Poor adherence to folic acid and iodine supplement recommendations in preconception and pregnancy: a cross-sectional analysis

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Abstract

Objective: To determine pregnant women's knowledge of and adherence to the recommendations for periconceptional folic acid supplementation (PFS) and iodine supplementation (IS). Secondary objectives include determining predictors of adherence, and identifying influential nutrition information sources.

Methods: A cross-sectional online survey was completed by 857 pregnant women, including a national cohort (n=455) recruited using an online panel provider and a South Australian cohort (n=402) recruited from a public maternity hospital.

Results: Adherence to PFS and IS recommendations was 27% and 23%, respectively. Planning pregnancy and awareness of the correct timing of recommendations were predictors of adherence for both recommendations. Not consuming any alcohol during pregnancy and living in metropolitan areas also predicted adherence to the IS recommendation. Awareness of the recommendation was greater for folic acid (more than 90%) than iodine (56-69%). Knowledge of the importance of folic acid and iodine was greater than knowledge regarding the recommended dose and timing of supplementation. Main healthcare providers were considered the most influential nutrition information sources.

Conclusions and implications: Knowledge of and adherence to supplement recommendations for preconception and pregnancy needs improvement. While main healthcare providers may play an important role, further research is needed to explore strategies for increasing adoption of recommendations.

Key words: iodine, folic acid, supplements, pregnancy, nutrition knowledge

Worldwide, women are advised to take dietary supplements containing selected nutrients during preconception and pregnancy.[1-3] In Australia, the recommended nutrients for supplementation are folic acid and iodine.[3] Folic acid is a B vitamin that is essential for DNA synthesis and is especially important during periods of rapid growth such as embryonic and fetal development. It is well documented that folic acid supplementation reduces the risk of neural tube defects (NTD).[4] Iodine is also an essential micronutrient, required for the production of thyroid hormones that are critical for normal fetal growth and cognitive development.[5] Iodine deficiency in pregnancy can lead to irreversible brain damage in severe deficiency.[6]

Pregnant women are at particular risk of folate and iodine deficiency due to their increased requirements, which can be difficult to meet through diet alone.[5] To reduce the risk of NTDs, global health authorities recommend daily supplementation with 400µg of folic acid beginning at least one month prior to conception and during the first trimester of pregnancy.[1] As a result, the incidence of NTDs in Australia has decreased from the 14.0 NTDs per 10,000 births between 1998 and 2000 to 11.8 between 2006 and 2008.[7] Since 2010, health authorities in Australia also recommend daily supplementation with 150µg of iodine for women who are pregnant, lactating or considering pregnancy because of concerns that mild iodine deficiency in pregnancy may impair cognitive development of children.[3]

Despite supplement use becoming common practice during pregnancy in Australia and worldwide, previous studies have consistently shown poor adherence to the recommendation for periconceptional folic acid supplementation (PFS).[8-12] To the best of our knowledge, no published studies have assessed adherence to the PFS recommendation in a national sample of Australian women or the adherence to the more recent NHMRC recommendation regarding IS. There is only one Australian study, of 200 women in Victoria, that has examined adherence to the NHMRC's IS recommendation during pregnancy,[13] with other studies in NSW assessing use of iodine-containing supplements during pregnancy but not adherence to the recommendation.[14-16] National data is also lacking with regards to pregnant women's knowledge of supplement recommendations and associations between knowledge and

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adherence. Thus, using data collected from a national sample of pregnant women across Australia, this study aims to: 1) measure pregnant women's knowledge of and adherence to the PFS and IS recommendations; 2) explore the maternal characteristics associated with adherence; and 3) establish preferred information sources related to nutrition and pregnancy.

Methods

Subjects and study design

Details of study design and recruitment have been provided previously.[17] Briefly, a web-based cross-sectional survey of pregnant women across Australia was conducted between June and November 2013. The overall survey was designed to assess nutrition knowledge, attitudes and practices among pregnant women. Women were eligible to complete the survey if they were currently pregnant; able to understand English; between 18-49 years of age; and not working in a nutrition-related industry or in market research. A national cohort of pregnant women was recruited by a reputable online research panel provider (Pureprofile). All eligible women in the Pureprofile database were invited to participate in the study. A South Australian (SA) cohort was recruited from the antenatal clinic at the Women's and Children's Hospital (WCH), a public tertiary maternity hospital in Adelaide; through study posters displayed around the WCH and through word-of-mouth. Ethics approval for the study was obtained from the University of Adelaide Human Research Ethics Committee, and the Women's and Children's Health Network Human Research Ethics Committee.

