ARCHIVOS LATINOAMERICANOS DE NUTRICION
Organo Oficial de la Sociedad Latinoamericana de Nutrición

Vol. 53 N° 1, 2003

Prevalence of nutritional deficiencies in Mexican adolescent women with early and late prenatal care

Esther Casanueva, Julieta Jiménez, Carlos Meza-Camacho, Mónica Mares, Luis Simon

Instituto Nacional de Perinatología (INPer). Montes Urales, México, Adolescent Clinic, INPer

SUMMARY. The objective was to evaluate the prevalence of specific nutritional deficiencies in a group of pregnant adolescents according to the gestational age when they started to receive prenatal care. A group of 163 pregnant adolescents that attended the Instituto Nacional de Perinatología (Mexico City) for the first time to receive prenatal care was evaluated. An anthropometrical evaluation was performed and a blood sample taken to determine hemoglobin, ferritin, erythrocyte folate and plasma zinc to all cases. The mean age was 15 years (11 to 17 years). The mean gestational age when starting prenatal care was 27 ± 7 gestation weeks and most of them tended to have low weight (97±12% expected weight for height and gestational age). Eight of every ten adolescents had anemia and iron deficiency. Late prenatal care (≥ 25 weeks) was associated with the risk of presenting anemia OR 5.11 (CI 95% 2.4- 10.7) iron deficiency (OR 3.5; CI 95% 1.7 to 7.1) and zinc deficiency (OR 2.9; CI 95%1.1 a 7.6). In relation to folate deficiency, the opposite effect was observed (OR 0.10; CI 95% 0.02 a 0.48). Lack of opportune prenatal care was associated with the presence of iron and zinc depletion. Probably iron deficiency contributes to an erythrocyte folate accumulation.

Key words: Adolescents, nutrition, pregnancy, prenatal care, iron, folate, zinc.

RESUMEN. Prevalencia de deficiencias nutricias en adolescentes mexicanas. Influencia del control prenatal. Con el objeto de evaluar la prevalencia de deficiencias nutricias específicas en un grupo de adolescentes embarazadas de acuerdo con la edad gestacional en que inician su control prenatal, se estudió en forma transversal a un grupo de 175 embarazadas adolescentes que acudieron por primera vez a control prenatal al Instituto Nacional de Perinatología (Ciudad de México). En todos los casos se realizó una evaluación antropométrica y se tomó una muestra de sangre para determinar hemoglobina, ferritina, ácido fólico eritrocitario y zinc plasmático. El promedio de edad fue de 15 años (11 a 17 años). El promedio de edad gestacional al inicio del CP fue de 27 ± 7 semanas de gestación y en su mayoría tendieron al bajo peso (97±12% del peso esperado para la estatura y edad gestacional). Ocho de cada diez adolescentes mostraron anemia y deficiencia de hierro. El control prenatal tardío (≥ 25 semanas) se asoció con el riesgo de presentar anemia (RM 5.11 IC95% 2.4-11.9), depleción de hierro (RM 3.53; IC95% 1.75- 7.10) y de zinc (RM 2.94; IC 95%1.14 a 7.58). En el caso de la deficiencia de folatos paradójicamente se observó el efecto contrario (RM 0.10; IC95% 0.02 a 0.48). La falta de control prenatal oportuno se asocia con la presencia de anemia, deficiencia de hierro y zinc. Probablemente la depleción de hierro conduce a la acumulación de folato eritrocitario.

Palabras clave: Adolescencia, nutrición, embarazo, vitamina A, hierro, zinc, folato.

INTRODUCTION

Pregnant teenagers are recognized as a nutritional risk group because of the presence of biological, social as well as psychological factors that make them more prone to present prenatal problems (1).

Pregnancy risks for a teenager are not only related to maternal problems, such as inadequate weight gain - whether it is deficient or excessive -, acute pregnancy hypertension, ferropenic anemia and vaginal infections on top of emotional disorders but also this group of women and their offspring tend to have higher neonatal morbidity associated to prematurity and growth retardation (2,3).

As far as the nutritional needs of pregnant teenagers are concerned, most of existing recommendations are simply weak substitutes for adult needs. Even within these limits, it is important to indicate that teenagers frequently have an insufficient intake of vitamins and minerals. There are many indications that iron, zinc, calcium, vitamin A, riboflavin, folic acid and pyridoxine are often deficient (4,5).

