban–rural divide. Women were recruited at their convenience between February and August 2013 after an ultrasound examination confirmed an ongoing singleton pregnancy. Height was measured to the nearest centimetre using a Seca wall-mounted digital metre stick with the woman standing in her bare feet. Weight and body composition were measured digitally to the nearest 0.1 kg and BMI calculated. Body composition (e.g. fat mass, percentage body fat, fat-free mass) was measured using advanced bioelectrical impedance analysis (Tanita MC 180; Tokyo, Japan). Socio-economic, health behavioural and physical activity data were collected at the same time, and written informed consent was obtained from all participants. The study was approved by the Hospital's Research Ethics Committee.

Inclusion and exclusion criteria

The inclusion criterion was confirmation of an ongoing singleton pregnancy of 18 weeks or less gestation upon ultrasound examination. This study was part of a longitudinal study examining weight trajectories in pregnancy and postpartum.[14] For baseline weight measurement during pregnancy, the gestational age at the time of measurement is important. It has been shown that there is no increase in average maternal weight before 18 weeks' gestation.[15] Thus, this was the threshold criterion for women booking for antenatal care. To reduce the number of potential confounding variables, the exclusion criteria included multiple pregnancies and maternal age <18 years.

Food frequency questionnaire

To collect habitual food intakes, women were asked to complete a self-administered, semi-quantitative Willet Food Frequency Questionnaire (WFFQ) at the first antenatal visit. This WFFQ was adapted from the European Prospective Investigation into Cancer and Nutrition study and validated for use in a population of Irish adults.[16–18] This WFFQ has also been validated in an Irish obstetric population.[19]

The WFFQ comprised 170 food and beverage items. Frequency of consumption of a standard portion of each food or beverage item was divided into nine categories, ranging from 'never or less than once per month' to 'six or more times per day'. The instrument captured food and nutrient data reflective of the periconceptional period, as the WFFQ focuses on habitual intake over the previous year. These WFFQ food intake data were entered into WISP version 4.0 (Tinuviel Software; Llanfechell, Anglesey, UK) to convert the reported food intakes into nutrient intakes. The food composition tables used in WISP are derived from McCance and Widdowson's Food Composition Tables 5th and 6th editions, and all supplemental volumes.[20] Supplement data were not included in the final nutrient estimation.

Other lifestyle information

Demographic, socio-economic, attitudinal and health behavioural data were also collected. Material indices of disadvantage including relative income poverty, relative deprivation and consistent poverty status were also calculated. Relative income poverty status was calculated by comparing equivalized household income against the 60% median income threshold. Relative deprivation status was assessed by determining whether respondents had experienced the enforced absence (due to financial constraint) of two or more basic necessities from a prescribed list of 11. Consistent poverty was identified if a respondent reported being in relative income poverty in addition to experiencing the enforced absence of 2 or more of the 11 basic markers of deprivation.[21,22]

Self-assessed habitual physical activity levels (PALs) were also collected. Individual PAL was estimated for each participant from a six-point scale ranging from 1.45 metabolic equivalents (METs) (seated work with no option of moving around and no strenuous leisure time activity); up to 2.20 METs (strenuous work or highly active leisure time (e.g. competitive athletes in daily training)).[23] Participants self-assessed their PAL using this scale as part of an unsupervised questionnaire.

Assessment of energy under- and over-reporting

Basal metabolic rate (BMR) was calculated for each participant using standard equations based on gender, weight and age.[24] Reported energy intakes (EI) were calculated using participants' WFFQ data and WISP version 4.0 nutrient analysis software (Tinuviel Software). Lowest plausible thresholds for PAL were calculated according to respondents' individual self-reported PAL.[25] Those whose ratio of EI to their calculated BMR (EI/BMR) fell below the calculated plausible threshold for their physical activity category were classified as dietary under-reporters.[26] In all PAL categories, those with an EI/BMR >2.5 were classified as dietary over-reporters.[27]