Survey questions

The survey included questions regarding supplement use, nutrition knowledge, nutrition information received and influential information sources, and socio-demographic and pregnancy-related characteristics. These questions were based on the following: 1) information gathered from focus group discussions and individual interviews with 40 women who were either pregnant or less than 12 months post-partum;[18] 2) NHMRC recommendations regarding folic acid and iodine supplementation;[3,5] 3) established health benefits of selected nutrients.

Information was collected on women's supplement use before and during pregnancy, whether they were advised by someone to take supplements in preconception/pregnancy, and who provided this advice. Women who reported taking supplements were presented with a table containing images of 36 different supplement products including products containing folic acid and/or iodine (no iodine-only supplements were presented), pregnancy multivitamins and general nutrient supplements that were identified in the focus group discussions and observed in the marketplace at the time of the study. Women were asked to select all products they had used or were currently using, and to list any other products not shown in the table that they used. For the selected products that contained iodine or folic acid, and all products listed in free-text form, additional information was collected on when women began and ceased supplementation, their frequency of use and usual dosage to assess adherence to recommendations for IS and PFS.

The nutrition knowledge questions assessed women's knowledge regarding health benefits of selected nutrients (multiple-choice), current supplement recommendations for preconception and pregnancy (multiple-choice), and dietary sources of iodine and folate (free-text unprompted responses). Questions regarding nutrition information and sources of information asked whether women's main healthcare provider (HCP) during pregnancy provided nutrition information, and on which nutrition related topics (multiple choice). Women were also asked to identify their most influential sources of pregnancy-related nutrition information during their current pregnancy (ranking the top three), and their most preferred sources of new pregnancy-related nutrition information (selecting up to three options).

The socio-demographic information included maternal age, educational attainment, area of residence (living in vs. outside metropolitan area), gross annual household income, living arrangements (living with/without a partner), whether women were Australian-born, ethnicity, and usual physical activity level prior to pregnancy (based on the national physical activity guidelines). Pregnancy-related variables including gestational age on commencement of the survey, gestational age upon learning of pregnancy, gravidity, parity, planned/unplanned pregnancy, pre-pregnancy weight and height (used to calculate pre-pregnancy body mass index [BMI]), and maternal smoking status and alcohol consumption during pregnancy were also assessed.

The survey was piloted with 67 women who were either pregnant, mothers, or of childbearing age. Based on feedback, changes were made to the wording and formatting of some questions to improve clarity, and some questions were removed to shorten the survey.

Statistical analysis

Data were analysed using SPSS (version 20.0) and the level of significance was set at $p<0.05$. Free-text responses were either recoded into the appropriate predetermined categories or new categories were created for common responses that did not fit into existing categories. Differences in means and medians between the two study cohorts were compared using the independent samples t-test and Mann-Whitney U-test, respectively; and differences in categorical variables were investigated using the Pearson chi-square test.

Logistic regression analyses were used to identify independent predictors of adherence to the recommendations for PFS and IS. Adherence to the recommendation for PFS was defined as 'taking ≥400µg folic acid at least one month preconception and for at least the first trimester'. Adherence to the IS recommendation was defined as 'taking 150ug iodine daily preconception and during pregnancy'. The independent variables used in the regression analyses were those that previous studies found to influence supplement use in pregnancy,[9,12,19,20] and that, in this study, were correlated with adherence at the 20% level of significance, as recommended by Maldonado and Greenland.[21]

For both PFS and IS, the included independent predictors were: education level (four categories), household income (five categories), planned pregnancy (yes or no), smoking during pregnancy (yes or no), awareness that supplementation is recommended in preconception and pregnancy (yes or no), awareness of the importance of the nutrient (yes or no), and awareness of the recommended daily dose (yes or no). Additionally, area of residence (in vs. outside metropolitan area) and alcohol consumption during pregnancy (yes or no) were included in the analysis for adherence to the IS recommendation. Maternal age, first pregnancy (yes or no), pre-pregnancy

adherence with national physical activity guidelines (yes or no), and knowledge of the correct timing (yes or no) were included in the analysis for adherence to the PFS recommendation.

