ORIGINAL ARTICLE

Night blindness among adolescent pregnant women attending a teaching maternity hospital in the Northeast Region

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Abstract

Objectives: to assess the prevalence of night blindness among pregnant adolescents assisted at a public maternity hospital in Northeast Brazil and to examine its association with socioeconomic, nutritional, and obstetric variables.

Methods: prospective descriptive study including 126 pregnant adolescents, followed from the beginning to the end of pregnancy. Information was collected on the presence of night blindness, pre-pregnancy and late-pregnancy nutritional status, weight gain, anemia, vitamin A intake, and socioeconomic and obstetric conditions. Fisher's Exact Test was used for statistical analysis (p<0.05) and software Nutwin.

Results: the prevalence of night blindness was 20.6%. Although no statistically significant associations were found, the condition was more frequent among younger adolescents, those without a partner, with lower education and income, inadequate sanitation, primiparity, gynecological age under two years, anemia, preterm or cesarean delivery, overweight, and excessive gestational weight gain.

Conclusion: the prevalence observed reflects the high nutritional and social vulnerability of this population. Systematic investigation of night blindness during prenatal care may represent an important strategy for preventing and controlling vitamin A deficiency and reducing maternal and perinatal complications.

key words *Vitamin A deficiency, Night blindness, Pregnancy in adolescence*

http://dx.doi.org/10.1590/1806-9304202620230256-en

Introduction

Night blindness (XN) is the difficulty in vision adaptation to low light or darkness, and it is the first functional manifestation of vitamin A deficiency (VAD),[1,2] denoting a subclinical deficiency. The assessment of this ocular symptom is a validated and widely employed indicator in population-based studies, particularly among the maternal-child group, which is considered highly vulnerable to vitamin A deficiency.[3]

Globally, it is estimated that 6.2 million women (5.8%) develop gestational XN. In Brazil there are no national-level data regarding this prevalence. However, a study conducted in Ethiopia reported a general prevalence of night blindness among pregnant women of 19.32%.[4] These figures are concerning, as studies indicate that this ocular symptom is strongly associated with adverse gestational outcomes and increased rates of maternal and infant morbidity and mortality.[5]

Vitamin A (VA) plays a critical role during pregnancy, as it is essential for fetal visual development and maternal ocular integrity. Its deficiency may lead to night blindness due to the impaired regeneration of the visual pigment in the retinal rods.[6] It plays a crucial role in the functional capacity of reproductive organs. It is also associated with skeletal development, immune system strengthening, and the development and maintenance of epithelial tissue, and is essential for normal embryonic development.[7] Consequently, a deficiency of this vitamin can compromise pregnancy outcomes.

Traditionally, adolescents are not included in the high-risk group for VAD. However, they stand out as a nutritionally vulnerable population group, owing to the increased demand for nutrients necessary to growth and maturation, coupled with frequent lifestyle changes.[7] In the case of pregnant adolescents, the overlap of physiological and psychosocial processes further amplifies nutritional needs, substantially increasing the risk of deficiencies and adverse maternal and fetal outcomes.[8]

Given the relevance of VAD and the paucity of national estimates regarding XN prevalence during pregnancy, and considering that the XN indicator is currently recognized as a robust predictor of VAD vulnerability, this study aimed to assess the occurrence of XN and its association with socioeconomic, nutritional, and obstetric variables in pregnant adolescent women attending a public maternity hospital located in the Northeast Region of Brazil.

Methods

This is a prospective, descriptive, and observational study conducted between October 2011 and March 2013 with 126 pregnant adolescents aged 12 to 18 years, corresponding to 5% of the adolescents who attended prenatal care in 2010 at a reference center for high-risk maternal and child care in a Northeast capital.

Participants were included with up to 20 gestational weeks, without recent use of vitamin-mineral supplements containing vitamin A, and up to five months before conception, without diseases in the pre-gestational period, non-smokers, and with a single fetus.

For data collection, two questionnaires were used. The first was applied at the initial contact with the pregnant adolescent, containing information on socioeconomic, obstetric, anthropometric, and dietary conditions, as well as the investigation of XN symptoms. The second survey, administered prior to and/or after delivery, addressed data on prenatal care, use of food or drug supplements containing vitamin A, and the presence of XN symptoms. Furthermore, the medical records and charts of pregnant women and newborns (NB) were consulted to obtain information concerning neonatal and gestational complications, in addition to data on the NB.

