Adequacy of prenatal care as a major determinant of folic acid, iron, and vitamin intake during pregnancy

Adequação dos cuidados pré-natais como determinante da utilização de ácido fólico, ferro e vitaminas durante a gravidez

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Abstract

This study aimed to quantify the association between adequacy of prenatal care and prevalence of folic acid, iron, and multivitamin intake during pregnancy. Data were obtained on socio-demographics, prenatal care, pregnancy complications, and use of vitamin/mineral supplements for 836 women, using a postpartum interview. Associations with the use of vitamin/mineral supplements were quantified with risk ratios (RR), computed by generalized binomial regression. A high proportion of women reported the use of folic acid (81.9%), iron (55.4%), and multivitamins (76.2%) as supplements during pregnancy. Use of supplements was independently associated with adequacy of prenatal care (adequate vs. inadequate: folic acid, RR = 2.28; 95%CI: 1.58-3.29; iron, RR = 1.99; 95%CI: 1.57-2.52, multivitamins, RR = 1.97; 95%CI: 1.54-2.51). Higher schooling was also associated with increased use of folic acid (RR = 1.42; 95%CI: 1.18-1.70), but not multivitamins (RR = 0.87; 95%CI: 0.77-0.98). Use of folic acid was less prevalent in single women (RR = 0.67; 95%CI: 0.48-0.95) and during unplanned pregnancies (RR = 0.81; 95%CI: 0.71-0.92). Adequacy of prenatal care is a major determinant of vitamin/mineral intake during pregnancy.

Folic Acid; Iron; Vitamins; Prenatal Care; Pregnancy

Introduction

Obstetric guidelines recommend that all women use folic acid supplements in the periconceptional period to prevent neural tube defects. Prescription of iron for all pregnant women is not a consensus [1,2,3], since dietary intake may be sufficient to maintain recommended levels [4]. Supplements should be reserved for women with or at high risk of anemia (women from developing countries, multiparous women, or those with multiple gestations or gestational hemorrhage) [2]. The use of other vitamins and mineral supplements is questioned, except for low-income women, those with special diets, or those under treatment with specific drugs [5,6].

Previous studies have quantified the use of vitamins and minerals in pregnancy [1,4,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38], and some have addressed its association with age [11,12,13,30,31,38], ethnicity [8,12,13,30,33], education [11,13,18,30,31,36,38], marital status [11,13,38], parity [11,13,18,31,38], and planning of pregnancy [11,18,32,34,38]. However, the effect of prenatal care has often been disregarded [8,11,18,27,29] or has relied on single measures such as the source of care [4,13,26,30,38] or simply attendance at prenatal care visits [12,36]. Additionally, the influence of prenatal care vitamin/mineral supplementation and its relationship to socio-demographic factors can be expected to vary from country to country, namely concerning

the presence of financial barriers to prenatal care.

We thus aimed to estimate the prevalence of vitamin/mineral supplement use during pregnancy and assess the role of demographic, social, and obstetric factors in the use of supplements by pregnant women in Portugal, a country where there is universal free access to medical care during pregnancy.

Material and methods

We conducted a cross-sectional analysis of data collected from 836 participants, previously evaluated as part of a case-control study, which aimed to evaluate risk factors for preterm delivery [39]. Complete information on drug use during pregnancy was obtained for 423 preterm and 413 term mothers consecutively delivered at two major public hospitals in the North of Portugal. Participants were interviewed 24-72 hours after delivery, using a standardized questionnaire. Self-reported information was obtained on maternal socio-demographic characteristics (age, schooling – categorized as elementary or ≤ 4 years, < secondary, and ≥ secondary, and marital status – married or living with a partner vs. other), number of gestations (nulliparous vs. parous), and pregnancy planning (planned vs. unplanned), chronic illnesses (asthma, diabetes, epilepsy, hypertension, and cardiac diseases), and medical complications during pregnancy (genitourinary infection, gestational hypertension, gestational diabetes, preeclampsia, or vaginal bleeding).

Prenatal care was classified according to the Adequacy of Prenatal Care Utilization Index (APNCU Index) [40]. This index combines the month of initiation of care and the percentage of recommended visits adjusted for gestational age at initiation of care and gestational age at delivery. The standard used here was the number of prenatal visits recommended in Portugal [41]. Inadequate care was defined as initiation of care after the fourth month of gestation or fewer than 50% of recommended visits.

Data on utilization of vitamins and minerals during pregnancy were obtained through specific questions on the use of folic acid, iron, and multivitamins and an additional open question on any other drugs not specifically mentioned. Information on use of medicines during pregnancy was obtained without reference to the exact trimester.