Although the two cohorts were recruited using different methods, the same trends were observed in each cohort with respect to nutrition knowledge and practice. Furthermore, there was no correlation between cohort and adherence to PFS or IS recommendations. Thus, results are presented for the total sample combined.

Studies published in the last decade showed that adherence to the PFS recommendation ranged from 10-46%.[9,12] To detect an adherence rate of 10% with 80% power and accuracy of ±5%, a sample size of 139 was required;[22] while 385 was required for an adherence rate of 50%. Larger samples were recruited to allow for controlling of multiple factors in the regression analyses.[23]

Results

Participants

The survey was completed by 857 respondents (n=455 national cohort and n=402 South Australian cohort), with an overall completion rate of 57% (857/1493) that did not differ significantly between cohorts. Socio-demographic and pregnancy-related characteristics of the total sample along with national/South Australian figures for comparison are presented in Table 1.

Table 1: Participant characteristics (n=857)[a] and comparison to national or South Australian data.

Characteristic	n	%	National or SA data
Maternal age (years)[b]	31	5	31[c,d]
Living in metropolitan area	668	78	70%[d]
Highest education level			
Secondary	166	19	35%[e]
Post-secondary but no tertiary	226	26	35%[e]
Tertiary	465	54	30%[e]
Gross household income			
≤$20,000	50	6	20%[f]
$20,001–$40,000	97	11	20%[f]
$40,001–$70,000	198	23	20%[f]
$70,001–$105,000	250	29	20%[f]
≥$105,001	262	31	20%[f]
Employed	591	69	68%[g]
Living with a partner	813	95	90%[h]
Born in Australia	644	75	68%[d]
Ethnic background			
Australian	407	48	
North-west European	51	6	
Southern and Eastern European	52	6	
British/Irish	146	17	
Asian	121	14	
Other	80	9	
Gestational age (weeks)[c]	24	16-32	
No previous births	401	47	44%[d]
Planned pregnancy	638	74	~50%[i]
Pre-pregnancy BMI ≥25.0kg/m^2	319	37	50%[j]
Adhered to physical activity guidelines pre-pregnancy	264	31	
Smoked during pregnancy	49	6	13%[h]
Consumed alcohol during pregnancy	182	21	

a: Data are n (%) unless indicated otherwise; b: Data are mean and SD; c: Data are median and IQR; d: Source[38]; e: Source[39]; f: Source[40]; g: Source[41] h: Source[42]; i: Source[31]; j: Source[43]

Nutrition knowledge

Seventy-five percent of the women surveyed were aware that folic acid 'helps prevent NTDs such as spina bifida' and almost one-half (45%) were aware that iodine 'is important for baby's brain development'.

Dietary sources of folate identified by women included green leafy vegetables (45%), legumes (beans, peas, lentils) (12%), breakfast cereals (10%), bread (8%), oranges/citrus fruit/orange juice (6%), nuts (6%) and vegemite/marmite/yeast extract (5%). Dietary sources of iodine included fish/seafood (23%), dairy (15%), seaweed (11%), eggs (11%) and bread (8%). Overall, 43% and 54% of pregnant women, respectively, were unable to identify any good dietary sources of folate and iodine (either answering they 'didn't know' or listing incorrect sources). Vegetables (in general) were most commonly identified incorrectly as good sources of folate and iodine, followed by fruit and meat. Overall, 11% of women identified iodised salt as a good source of iodine and a further 11% identified 'salt' but did not specify whether it was iodised. Thirty percent and 23% were able to identify more than one good dietary source of folate and iodine, respectively.

Knowledge regarding supplement recommendations

While almost all women believed folic acid supplements are recommended in preconception (92%) and during pregnancy (94%), fewer women were aware of recommendations for iodine supplementation (56% and 69%, respectively). Between 40% and 59% of women incorrectly believed that omega-3 fatty acid, vitamin D, iron and calcium supplements are recommended in preconception, increasing to 55-77% in pregnancy.

Of the 95% and 71% women, respectively, who indicated that supplementation with folic acid or iodine is recommended for all women in preconception and/or pregnancy, over three-quarters (78%) were aware of the importance of folic acid and just over one-half (54%) were aware of the importance of iodine. While 33% and 10% of women correctly identified the recommended daily dose of folic acid and iodine, respectively, a further 25% and 30% reported that the amount recommended is, 'However much is in the supplement I am taking'. One-in-10 women correctly identified the recommended duration of supplementation with folic acid (11%, 'at least one month before conception and the first three months of pregnancy'), with a further 36% believing supplementation is recommended 'at least three months before conception and the first three months of pregnancy'. Over one-half of women were aware iodine supplementation is recommended in preconception (56%) and pregnancy (69%).