Statistical analysis

Data analysis was carried out using PASW statistics version 20.0 (IBM Corporation, Armonk, New York). Respondent data for weight, height, age, gestational age, BMI, %fat mass and %fat-free mass were all normally distributed. Independent samples *t*-tests were used to compare the mean values for these variables between the plausible reporter and misreporter groups. As fat mass and fat-free mass levels were non-normally distributed, differences in their median intakes between the plausible reporter and misreporter groups were assessed using Mann–Whitney U tests. Cross-tabulation with Chi-square analyses were used to test differences between the proportions of plausible reporters and misreporters in different demographic, socio-economic and health behavioural groups, e.g. ethnicity, smoking status; reporting the Yates continuity correction for all dichotomous 2×2 tests. Food group and nutrient intake data were non-normally distributed; thus mean (with standard deviation (SD)) and median (with interquartile range) absolute and energy-adjusted intakes were both reported. Plausible dietary reporters (i.e. subjects who were not classified as under- or over-reporters) were dichotomized into those meeting and not meeting recommended intake guidelines for dietary fibre, macronutrients and micronutrients.

Results

Table 1 shows the characteristics of the women presenting for antenatal care and the differences between plausible dietary reporters and those who under-reported their EIs. There were no energy over-reporters identified. For the total population (including plausible and implausible dietary reporters; $n = 524$), the mean age was 30.1 ± 5.3 years with 94.7% of participants aged between 20 and 39 years. The mean gestational age was 12.6 ± 2.6 weeks; the mean BMI was 25.4 ± 5.6 kg/m^2, 16.6% were obese. Forty-five percent of the sample was nulliparas. This sample was similar to the broader national obstetric population of whom 92% are aged between 20 and 39 years and 39% are nulliparas.[28] The sample was also representative of women booking into the Coombe in 2014, where 39.1% of women were nulliparas, 15.3% were obese and 91.8% were aged between 20 and 39 years.[29]

Under-reporting of EI occurred in 23.2% ($n = 122$) of women, and these subjects were excluded from all subsequent food and nutrient intake analyses. Under-reporters were 2.8 years younger, 3.2 times more likely to be obese and 2.5 times more likely to be materially deprived than those who were plausible dietary reporters.[30]

Of the plausible EI reporters, 56.7% ($n = 228$) reported supplement use. Table 2 shows food group intakes among plausible EI reporters presenting for antenatal care. Of note are the very low reported intakes of dairy (36.0 g/day), breakfast cereals (42.0 g/day) and fish (31.5 g/day) and the seemingly adequate reported intakes of fruit and vegetables (558.5 g/day). Energy, dietary fibre and macronutrient intakes (percentage of total energy) among plausible reporters are presented in Table 3. Percentage EIs from protein, carbohydrate and fat were 17.3%, 48.1% and 36.2%, respectively, among these plausible reporters ($n = 402$). Absolute and energy-adjusted intakes of micronutrients are presented in Table 4. In general, no differences in food group, energy, dietary fibre, macronutrient or micronutrient intakes were observed according to parity and maternal nativity. However, obese women had higher EIs compared to non-obese women (2300 versus 2087 kcal, respectively, $P = 0.01$), while folate intakes were also lower among these obese women than among their non-obese peers (33.6 versus 39.5 μg/MJ/day, respectively, $P = 0.04$) (data not presented).

Table 5 shows compliance with national nutritional recommendations. Only 1 in 10 women achieved the recommended intakes of energy from saturated fat. Nearly, all women failed to meet the recommendation for vitamin D. Over one in five women failed to meet the estimated average requirement (EAR) for iron, while over one in three women (37%) did not achieve the recommended daily allowance (RDA) for iron of 14 mg/day.[33] Half of the women did not meet the RDA for calcium of 800 mg/day, and 14% of women failed to achieve the EAR for calcium. One in three women failed to achieve a folate intake of 400 μg/day. One in six women (17.7%) had a folate intake below 500 μg/day, which is the recommended requirement for the second half of pregnancy.[33]