The association between socio-demographic, obstetric, and prenatal care characteristics and the use of folic acid, iron, and multivitamin supplements was quantified with generalized binomial regression risk ratios (RR) and respective 95% confidence intervals (95%CI), computed using Stata version 9.0 (Stata Corp., College Station, USA).

Results

Prevalence of use of supplements during pregnancy was 55.4% for folic acid, 81.9% for iron, and 76.2% for multivitamins.

The use of all types of supplements studied was positively associated with the adequacy of prenatal care. Compared to women with inadequate prenatal care, those ranked as adequate were more likely to take folic acid (RR = 2.28; 95%CI: 1.58-3.29), iron (RR = 1.99; 95%CI: 1.57-2.52), and multivitamins (RR = 1.97; 95%CI: 1.54-2.51) (Table 1). The association remained significant and with the same magnitude after adjustment for age, schooling, or income (data not shown).

Folic acid supplements were significantly less frequent among single women (RR = 0.67; 95%CI: 0.48-0.95) and those with unplanned pregnancies (RR = 0.81; 95%CI: 0.71-0.92), but increased with schooling (5-11 vs. ≤ 4 years: RR = 1.23; 95%CI: 1.04-1.47 and ≥ 12 vs. ≤ 4 years: RR = 1.42; 95%CI: 1.18-1.70). Similar results were observed for iron and multivitamins, but the associations with planning of pregnancy were weaker and non-significant (iron: RR = 1.00; 95%CI: 0.95-1.17 and multivitamins: RR = 0.97; 95%CI: 0.90-1.04), while use of multivitamins was significantly less frequent in women with more education (≥ 12 years of formal schooling vs. ≤ 4 years: RR = 0.87; 95%CI: 0.77-0.98) as shown in Table 1.

Discussion

According to this study, 80% of pregnant women used iron, slightly more than half received folic acid supplementation, and three-fourths used multivitamins during pregnancy, and adequacy of prenatal care was a strong determinant of the use of these supplements some time during pregnancy.

The retrospective data collection may have underestimated the use of supplements, especially folic acid, which is indicated during the periconceptional period and in the first trimester [42], while recall of use of medicines during pregnancy is known to be improved by direct questioning about specific drug groups [43], as occurred in our study for folic acid, iron, and multivitamins. However, the proportions presented in this study describe the use of these supple-

Table 1

Use of folic acid, iron, and multivitamins during pregnancy according to socio-demographic status and prenatal care in a sample of Portuguese women *.