For the sociodemographic data, sanitation conditions were considered adequate when the following services were available: water supply connected to the public network with internal plumbing; regular waste collection; sewage connected to the public network or a septic tank. Conversely, conditions were considered inadequate if any of these sanitation services were unavailable.

For the obstetric indicators, gynecological age was defined as the interval between menarche and pregnancy, and was categorized according to the risk levels as: ≤ 2 years and ≥ 2 years.[9] Preterm delivery was defined as one that occurred before 37 weeks of pregnancy.

For the anthropometric assessment, the Body Mass Index for gestational age was used, adopting the recommendations of the Institute of Medicine[10,11] and the Food and Nutrition Surveillance System.[12]

Pre-gestational weight information was self-reported by the pregnant adolescent, considering a weight measured up to two months before pregnancy. If the information was unknown, the weight measured at the first prenatal consultation was considered, along with her height.

The adequacy of total gestational weight gain adequation was estimated according to the recommendations of the Brazilian Ministry of Health ,[13] which stipulates a range of weight gain based on the pre-gestational nutritional status. Accordingly, the classification of total weight gain during pregnancy was determined as below the lower limit (Below), above the upper limit (Above), or within the recommended range (Adequate), according to each nutritional status category.[13]

To estimate food consumption, three 24-hour food recalls were applied, one at the initial contact with the pregnant adolescent, the second between 20 and 28 gestational weeks, and the third after 28 gestational weeks. The interval between applications was ≥5 weeks, and one survey day corresponded to a weekend (Sunday) or a holiday. The quantitative analysis of macro and micronutrients from 24-hour recall was performed using the Nutritional Support Program – Nutwin software, version 1.5.[14]

To characterize the adequacy and inadequacy of vitamin A intake, the EAR (Estimated Average Requirement = 530μg RE) was used as the cutoff point. For this purpose, the mean values of vitamin A intake, obtained from the three 24-hour recalls, were submitted to energy adjustment and correction for intra- and interpersonal variability using analysis of variance (ANOVA). After obtaining the adjusted nutrient distribution, food intake was assessed using the method described by the Institute of Medicine (IOM).[15]

The method chosen to investigate the presence of gestational XN at the end of pregnancy (pre-labor or immediate postpartum), was the WHO standardized interview.[16]

Pregnant adolescents were considered to have iron deficiency anemia when hemoglobin (Hb) values were less than 11g/dL.[12,17]

The variables were analyzed descriptively using frequencies, measurements of central tendency, and dispersion. Proportions were compared using Fisher's Exact Test, adopting a 5% significance level ($p<0.05$).

This study received approval from the Research Ethics Committee of UFPI, Brazil (protocol nº. 0018.0.045.00-10), in accordance with national standards and the principles of the Declaration of Helsinki. Written informed consent was obtained from all pregnant adult participants. In the case of pregnant adolescents, written informed consent was obtained from their legal guardians, and assent was obtained from the adolescents themselves. Participation was voluntary, and confidentiality and anonymity were fully guaranteed.

Results

Regarding the socioeconomic and demographic characteristics, the prevalence of XN on the 126 pregnant adolescents studied was

Table 1

Sociodemographic characteristics and gestational XN in pregnant adolescents attending a teaching maternity hospital in Teresina-PI, Brazil, (2011- 2013).

Variables	Sample (n=126)		Gestational XN				*p**
			Yes		No		
	n	%	n	%	n	%	
Maternal age (years)							
≤ 15	47	37.3	11	23.4	36	76.6	0.850
16 - 18	79	62.7	15	19.0	64	81.0	
Schooling (years)							
4 - 8	84	66.7	19	22.6	65	77.4	0.492
> 8	42	33.3	07	16.7	35	83.3	
Per capita income							
≤ ½ minimum wage	78	61.9	20	25.6	58	74.4	0.112
> ½ minimum wage**	48	38.1	06	12.5	42	87.5	
Color							0.548
White	19	15.1	06	31.6	13	68.4	
Black	17	13.5	04	23.5	13	76.5	
Mixed-race/Brown	89	70.6	16	18.0	73	82.0	
Other	01	0.8	00	0.0	01	100.0	
Marital status							0.653
With a partner	82	65.1	16	19.5	66	80.5	
No partner	44	34.9	10	22.7	34	77.3	
Basic sanitation							0.134
Adequate	93	73.8	16	17.2	77	82.8	
Inadequate	33	26.2	10	30.3	23	69.7	

*Fisher's exact test; ** Minimum wage: R$ 545.00 (2011).