Discussion

Main findings

This observational study of women booking for prenatal care in a large maternity unit found that on analysis of macronutrient intakes, 9 out of 10 women were getting energy from a higher than recommended intake of saturated fat. This has potential adverse consequences, such as an increased risk of GDM for the women, and increased risk of later obesity and Type 2 diabetes mellitus in the offspring.[35,36] On analysis of micronutrient intakes, the most striking finding is that 99% of women did not meet the national recommendation for vitamin D intakes. In addition, suboptimal intakes of folate, calcium and iron are of major

Table 1 Characteristics of study population at initial antenatal visit

	Total (n = *524*)	*Plausible reporters* (n = *402*)	*Under-reporters* (n = *122*)	P
Weight (kg)[a]	69.4 ± 14.7	67.1 ± 12.5	76.9 ± 18.3	<0.001
Height (m)[a]	1.65 ± 7.0	1.65 ± 7.3	1.66 ± 6.2	NS
Age (years)[a]	30.1 ± 5.3	30.8 ± 5.2	28.0 ± 4.8	<0.001
Gestational age at first visit (weeks)[a]	12.6 ± 2.5	12.7 ± 2.6	12.3 ± 2.3	NS
BMI (kg/m^2)[a]	25.4 ± 5.6	24.6 ± 4.7	28.1 ± 6.9	<0.001
Underweight (%)	2.9	3.5	0.8	—
Ideal weight (%)	51.3	55.8	36.9	0.002
Overweight (%)	29.1	29.8	27.0	NS
Obese (%)	16.7	10.9	35.2	<0.001
Fat mass (kg)[b]	20 (10)	19 (10)	24 (15.6)	<0.001
Fat mass (%)[a]	30.6 ± 7.0	29.7 ± 6.6	33.2 ± 7.6	<0.001
Fat-free mass (kg)[b]	46.0 ± 6.0	46.0 ± 6.3	49.0 ± 9.3	<0.001
Parity[b]	1 (1)	1 (1)	0 (1)	—
Nativity				
Irish (%)	77.0	75.6	82.0	NS
Other European (%)	16.5	17.2	13.9	NS
Asian (%)	1.5	1.5	1.6	—
African (%)	0.8	1.0	0	—
Other (%)	4.2	4.7	2.5	—
Smoking status				
Current smoker (%)	12.5	12.7	11.5	NS
Former smoker (%)	43.9	45.0	39.3	
Never smoked (%)	43.7	42.3	49.2	
Relative income poverty[c]				
At risk (%)	33.5	34.6	24.6	NS
Relative deprivation[d]				
At risk (%)	24.0	7.7	18.9	0.001
Consistent poverty[e]				
At risk (%)	11.6	7.7	7.4	NS

[a]Mean ± SD.
[b]Median (Interquartile range).
[c]Data available on n = 519.
[d]Data available on n = 508.
[e]Data available on n = 503.
P-value indicates differences between plausible reporters and under-reporters.

concern. Our findings highlight serious inadequacies in nutrient intakes among Irish women and will help guide professional dietary advice to women attending for future obstetric care in Ireland.

This study has a number of strengths. Firstly, the clinical, demographic and dietary data were all collected at the first antenatal visit by a single researcher using standardized and validated methodologies, thereby reducing interobserver, recall and social-desirability biases. Maternal height and weight were also measured rather than self-reported. Individual PALs were collected for participants facilitating more accurate identification and removal of respondents who had quantitatively misreported their dietary intakes.

Limitations

A potential limitation is that recruitment was by convenience sampling rather than consecutive. However, given the time required for collecting the information at the first visit (~75 minutes), it would not have been feasible for a single researcher to recruit women consecutively in such a busy maternity unit. Also, some women at the antenatal clinic were under time constraints to return to work or home, leading potentially to self-selection bias. However, our post hoc analyses suggest that our population is similar to the broader national obstetric population in terms of their major socio-demographic indicators.[28] The most significant limitation of the study relates to the exclusion of a subgroup of dietary misreporters who differ from the retained cohort of plausible reporters in terms of their age, anthropometric and socio-economic status.[30] However, the implication of retaining these dietary under-reporters in the analysed data set would be that population mean food and nutrient intakes would be artefactually decreased, thereby invalidating our final nutrient intake and compliance findings.