	n	Gestational use of							
		Folic acid		Iron			Multivitamins		
		%	RR (95%CI) **	RR (95%CI) ***	%	RR (95%CI) **	RR (95%CI) ***	%	RR (95%CI) **	RR (95%CI) ***
Age (years)										
≤ 19	52	38.5	1.00	1.00	67.3	1.00	1.00	71.2	1.00	1.00
20-34	685	56.9	1.34 (0.96-1.90)	1.34 (0.94-1.90)	83.8	1.08 (0.93-1.27)	1.09 (0.93-1.27)	77.5	0.97 (0.85-1.11)	0.98 (0.86-1.12)
≥ 35	97	54.6	1.34 (0.92-1.95)	1.39 (0.95-2.03)	78.4	1.09 (0.92-1.29)	1.11 (0.94-1.29)	70.1	0.90 (0.76-1.08)	0.94 (0.79-1.12)
Schooling (complete years)										
≤ 4	205	41.5	1.00	1.00	70.7	1.00	1.00	72.2	1.00	1.00
5-11	445	56.6	1.23 (1.04-1.47)	1.26 (1.05-1.50)	84.5	1.09 (1.00-1.18)	1.09 (1.01-1.19)	80.4	1.01 (0.93-1.10)	1.01 (0.93-1.10)
≥ 12	186	67.7	1.42 (1.18-1.70)	1.43 (1.18-1.72)	88.2	1.08 (0.99-1.18)	1.08 (0.99-1.19)	70.4	0.87 (0.77-0.98)	0.88 (0.78-0.98)
Marital status										
Married	764	57.7	1.00	1.00	84.2	1.00	1.00	77.6	1.00	1.00
Single	72	30.6	0.67 (0.48-0.95)	0.71 (0.50-0.99)	58.3	0.89 (0.76-1.04)	0.89 (0.76-1.04)	61.1	0.94 (0.79-1.10)	0.89 (0.75-1.06)
Paid work										
No	198	53.0	1.00	1.00	78.2	1.00	1.00	74.8	1.00	1.00
Yes	635	56.2	1.02 (0.89-1.17)	0.95 (0.83-1.09)	83.0	1.02 (0.95-1.09)	1.01 (0.94-1.07)	76.7	0.98 (0.90-1.06)	1.00 (0.92-1.08)
Previous gestations										
No	411	56.0	1.00	1.00	83.4	1.00	1.00	78.4	1.00	1.00
Yes	425	54.4	1.02 (0.91-1.14)	1.02 (0.91-1.15)	80.5	0.99 (0.94-1.05)	1.01 (0.96-1.07)	74.1	0.96 (0.90-1.03)	0.98 (0.92-1.06)
Pregnancy planning										
Planned	498	62.9	1.00	1.00	85.9	1.00	1.00	80.1	1.00	1.00
Unplanned	327	45.0	0.81 (0.71-0.92)	0.84 (0.74-0.95)	75.8	1.00 (0.95-1.17)	1.01 (0.96-1.07)	69.7	0.97 (0.90-1.04)	0.96 (0.89-1.03)
Illnesses during pregnancy										
No	300	50.0	1.00	1.00	77.3	1.00	1.00	72.3	1.00	1.00
Yes	535	58.5	1.07 (0.94-1.22)	1.06 (0.94-1.19)	84.5	1.00 (0.95-1.06)	1.00 (0.94-1.05)	78.3	1.03 (0.96-1.11)	1.03 (0.96-1.11)
Chronic illnesses										
No	702	56.6	1.00	1.00	83.0	1.00	1.00	76.9	1.00	1.00
Yes	126	50.0	0.89 (0.75-1.07)	0.87 (0.35-1.04)	76.2	0.93 (0.85-1.02)	0.92 (0.84-1.01)	72.2	0.98 (0.88-1.08)	0.98 (0.89-1.08)
Gestational age (weeks)										
≥ 37	413	56.4	1.00	1.00	84.3	1.00	1.00	78.9	1.00	1.00
< 37	423	54.4	1.03 (0.92-1.16)	1.05 (0.94-1.17)	79.7	1.02 (0.96-1.07)	1.02 (0.97-1.07)	73.5	0.98 (0.92-1.05)	0.99 (0.92-1.06)
Adequacy of prenatal care										
Inadequate	93	24.7	1.00	1.00	43.0	1.00	1.00	41.9	1.00	1.00
Intermediate	116	53.4	2.16 (1.46-3.20) #	2.10 (1.42-3.09) ##	82.8	1.92 (1.50-2.47) #	1.86 (1.46-2.38) ##	76.7	1.83 (1.41-2.37) #	1.88 (1.44-2.44) ##
Adequate	361	56.5	2.28 (1.58-3.29) #	2.06 (1.43-2.97) ##	85.6	1.99 (1.57-2.52) #	1.90 (1.50-2.40) ##	82.6	1.97 (1.54-2.51) #	2.02 (1.58-2.59) ##
Adequate plus	256	67.6	2.73 (1.90-3.93) #	2.41 (1.67-3.47) ##	91.0	2.12 (1.67-2.68) #	2.01 (1.59-2.54) ##	80.5	1.92 (1.50-2.46) #	2.00 (1.55-2.57) ##

* The sum of participants in each category may be lower then 836 due to missing data;

** Adjusted for prenatal care adequacy;

*** Adjusted for prenatal care adequacy, age, and schooling;

Crude RR estimate;

Adjusted for age and schooling.

ments any time during pregnancy, regardless of dosage and duration of exposure, and no conclusions can be drawn about the proportion of women correctly using supplements regarding timing, dosage, or adherence to prescription regimens.

Our study included an over-sampling of mothers of preterm babies. However, this is not expected to compromise the validity of our estimates, since no significant association was found between the use of vitamin/mineral supplements and preterm status.

Wide variation is observed between countries in the proportion of women taking vitamin or mineral supplements during pregnancy, but such use in different populations cannot be directly compared, because the methods for evaluating exposure differ considerably among studies. Some have been based on institutional databases [8,12,13,23,27,29,37] and have therefore considered only the prescribed vitamins/minerals, not reflecting the real intake. When information was obtained by interview, the moment of data collection was different and varied from prenatal visits [1,7,10,15,16,17,18,19,21,22,25,26,31,34,35,36,38,44,45] until two months after childbirth [9,11,14,20,24,30,33,46,47].