Advice received regarding supplementation

Of the women who planned their pregnancy, 65% were advised to take a nutritional supplement pre-conception; and 80% of women overall were advised to take a nutritional supplement during pregnancy.

A higher proportion of women were advised to supplement with folic acid when planning pregnancy compared to during pregnancy (84% vs. 72%). It was the opposite for multivitamins (48% vs. 54%), vitamin D (36% vs. 47%) and iron supplements (34% vs. 44%), which were more commonly recommended during pregnancy. For iodine (40%) and omega-3 fatty acids (25%) the proportion advised to take supplements before vs. during pregnancy did not differ.

Both when planning pregnancy and during pregnancy, general practitioners (GP) were the most common source recommending folic acid (73% and 76%, respectively), iodine (65% and 69%) and multivitamin supplements (30% and 67%). This was followed by obstetricians, midwives and family/friends.

Nutrition information received during pregnancy and the most influential and preferred information sources

Approximately two-thirds of women (69%, 565/816) reported receiving some nutrition information from their main HCP. The most common topics women received information about are shown in Table 2. Overall, the most influential sources of nutrition information during pregnancy were women's GP (51%), midwife (46%) and obstetrician (36%). These sources were followed by family/friends (26%), common-sense (24%), internet sites other than government/hospital health websites (18%), and own previous experience (17%). Further, compared with the nulliparous women, multiparous women were significantly more likely to rank their own previous experience (27% vs. 4%, $p<0.001$) as one of their top three most influential sources of nutrition information during pregnancy, and less likely to rank their GP (47% vs. 55%, P=0.017), family/friends (22% vs. 30%, $p=0.006$), and internet sites other than government/hospital health websites (13% vs. 23%, $p<0.001$).

Overall, the most preferred methods of receiving new pregnancy-related nutrition information were 'via a booklet or pamphlet' or 'verbally' during an appointment with the main HCP (53%). This was followed by the internet (31%) and via a booklet or pamphlet received in the mail (24%).

Supplement use during preconception and pregnancy

Sixty-four percent of women reported taking dietary supplements in the month prior to becoming pregnant. Supplement use increased to 93% during pregnancy. The majority of women were taking supplements containing folic acid (89%) and iodine (81%) during pregnancy, with 84% and 74%, respectively, supplementing with the recommended dosage. Fewer women were taking supplements containing folic acid (61%) and iodine (50%) pre-conception, with 57% and 46%, respectively, supplementing with the recommended dosage.

Table 2: Nutrition-related topics women received information about from their main healthcare provider.[a]

Nutrition-related topic	n	%
Iron	226	0.4
Folate	351	62
Calcium	201	36
Iodine	179	32
Vitamin D	239	42
Omega-3 fatty acids (e.g. fish oil)	110	20
Dietary intake/nutrition for pregnancy	306	54
Weight gain during pregnancy	187	33
Listeria/food safety	305	54
Mercury	102	18
Dietary supplements/multivitamins	268	47
None of the above	10	2

a. Data shown are for women who reported having a main healthcare provider during this pregnancy and reported receiving nutrition information from them (n=816).

Adherence to PFS and IS recommendations

Only 27% of women fully adhered to the recommendation for PFS (≥400µg folic acid daily at least one month preconception and in the first trimester) and 23% adhered to the recommendation for daily supplementation with 150µg of iodine during pregnancy and prior to pregnancy. Adherence rates were higher among women with planned pregnancies compared to those with unplanned pregnancies (PFS: 25% vs. 2%, $p<0.001$; IS: 22% vs. 1%, $p<0.001$). Overall, just one-in-five women adhered to both the PFS and IS recommendation.

Predictors of adherence to supplement recommendations

The odds ratios for adherence to the PFS and IS recommendations are shown in Table 3. Planning pregnancy and awareness of the recommended duration of supplementation were independent predictors of adherence to both the PFS and IS recommendation. Additionally, women living in metropolitan areas and those who did not consume any alcohol during pregnancy were more than one-and-a-half times more likely to meet the recommendation for IS.