On the other hand, it often occurs that the pregnant teenager visits the prenatal care clinic rather late (6), so the areas requiring special attention at each stage of the pregnancy must be identified so as to plan preventive as well as nutritional strategies adequate for the gestational age when prenatal care begins.

On these bases, the goal of the present study was to evaluate the prevalence of specific nutritional deficiencies according to gestational age when starting prenatal care.

METHODS

For this study, all teenagers who attended the prenatal care clinic of the Adolescent Clinic (AC) of the Instituto Nacional de Perinatología (INPer) for the first time were invited to participate in consecutive form for a six months period. Nutritional assessment evaluation is part of the routine studies of the AC, so no written consent was requested. All women answered a questionnaire to obtain information about age, pre-pregnancy weight, date of last menstrual period, onset of menarche and number of pregnancies. Later, weight and height were evaluated and a 5 mL of blood sample was taken to determine:

- Hemoglobin using an automatic counter (Coulter Counter T-830, USA). Hemoglobin determinations were made daily. Two commercial controls were made every day with assigned values, which enabled us to evaluate precision (3% and 2%, respectively). Values used as cut-off points correspond to those proposed by the USA Center for Disease Control, corrected for altitude (2240 m over sea level) and gestational age and were 120, 115, 122 g/L for the first, second and third pregnancy trimesters respectively (7).
- Ferritin was determined by ELISA kit (OPUS, Dade-Behringer, Illinois, USA). Samples were all processed in one day and three internal controls were included (high, medium and low) with assigned values that showed adequate precision (<5%). When ferritin concentration showed <12 μg/L, it was considered as iron depletion (8).
- Erythrocyte folate was determined by radioimmunoassay through a commercial kit (Gamacounter, Dualcount, Abbott, USA). As previously mentioned, all samples were evaluated in one day using an internal program of quality control. To evaluate folate nutritional status, the criteria proposed by Magnus and Caudill were used and they corresponded to 148 ng/mL (322 nmol/mL) for women with <26 weeks of pregnancy and 118 ngl/mL (257 nmol/mL) for the others (9,10).
- Serum zinc was evaluated by mass spectrophotometry with a counter (Pelkin-Elmer, USA). The cut-off point was adjusted according to gestational age and corresponded to 73, 60 and 54 mg/dL for each pregnancy trimester (11).

The samples corresponding to determinations made with a commercial kit were separated and frozen at -70°C to be quantified synchronically by duplicate and in each case the variation coefficient was less than 6%.

In the cases where anemia or some specific deficiency was found, nutritional advice and specific management was granted without cost.

For data analysis, dispersion and central tendency measurements were calculated. Considering distribution characteristics, ferritin values were analyzed through geometric mean and dispersion was calculated from natural distribution logarithm.

Upon analyzing concentrations of micronutrients, it was found that there was no significant difference between women who began prenatal care between the 25th and the 32nd week of pregnancy and those who visited the clinic after this period. Thus, the following tests were made dividing the women into two groups: those with early prenatal care (<25 weeks) and late prenatal care (≥25 weeks), considering the pertinent corrections for gestational age.

To establish differences, t tests and χ^2 tests were used for independent samples, depending on distribution nature. The odds ratio was calculated and confident intervals were estimated according to the Woolf method (12). All information was processed using the Statistical Program for Social Science (SPSS version 10,0).

RESULTS

175 pregnant teenagers were invited to the study, 12 were excluded for lack of information, with 163 teenagers remaining. This sample represents 41% of the total of teenagers cared for yearly at the INPer.

Table 1 shows that mean age was 15 years, which coincides with onset of active sexual life. This indicates that pregnancy occurred in the first year after beginning of active sexual life. Pre pregnancy body mass index (BMI), was within the recommended margins (from 20 to 25) (13) but with a leftward deviation, that is, with a clear tendency towards underweight. As an example of the aforesaid, weight relationship with the expected figures for weight and gestational age was also within the lower recommended limit (14). Average pregnancy age at beginning of prenatal care was 27 weeks, which reflects late prenatal attention. However, it is important to indicate that almost one third of the women visited the clinic before 20 weeks of pregnancy.

Table 2 presents concentration of various metabolites related to maternal nutrition. Hemoglobin, ferritin and zinc showed significantly lower concentrations in women who visited prenatal care in the third trimester. It is interesting to note that erythrocyte folate concentration (which is a store indicator) was significantly higher in women who began prenatal care after the 32nd week of pregnancy.