Some studies have considered exposures during the entire pregnancy, without differentiating between trimesters [1,4,7,8,9,10,11,12,13,19,20,23,24,27,33,35,37,38,44,45,46], some have distinguished between exposure in the first, second, and third trimesters [14,15,22,26,29,30,31,36,47] , and others have included preconceptional use [15,16,17,18,21,38]. The drug groups evaluated and the nomenclature used for characterizing them have also varied across studies, some considering each group separately (folic acid, iron, and vitamins) [8,12,15,16,17,18,21,22,23,24,28,30,31,34,36,38,44,45], others in association (e.g.: antianemics, vitamins, and/or antianemics) [1,10,13,20,25,27,33,35,47], or both [4,7,9,11,14,19,26,29,37].

Despite methodological differences, our study and most others performed in other population groups showed that age (20-34 years) [13,30,32], more schooling [11,13,18,30,31,32,38], and planning of pregnancy [18,32,34] were associated with higher prevalence of vitamin/mineral use.

In this sample of Portuguese women, schooling was positively associated with use of folic acid and iron, but not with multivitamins, which were taken more frequently by less educated women. This distribution in the prevalence of use of supplements provides evidence of social inequity, since it probably reflects the ability of better-educated women to make more appropriate health choices: the use of folic acid and iron during pregnancy is frequently recommended and has well-recognized effects, but the same does not apply to multivitamins, unnecessary in most pregnancies. No significant association was observed between having paid work and the use of supplements, suggesting that financial constraints are not as important as education in determining the use of folic acid and iron.

The observation of less frequent supplement use in women with unplanned pregnancies suggests that timing of prenatal care and maternal attitudes toward pregnancy may compromise the ideal scheduling of and compliance with prescribed vitamins and minerals. This effect was seen more clearly for folic acid, probably because it should be used even before conception and is therefore more influenced by pregnancy planning.

Previous research has shown that women attending prenatal care receive supplements more frequently [13]. Our study uses a more comprehensive measure of prenatal care adequacy that combines independent assessment of the timing of prenatal care initiation and the frequency of visits received after initiation [40], strengthening the role of prenatal care adequacy as a determinant for the use of supplements.

The association between other socio-demographic and obstetric factors and less frequent use of supplements during pregnancy is independent from the adequacy of prenatal care utilization and further reflects maternal attitudes towards pregnancy, social inequity, and failure of primary care providers to promote maternal health. However, we cannot rule out the hypothesis that these results are confounded by other prenatal care characteristics such as adequacy of prenatal care content.

Public health strategies to improve the correct use of vitamins and minerals during pregnancy should include the promotion of pregnancy planning and maternal recognition of the importance of supplements, especially early use of folic acid.

Resumo

Quantificar a associação entre a adequação dos cuidados pré-natais e a prevalência de utilização de ácido fólico, ferro e vitaminas durante a gravidez. Após o parto, 836 mulheres foram questionadas relativamente a características sócio-demográficas, utilização dos cuidados pré-natais, complicações durante a gravidez e utilização de suplementos vitamínicos/minerais. A associação entre as variáveis foi quantificada por meio de riscos relativos (RR) calculados por regressão binomial generalizada. Uma elevada proporção de mulheres reportou ter tomado ácido fólico (81,9%), ferro (55,4%) e multivitaminas (76,2%) durante a gravidez. A utilização de suplementos esteve independentemente associada à adequação dos cuidados pré-natais (adequado vs. inadequado: ácido fólico, RR = 2,28; IC95%: 1,58-3,29; ferro, RR = 1,99; IC95%: 1,57-2,52; multivitaminas, RR = 1,97; IC95%: 1,54-2,51). O elevado nível de escolaridade associou-se ao uso de ácido fólico (RR = 1,42; IC95%: 1,18-1,70), mas não de multivitaminas (RR = 0,87; IC95%: 0,77-0,98). A utilização de ácido fólico foi menos prevalente em mulheres que viviam sozinhas (RR = 0,67; IC95%: 0,48-0,95) e cuja gravidez não foi planeada (RR = 0,81; IC95%: 0,71-0,92). A adequação dos cuidados pré-natais é um determinante importante da utilização de vitaminas/minerais durante a gravidez.

Ácido Fólico; Ferro; Vitaminas; Cuidado Pré-Natal; Gravidez

Contributors

N. Lunet contributed to the data analysis and interpretation and wrote the first version of the manuscript. T. Rodrigues contributed to the study conception and design and revision of the manuscript. S. Correia contributed to the data analysis and revision of the manuscript. H. Barros contributed to the study conception and design and critically revised the manuscript for intellectual content. All the authors approved the final version of the manuscript for publication.

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