Discussion

Ours is the first study to report nationwide data on Australian women's adherence to the PFS and IS recommendations. Our findings not only show that adherence to both recommendations is low, but reveal widespread misconceptions about the need for supplementation with omega-3 fatty acids, vitamin D, iron and calcium in preconception and pregnancy.

We have also shown for the first time that awareness of the recommended duration of supplementation (but not recommended dose) is an independent predictor of adherence to the IS and PFS recommendations. While the majority of women knew that PFS and IS are recommended in both preconception and pregnancy, it was knowledge of the specific periconceptional timing that predicted adherence to the PFS recommendation. A possible explanation for the low adherence to the IS recommendation (23%) despite the high awareness of the need for IS in preconception and pregnancy (71%), is that women's responses to the IS awareness questions did not always reflect their true awareness; this may have occurred if women guessed the right answers. Thus, future studies could consider eliciting unprompted (free-text) responses for questions regarding awareness of supplement recommendations. Additionally, fewer women may have been aware of the recommended duration of IS if it was more specific, as is the case for PFS.

The finding that women who consumed alcohol during pregnancy were less likely to adhere to the IS recommendation, has also not been identified in previous studies examining adherence to IS or PFS recommendations. This finding is, however, consistent with previous research showing that women with the highest total folate intakes tended to consume less alcohol than women with lower intakes.[24] It is also consistent with the 'inverse supplement hypothesis', which suggests that those least likely to need supplements are those most likely to be taking them.[25]

Confirming the results of previous studies, we found that while prevalence of supplement use during pregnancy was high, adherence to supplement recommendations was low;[8-12] women were more likely to meet the PFS and IS recommendations if they

planned their pregnancy;[9,12] awareness of the importance of folic acid was greater than awareness of the recommended dose and timing of supplementation;[8] knowledge of the recommended duration, dose and importance of supplementation was greater for PFS than IS;[26,27] and knowledge regarding dietary sources of folate and iodine was poor[15,16,27], with around half of pregnant women unable to name a single source and less than one-in-10 recognising bread as a good source of the nutrients. Notably, we did not find household income to be a predictor of supplement use, which suggests that the lack of subsidised or funded prescriptions for the recommended supplements in Australia is not a significant barrier to adherence.

In Australia, antenatal care is provided in a range of settings, including primary care, obstetric and midwifery practice and public and private hospitals. The main antenatal HCPs include GPs, obstetricians and midwifes; and the first antenatal visit usually occurs around 12 weeks gestation. Notably, our findings that GPs, obstetricians and midwives are the three most influential sources of nutrition information during pregnancy are consistent with the Australian and international literature.[28,29] However, while women may look to healthcare providers for reliable pregnancy-related nutrition information, the limited available literature indicates that Australian HCPs across general practice, nursing/midwifery and pharmacy service settings feel that they need further nutrition training.[30] Ongoing nutrition education may be especially valuable for antenatal HCPs given that nutrition-related recommendations during pregnancy are not just limited to the supplement recommendations but also include recommendations around high-listeria-risk foods, mercury in fish, gestational weight gain and alcohol consumption.

Overall, with over one-half of pregnancies in Australia estimated to be unplanned,[31] potentially effective strategies for increasing intake of iodine and folic acid in the preconception period may be: 1) increasing awareness of the recommended timing and duration of PFS and IS among childbearing aged women, and 2) encouraging women to maintain an optimal folate and iodine intake throughout their childbearing years, through natural and nutritionally-fortified dietary sources. Determining which methods of communication are most effective among women of childbearing age warrants further investigation, especially as women may seek health information from a range of sources, including GPs, pharmacies, women's health clinics, sexual health services, telephone helplines, traditional mass media as well as the internet and social media, which are able to reach more diverse audiences.[32-35] Thus, dissemination of nutrition information through both traditional mass media and social media platforms with simultaneous reinforcement of that information by healthcare providers might be an effective method of informing childbearing-aged women about pregnancy-related recommendations.