A further limitation is that supplement data were not included in the final nutrient analysis. Current obstetric recommendations in Ireland advise women on folic acid, iron and vitamin D supplementation guidelines during pregnancy.[37] As supplements were taken 57% of women, more than half of this representative sample of women may have augmented their micronutrient intakes from food recommendations through supplement use. Further research is needed in this area to determine the incremental nutrient intake attributable to supplement use in pregnancy, and the impact of such supplement use on the achievement of micronutrient intake targets among obstetric populations.

Table 2 Food group intakes in pregnant women who were plausible reporters (*n* = 402)

Food group	*Absolute intakes (g/day)*[a]	*Energy-adjusted intakes (g/MJ/day)*[a]
Breads	44.5 (53.5)	4.6 (4.7)
Breakfast cereals	42.0 (79.0)	4.3 (7.8)
Rice/pasta	92.0 (95.75)	9.5 (9.2)
All meat groups	139.0 (88.5)	14.2 (7.8)
Fruit and vegetables	558.5 (424.5)	54.9 (40.5)
All fish	31.5 (42.0)	3.0 (4.3)
Milk/cream/cheese	36.0 (46.0)	3.7 (4.4)
Eggs	21.0 (15.0)	1.7 (1.8)
Potatoes	107.0 (88.50)	10.3 (8.3)
Sugar groups	62.0 (67.75)	14.4 (12.1)
Fats/oils	5.0 (8.0)	0.5 (0.8)
Fruit juices	69.0 (115.0)	6.6 (10.2)
Other drinks	585.0 (604.25)	58.0 (57.0)
Other foods	123.0 (125.25)	11.8 (11.3)

[a]Median (interquartile range).

What is already known on this topic?

Adverse outcomes in pregnancy, such as the development of GDM, have been linked to excessive saturated fat intake.[32, 33] At an individual level, only 9.5% of women were complying with saturated fat guidelines. Saturated fat intakes in our sample were estimated at 12.0% of total energy, a figure lower than the intake levels previously reported in a sample of secundigravidas women with a history of a macrosomic delivery (13.9 % of total energy).[13] Nonetheless, the saturated fat intakes observed in our sample substantially exceed the current recommended intakes.[32]

Table 3 Percentage of total EI from macronutrients among plausible reporters (*n*=402)

Variable	*Plausible reporters Percent total energy*			
	Mean (SD)	*Median (IQR)*	*25th centile*	*75th centile*
Energy (kcal)	2380.1 (1034.4)	2110.5 (959)	1754.3	2713.3
Fibre (g/MJ/day) (AOAC)	3.39 (1.2)	3.20 (1)	2.64	4.00
Protein	18.0 (4.4)	17.3 (5)	15.3	20.0
Carbohydrate	48.5 (8.0)	48.1 (10)	43.4	53.0
Fat	35.9 (6.4)	36.2 (7)	32.3	39.4
Saturates	12.4 (3.2)	12.0 (3)	10.6	14.0
Monounsaturated fat	11.6 (2.5)	11.6 (3)	10.1	12.9
Polyunsaturated fat	7.80 (2.0)	7.70 (3)	6.41	9.03
Non-milk extrinsic sugar	7.60 (4.6)	6.70 (5)	4.69	9.22

IQR, interquartile range; AOAC, Association of Organic and Analytic Chemists.