Table 3 shows deficiency prevalence according to gestational age at beginning of prenatal care. As may be observed, anemia, iron depletion and zinc deficiency was more frequent between teenagers who began prenatal care rather late. In fact, prenatal care ≥25 weeks of pregnancy mean at risk of 5.11, 2.5 and 2.9 times to present anemia, iron depletion or zinc deficiency respectively. In relation to folate deficiency, late prenatal care seems to be an apparent "protecting factor" (OR. 0.10 IC 95% 0.02- 0.48).

TABLE 1
General characteristics of the studied group
n=163

Indicator	Mean ± sd	Range
Age (years)		
* chronological	15 ± 1	11-17
* menarche	11 ± 1	9-15
* gynecological*	3 ± 1	1-8
* onset of sexual life	15 ± 1	11-16
Gestational age at onset of prenatal care, weeks	27 ± 7	6-40
Height, cm	155 ± 6	130-170
Pregestational BMI	21 ± 3	19-26
% Weight/height and gestational age**	97 ± 12	74-144

* Gynecological age= Chronological age – menarche age
** According Arroyo et al (14)

TABLE 2
Biochemical indicators of nutritional status according to weeks of pregnancy at beginning of prenatal care

	Weeks of pregnancy 6-24 (n=53)	25-32 (n=65)	>32 (n=45)	ANOVA	p
Hemoglobin g/L	123 ± 15	120 ± 10	118 ± 13	5.48	0.005
Ferritin µg/L *	12.55 (10.92 – 14.49)	6.95 (6.29- 7.68)	6.46 (5.76 – 7.26)	8.24	0.005
Erythrocyte folate nmol/L	190 ± 72	233 ± 89	231 ± 71	5.56	0.004
Zinc µg/dL	72 ± 12	65 ± 12	66 ± 10	5.61	0.004

* geometric mean (± sd)

TABLE 3
Prevalence of nutritional deficiency by age at beginning of prenatal care

	Prenatal control weeks <25 n (%)	≥25 n (%)	Odds ratio (CI 95%)
Anemia	44/53 (83.0)	83/110 (75.5)	5.11 (2.38- 10.96)
Iron deficiency	26/53 (49.0)	85/110 (78.0)	3.53 (1.75- 7.10)
Zinc deficiency	6/53 (11.4)	30/110 (27.3)	2.94 (1.14-7.58)
Folate deficiency*	11/53 (20.7)	2/77 (2.6)	0.10 (0.02- 0.48)

DISCUSSION

From an obstetrical point of view, the population studied is not considered of high risk because its gynecological age averages three years, so no obstetrical complications are expected. However, it is important to indicate the fact that it is a group that begins a pregnancy being underweight and that in general remains close to the lower weight limit expected for height and gestational age.

Anemia prevalence represented a health problem in the studied sample since among the women with early prenatal care it was of 20% while in those with late prenatal care reached 57%, this coincides with the information about Mexican adult population which varies between 25 and 40%, depending upon the source consulted (15-18), and is even higher than that of adult pregnant women cared for in the same institution (19). It is important to notice that in this population, iron depletion is by far the most frequent cause of anemia, so that it is basic to promote adequate iron nutrition from puberty through menopause, because it is within this stage that women are exposed to the risk of presenting a negative balance of this nutrient, due to increase loss during menstrual periods (20). Some authors suggest that throughout women's reproductive life iron supplements should be given (120 mg elementary iron/once a week) at regular intervals (21,22).

As to zinc deficiency, although its prevalence is not as high as that of iron, the increase in the number of cases observed among women with late prenatal care suggests the need to supplement this nutrient, particularly if it is considered that this deficiency is related to low birth weight. Nevertheless, this point is still being debated (23,24).

Finally, the pattern shown by erythrocyte folate seems to indicate, as reported above, that late prenatal care paradoxically has a protecting effect against folate deficiency. In reality, the effect observed is due to the high prevalence of iron deficiency, which translates into the inability of the body to synthesized hemoglobin (25) and thus folate deposit is increased. In studies of iron supplements given to a population with high anemia prevalence have shown a significant decrease of folate store (26).

As a corollary, we may say that in this group, iron was the most affected nutrient in teenagers that did not have prenatal care and routine iron supplements should be given as early as possible.

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Recibido: 22-03-2002
Aceptado:23-01-2003