20.6% (n=26). The mean age was 16 (SD ± 1.42) years, with the majority being ≥16 years old (62.7%). Most lived with adequate sanitation conditions (73.8%), had a partner (65.1%), self-declared as Brown or mixed-race (70.6%), had four to eight years of formal education (66.7%), and had a per capita family income below half a minimum wage (62.8%). Statistical analysis showed no association between XN and socioeconomic variables (Table 1).

Regarding obstetric characteristics (Table 2), there was no statistically significant association between XN and these variables (p>0.05). However, it was observed that the XN frequency was higher among primiparas, adolescents who accepted the pregnancy, attended six or more prenatal consultations, had a gynecological age <2 years, those who had anemia, had cesarean delivery, and delivered preterm infants.

Table 2

Obstetric characteristics and gestational XN in pregnant adolescents attending a teaching maternity hospital in Teresina-PI, Brazil, (2011-2013).

Variable	Sample (n=126)		Gestational XN				p*
			Yes		No		
	n	%	n	%	n	%	
Pregnancy acceptance							
Yes	91	72.2	21	23.1	70	76.9	0.333
No	35	27.8	05	14.3	30	85.7	
N° of consultations							
<6	49	38.9	09	18.4	40	81.6	0.654
≥6	77	61.1	17	22.1	60	77.9	
Gynecological age							
≤2 years	24	19.0	07	29.2	17	70.8	0.269
>2 years	102	81.0	19	18.6	83	81.4	
N° of pregnancies							
Primipara	107	84.9	24	22.4	83	77.6	
2 or more	19	15.1	02	10.5	17	89.5	0.359
Type of delivery							
Vaginal	72	57.1	14	19.4	58	80.6	0.825
Cesarean	54	42.9	12	22.2	42	77.8	
Anemia							
Yes	35	27.8	08	22.9	27	77.1	0.806
No	91	72.2	18	19.8	73	80.2	
Prematurity							
Yes	14	11.1	04	28.6	10	71.4	0.485
Não	112	88.9	22	19.6	90	80.4	

*Fisher's exact test.

Table 3

Nutritional characteristics and gestational XN in pregnant adolescents attending a teaching maternity hospital in Teresina-PI, Brazil, (2011-2013).

Variable	Sample (n=126)		Gestational XN				p*
			Yes		No		
	n	%	n	%	n	%	
Pre-gestational nutritional status							0.443
Low weight	6	4.8	0	0.0	06	100.0	
Adequate	104	82.5	21	20.2	83	79.8	
Overweight/obesity	16	12.7	05	31.2	11	68.8	
Final nutritional status of pregnancy							0.501
Low weight	32	25.4	06	18.8	26	81.3	
Adequate	60	47.8	10	16.7	50	83.3	
Overweight/obesity	34	26.9	10	29.4	24	70.6	
Adequacy in gestational weight gain							0.389
Below	32	25.4	05	15.6	27	84.4	
Adequate	50	39.7	09	18.0	41	82.0	
Above	44	34.9	12	27.3	32	72.7	
Vitamin A intake							0.819
Adequate	45	35.7	10	22.2	35	77.8	
Inadequate	81	64.3	16	19.8	65	80.2	

*Fisher's exact test.

Regarding nutritional status (Table 3), 64.3% of pregnant women had an inadequate dietary vitamin A intake, however, no significant association was found with gestational XN or anthropometric measures. Nonetheless, a higher frequency of night blindness was observed among overweight adolescents, those with weight gain above the recommended range, and with insufficient vitamin A intake.