Table 4 Absolute and energy-adjusted micronutrient intakes in plausible reporters (n = 402)

Micronutrient	Absolute intakes (mg)				Energy-adjusted intakes (mg/MJ/day)			
	Mean (SD)	Median (IQR)	25th centile	75th centile	Mean (SD)	Median (IQR)	25th centile	75th centile
Sodium	3169 (1770)	2837 (1465)	2178	3640	317 (75)	308 (84)	271	354
Potassium	7320 (6627)	4292 (6736)	3244	9970	738 (614)	653 (508)	375	883
Calcium	919 (699)	794 (534)	582	1116	91.1 (30.3)	86.2 (34)	71.0	104.6
Magnesium	642 (583)	387 (588)	275	865	61.6 (54.0)	41.6 (44)	32.5	76.4
Phosphorus	1791 (1012)	1553 (952)	1188	2141	179.7 (50.3)	166.0 (49)	148	198
Iron	19.3 (10.3)	17.0 (12)	16.5	24.0	1.95 (0.8)	1.70 (0.9)	1.41	2.27
Copper	2.5 (1.4)	2.0 (1.0)	2.0	3.0	0.25 (0.1)	0.20 (0.1)	0.16	0.30
Zinc	12.2 (5.8)	11.0 (5)	9.0	14.0	1.24 (0.3)	1.20 (0.3)	1.06	1.37
Chloride	4647 (2498)	4131 (2028)	3204	5232	465 (106)	453 (124)	396	520
Iodine	107 (166)	91.0 (48)	70.0	118.0	10.5 (4.1)	9.70 (4.0)	8.04	12.09
Retinol*	476 (1039)	297 (244)	209	455	44.4 (68)	33.1 (22)	25.2	46.9
Carotene*	7658 (6180)	6437 (4976)	4638	9627	816 (561)	709 (591)	471	1062
Vitamin D*	3.2 (2.7)	3.0 (2.0)	2.0	4.0	0.33 (0.2)	0.30 (0.2)	0.2	0.4
Vitamin E	12.8 (6.1)	11.0 (6.0)	9.0	15.0	1.30 (0.3)	1.30 (0.4)	1.3	1.5
Vitamin C	243.9 (168.3)	220 (149)	146	295	25.6 (15.1)	22.8 (17)	14.8	31.6
Thiamin	2.2 (1.1)	2.2 (1.0)	2.0	3.0	0.22 (0.1)	0.22 (0.1)	0.2	0.3
Riboflavin	1.8 (1.0)	2.0 (1.0)	1.0	2.0	0.18 (0.1)	0.17 (0.1)	0.14	0.22
Niacin	28.1 (11.2)	26.0 (11.0)	20.0	32.0	2.89 (0.7)	2.90 (0.9)	2.42	3.30
Vitamin B_6	2.9 (1.2)	3.0 (1.0)	2.0	3.0	0.30 (0.1)	0.30 (0.1)	22.7	34.6
Vitamin B_{12}	5.3 (3.4)	4.0 (3.0)	3.0	6.0	0.54 (0.3)	0.50 (0.2)	0.4	0.6
Folate*	379.7 (161.8)	337 (170.0)	275	445	39.1 (11.0)	37.1 (14.0)	31.6	45.5

*Absolute intakes in micrograms, energy-adjusted intakes µg/MJ/day; IQR, interquartile range; AOAC, Association of Organic and Analytic Chemists.

We found that women had low intakes of dairy foods, breakfast cereals and fish intakes. These food groups are known to contribute to nutrient intakes known to be important in pregnancy, for example calcium, vitamin D and folate.[38–40] Low serum vitamin D concentrations in pregnancy have been associated with a wide range of adverse health outcomes for the women and their offspring including impaired glucose tolerance, low birth weight, increased childhood adiposity, neurocognitive deficits and poor skeletal development of the foetus.[6–9,41,42] This is potentially a greater problem in Ireland where due to low solar UVB irradiation, especially during wintertime, dietary sources of vitamin D are more important for pregnant women than for their peers residing in sunnier climates.[43,44] Of major concern is the finding that only 1% of the women were taking adequate dietary vitamin D, and that low intakes of vitamin D were common across all population subgroups in this study. These findings suggest that the suboptimal vitamin D status previously identified in the broader Irish population may also be present among obstetric populations in this country.[45]