The key advantage of using an online survey for data collection was that it increased the efficiency and practicality of collecting national data. Allowing respondents to return to the survey and complete it in their own timeframe may have also improved data quality by reducing respondent fatigue. Further, while use of an online survey limited the generalisability of the findings to pregnant women with internet access, the majority of households nationally (79%) had internet access in 2010-2011.[36]

Recruiting a convenience sample via an online provider increased the risk of selection bias with those more interested in nutrition more likely to participate. Selection bias occurs in all voluntary studies, and therefore it also likely occurred in the SA cohort. This is likely to have contributed to the over-representation of women with higher education and income levels, and those who planned their pregnancy. Given that planning pregnancy was an independent predictor of adherence; our study is likely to overestimate true adherence rates, with adherence likely to be even lower in the general pregnant population, reflecting the higher proportion of unplanned pregnancies. Overall, the socio-demographic subgroups were sufficiently large to draw statistical conclusions (with the exception of women who smoked during pregnancy, of whom there were less than 50);[37] and the study sample was similar to the population of Australian women giving birth in 2012 with respect to mean maternal age and the proportion of women who were nulliparous, Australian-born, and living in metropolitan areas.[38] Future studies

Table 3: Odds ratios for adherence to the periconceptional folic acid and iodine supplement recommendations.[a]

	PFS (n=799)			Iodine (n=854)		
Independent variable	**OR**	**95%CI**	**P-value**	**OR**	**95%CI**	***p*-value**
Maternal age	1.0	1.0–1.1	0.324	1.0	1.0–1.0	0.825
Educational attainment						
Up to year 12	1.0					
Post-secondary but no tertiary	1.0	0.6–1.7	0.945	1.0	0.6–1.7	0.924
Tertiary- undergraduate	1.1	0.7–1.9	0.591	1.0	0.6–1.6	0.898
Tertiary- postgraduate	1.1	0.6–2.0	0.661	1.1	0.6–2.0	0.768
Income						
Below $20,000	1.0					
$20,001–$40,000	1.7	0.5–5.1	0.378	1.4	0.5–4.0	0.512
$40,001–$70,000	2.2	0.8–6.2	0.139	1.5	0.6–3.9	0.419
$70,001–$105,000	2.7	1.0–7.6	0.056	2.2	0.9–5.7	0.099
≥$105,001	2.1	0.7–5.8	0.172	1.6	0.6–4.1	0.348
Living in metropolitan area	-	–	-	1.6	1.0–2.5	0.045
Planned pregnancy	5.2	3.1–9.0	<0.001	7.6	4.0–14.5	<0.001
First pregnancy	0.8	0.5–1.1	0.174	-	–	-
Pre-pregnancy adherence to national physical activity guidelines[b]	1.4	1.0–1.9	0.084	-	–	-
Smoked during pregnancy	0.8	0.3–1.9	0.559	1.0	0.4–2.5	0.996
Did not consume alcohol during pregnancy	-	–	-	1.8	1.2–2.9	0.010
Aware supplementation is recommended in preconception and pregnancy	0.5	0.2–1.3	0.175	1.9	1.3–2.7	0.001
Aware of correct duration of PFS[c]	2.3	1.3–4.1	0.004	-	–	-
Aware of importance of nutrient[d]	1.4	0.9–2.2	0.123	1.3	0.9–1.9	0.110
Aware of correct daily dose	0.9	0.6–1.3	0.569	1.3	0.7–2.6	0.397

Abbreviations: PFS=periconceptional folic acid supplementation.

a: Adherence defined as: 'taking ≥400ug folic acid at least one month preconception and during the first trimester', and 'taking 150µg iodine daily preconception and during pregnancy'.

b: 30 min of daily exercise ≥5days/week.[44]

c: At least one month preconception and during the first trimester

d: Aware that 'Folic acid helps prevent neural tube defects such as spina bifida' or 'Iodine is important for baby's brain development'.

investigating nutrition in pregnancy should aim to over-sample the underrepresented sub-groups to cover a wider range of the pregnant population; and comparison of public and private-hospital patients should also be considered.

Conclusions and implications

Our study shows that the majority of pregnant women in Australia do not meet the recommendation for PFS or IS. For both recommendations, adherence was positively predicted by awareness of the recommended duration of supplementation. However, despite the majority of women being aware of the recommended timing of IS, few women adhered to this recommendation. Further research is needed to explore strategies for increasing adoption of the IS recommendation, particularly given that a large percentage of pregnancies are unplanned, and supplementation is recommended pre-conceptually. Main HCPs in pregnancy were shown to be the most influential and preferred sources of nutrition information, and may therefore play an important role in increasing nutritional knowledge and adoption of both IS and PFS recommendations in preconception and pregnancy.

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