Discussion

XN prevalence among adolescents in the present study (20.6%) was considered a major concern. This index is significantly higher than the 5% threshold established by the International Vitamin A Consultative Group (IVACG), which already classifies Vitamin A Deficiency (VAD) as a public health problem.[2]

Although no significant association was found with socioeconomic variables, the problem was more frequent among adolescents with higher social and biological vulnerability, those who were younger, with less schooling and lower income, poor sanitation, reduced gynecological age, anemia, excessive weight gain, and preterm or cesarean delivery. These findings corroborate the literature, which links vitamin A deficiency to poverty, restricted food access and increased exposure to infectious processes, primarily affecting developing countries.[18]

Despite the lack of statistical association, when a population is vulnerable to nutritional deficiencies, vitamin A deficiency may occur without clinical signs detectable in mothers. However, it can lead to multiple consequences for the mother-child dyad, favoring morbidity and mortality for both, due to conditions of exclusively nutritional immunodeficiency.[19]

A study conducted in the United States[20] also evidenced that inadequate vitamin A status during pregnancy is more likely to occur in less favored populations. Likewise, a higher percentage of women with better socioeconomic status (higher per capita household income and fewer residents) and higher educational attainment are determinants of a lower prevalence of gestational XN as they have greater access to healthy food, and consequently, to vitamin A-rich foods, and lower exposure to infections and parasites.[18]

A growing nutritional imbalance was observed throughout pregnancy, with an increase in both underweight and excessive weight gain. Ultimately, night blindness was more frequent among adolescents who were overweight, obese, and with weight gain above the recommended range, although without statistical significance. Excessive body weight may reduce the bioavailability of fat-soluble vitamins in plasma due to lower intake of these nutrients and/or greater deposition in the adipose tissue, which, being fat-soluble, favors vitamin A deficiency and the clinical manifestation of the symptom.[21,22,23]

The high proportion of inadequate vitamin A intake (64.3%) underscores the significance of dietary assessment, even with no statistical association with night blindness. This inadequacy has been previously described in pregnant women from different socioeconomic contexts and may be related to nutritional imbalances common in adolescence. Overweight, also observed in this study, may compromise the bioavailability of fat-soluble vitamins, thus favoring nutritional deficiencies. The adolescents had an intake below the estimated average requirement (EAR), with a probability of adequate intake less than 85%, which indicates a risk for VAD.

It is recommended that more effective preventive and therapeutic measures for vitamin A deficiency and the adequate control of weight gain be adopted before or during pregnancy.[18] Proactive strategies include nutritional education and diet diversification, emphasizing the daily consumption of vitamin A-rich foods, in addition to the assessment of night blindness in routine prenatal care, due to its deleterious consequences to maternal and child health.[13] Nutritional monitoring should be considered a priority action, as a study has demonstrated its protective effect against the occurrence gestational night blindness.[24] It is also essential to expand the availability and access to foods with high micronutrient bioavailability, promoting a healthy and sustainable diet.[25] Another frequently used strategy in at-risk populations is t vitamin A supplementation; however, in pregnant women, it must be performed with caution, as the inadequate administration may result in toxicity and fetal malformations.[26]

The limitations of this study include the age of the data (2011-2013), the use of self-reported data for the investigation of night blindness, which is subject to recall bias, and the relatively small sample size, which may have limited the identification of statistical associations. Regarding dietary inadequacy, attention must also be drawn to the limitations of the food survey method and the differences between food composition tables, which present a multiplicity of information that may have led to an underestimation of the nutrient intake.

Key strengths include the prospective design, the use of standardized data collection instruments, the rigorous sample selection, and the focus on a population with acknowledged nutritional vulnerability. These factors contribute to enhancing the understanding of the problem and informing maternal and child health policies.

The prevalence of night blindness among pregnant adolescents was high, reflecting significant nutritional and social vulnerability. Although statistically significant associations were not observed, the condition occurred more frequently among adolescents in higher-risk contexts, such as low educational attainment and income, poor sanitation, anemia, and excessive weight gain.

The systematic investigation of this problem during prenatal care can constitute a relevant strategy to prevent and control vitamin A deficiency. Furthermore, it can inform educational, nutritional and assistance actions aimed at reducing maternal and perinatal complications.

Author's contribution

Lima GSP, Faria EC, Barros-Mazon S: conceptualization, analysis, data interpretation, manuscript writing and critical review. Castro LC; Neves AC, Timóteo TL: analysis, data interpretation, manuscript writing and critical review. All authors approved the final version of the article and declared no conflicts of interest.

Data availability

All datasets supporting the study are included in the article.

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Received on August 9, 2024
Final version presented on October 1, 2025
Approved on October 2, 2025

Associated Editor: Nathália Souza