Our findings indicate that only one in three women achieved the recommended dietary folate intake of 400 µg/day.[33] This is a concern because dietary deficiencies of folate are associated with an increased risk of neural tube defects (NTDs).[46] Although there is no European consensus on recommendations for folic acid supplementation in the perinatal period, biomarker studies suggest that supplementation for 12 weeks will achieve a blood level that will help prevent NTDs.[47,48] However, nearly all women only begin folic acid supplementation at some stage during pregnancy and not 12 weeks preconceptionally.[49] While the incidence of NTDs in Europe has stayed the same, in Ireland the incidence of NTDs has increased.[50,51] It is recommended that women increase dietary folate intakes in the second half of pregnancy to 500 µg/day.[33] However, only one in six women achieved this intake in our sample of women in early pregnancy.

Low iron status in pregnancy has been linked to low birth weight and impaired cognitive development.[2,3] The Irish National Adult Nutrition Survey found that 61% of 18- to

Table 5 Plausible reporters meeting and not meeting nutrient intake recommendations (*n* = 402)

Nutrients	*Recommended daily intake*	*Meeting guideline (%)*
Carbohydrate	>50% of energy[31]	35.3
Dietary fibre	>25 g/d[31]	68.2
Non-milk extrinsic sugars	<11% of energy[31]	88.5
Total fat	<35% of energy[32]	40.3
Saturated fat	<10% of energy[32]	9.50
Protein	54 g/d[31]	98.3
Sodium	<2400 mg/d[34]	26.4
Calcium*	>615 mg/d[31]	85.9
Iron*	>10.8 mg/d[31]	72.5
Zinc*	>5.5 mg/d[31]	100.0
Vitamin B_{12}**	>1.0 µg/day[33]	99.8
Vitamin D*	>10 µg/day[33]	1.0
Vitamin C*	>46 mg/day[33]	98.3
Retinol*	>500 µg/day[33]	20.9
Iodine*	>100 µg/day[33]	42.0
Folate*	>400 µg/day[33]	89.1

*Goals are for EAR. **Goals are for RDAs. IQR: interquartile range, NS: Non-significant, [33]Food Safety Authority of Ireland 1999, [32]Food Safety Authority of Ireland 2011, [31]DOH 1991, [34]Food Safety Authority of Ireland 2005.

50-year-old women did not meet the EAR for Iron, when all EI reporters were included in the analysis.[52] The SLAN study also reported a high percentage of non-pregnant women (41%) to be consuming iron at intakes less than the EAR when all EI reporters were included.[53] However, when EI under-reporters were excluded, the proportion of women not meeting the EAR for iron declined to 18%. Our finding that after the exclusion of dietary under-reporters, 27% of women consumed iron at intakes less than the EAR suggests that compliance with iron intake recommendations in women is inadequate.

While the majority of women complied with the EAR for calcium, absolute intakes of calcium in our study (794 mg) were lower than those previously reported in an Irish sample of secundigravidas (1025 mg among plausible EI reporters).[13] It has previously been shown that >50% of pregnant women complied with the 800 mg RDA for calcium; however, it is unclear whether under-reporters were excluded in this analysis.[13] In the SLAN survey, 9% of women consumed calcium at levels below the EAR when under-reporters of EI were excluded. Our study found that 14% of women were below the EAR for calcium after the exclusion of dietary under-reporters, and 50% of women fell below the RDA.

What this study adds

This large observational study of food and nutrient intakes among women in early pregnancy highlights the importance of excluding dietary over- and under-reporters from any quantitative evaluation of macronutrient and micronutrient intakes. In relation to food and nutrient intakes, it also highlights that low dairy foods, breakfast cereals and fish intakes are common among pregnant women in Ireland. Despite Ireland's economic wealth, it is disconcerting that we have identified serious inadequacies in vitamin D, folate, calcium and iron intakes from food and drink in women presenting for antenatal care. These findings highlight the prominent risk of micronutrient inadequacy among pregnant women in Ireland, particularly those who do not take dietary supplements. Our findings highlight concerning deficits in nutrient intakes among Irish women and will help guide professional dietary advice to women attending for future obstetric care in Ireland.

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