ORIGINAL ARTICLE

Assessment of gestational night blindness in women receiving care at a public maternity hospital in Rio de Janeiro, Brazil

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Abstract

Objectives: to investigate the prevalence of gestational night blindness (XN) among women receiving care at a public maternity hospital in Rio de Janeiro between 2021 and 2023 (GII) and to compare it with the prevalence observed at the same facility in 2007–2008 (GI).

Methods: this is a descriptive prevalence study based on data from two cross-sectional studies. Gestational XN was assessed in the immediate postpartum period using a validated interview method proposed by the World Health Organization. Maternal data were collected through interviews and medical record reviews. The chi-square and Fisher's exact tests were used, and crude odds ratios (OR) with 95% confidence intervals (95%CI) were estimated.

Results: a total of 436 postpartum women were evaluated (GI=172; GII=264). The prevalence of gestational XN was found to be 2.8% (n=12), being 4.2% in GII and 0.6% in GI, in the crude comparison by Fisher's exact test (p=0.033). The small number of events warrants a cautious interpretation of the finding. Given the results of the exploratory analysis regarding gestational XN and inadequate sanitation conditions (crude OR=6.4; 95%CI=1.6–25.4; r_ϕ=14.4%) and alcohol consumption during pregnancy (crude OR=4.5; 95%CI=1.4–14.8; r_ϕ=13.2%), these associations should be interpreted as hypotheses.

Conclusions: as this was an exploratory analysis, the results are suggestive and warrant further investigation in studies with greater statistical power. The findings highlight the importance of monitoring for gestational XN during prenatal care.

Key words *Vitamin A deficiency, Night blindness, Pregnancy, Postpartum period*

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Introduction

Vitamin A deficiency (VAD) is a public health issue in several regions worldwide, particularly affecting the maternal and child population. In Brazil, the prevalence of VAD in pregnant women increased across the decades, rising from 9.5% until 1990, to 10.8% in the 2000s and 17.8% in the 2010s. Furthermore, more than 10% of Brazilian women of childbearing presented VAD.[1,2] VAD during pregnancy and early childhood is a global concern, particularly in developing countries such as Brazil.[1,3,4,5]

Subclinical Vitamin A deficiency occurs when the concentration of the vitamin in tissues is low enough to lead to adverse health consequences, even in the absence of clinical manifestations, that is, when signs of xerophthalmia are not present.[6]

Gestational night blindness (XN) is characterized by the difficulty seeing at night or in environments with low light.[6] It is the first subclinical ocular manifestation of VAD, which can occur, particularly, in the third trimester of pregnancy, a period of intense maternal-fetal transfer of the nutrient.[7] Women with this ocular symptom have an increased risk of mortality during pregnancy and in the period up to one year after delivery, as well as higher risk of neonatal mortality is higher within this group.[8]

The global prevalence of VAD between 1995 and 2005, according to the presence of gestational XN was estimated at 7.8%, corresponding to approximately 9.7 million of pregnant women. Considering low serum retinol concentrations, 15.3% of pregnant women – about 19 million women – were affected.[9] More current data were not found.

It is important to highlight that there are no population-based data on gestational XN prevalence in Brazilian women,[10] however, studies across different regions of Brazil have found high prevalences, varying from 9.9% in Rio de Janeiro, in the Southeast region, to 11.5% in the state of Acre, in the North region of the country.[8,10]

A previous study conducted at a teaching maternity hospital of the Federal University of Rio de Janeiro (*Maternidade Escola da Universidade Federal do Rio de Janeiro* - ME/UFRJ) observed a prevalence of gestational XN of 0.6% in the period between 2007 and 2008.[11] The low prevalence may be explained by the expansion of nutritional coverage concomitant with prenatal visits since 2005 in the aforementioned maternity hospital.[8]

In this context, the aim of this study was to investigate and compare the prevalence of gestational XN among postpartum women receiving care at a public maternity hospital in Rio de Janeiro (2021-2023) with that found in the 2007-2008 period, in addition to identifying the factors associated with the outcome.

Methods

This is a descriptive prevalence study, conducted with data from two cross-sectional studies carried out with postpartum women who received care at the ME/UFRJ, an institution affiliated with the Brazilian Unified Health System (SUS), in the periods between 2007 and 2008 (GI) and 2021 and 2023 (GII).

At the studied maternity hospital, in addition to pregnant women who underwent prenatal care on-site, women whose prenatal care took place in other health units of the municipality and who were referred by the Regulation System (SISREG) for delivery at the facility are also treated. The ME/UFRJ is a teaching hospital located in the Southern Zone of the city and features a multidisciplinary team for both standard and high-risk prenatal care. Women who undergo prenatal care at the institution are screened for gestational XN and receive nutritional counseling during consultations to prevent this problem, unlike what happens in other health units in the municipality of Rio de Janeiro.

The inclusion criteria were: singleton pregnancy, maternal age (≥ 20 years), and immediate postpartum period (up to 12 hours after delivery). Women with chronic diseases (except obesity) were excluded.

In addition to the investigation of gestational XN, sociodemographic, clinical, anthropometric, obstetric, and prenatal data were collected for both groups. Dietary information was obtained only for GII through the application of a semi-quantitative food frequency questionnaire.[12]

Data collection for GII took place from August 2021 to February 2023 and followed the same procedures adopted for GI[11], through the review of maternal medical records and interviews conducted by a trained and supervised team.

The study population consisted of adult women who received care at the studied health unit during prenatal care and/or delivery/postpartum.

The study sample was convenience-based and comprised data from postpartum women divided into two groups: group I (GI), using data from a study conducted in 2007–2008;[11] and group II (GII), with data collected between 2021 and 2023. The recruitment of participants for both groups took place in the postpartum wards on all weekdays, except weekends.

The dependent variable was the diagnosis of gestational XN, analyzed as a categorical variable (yes/no).

The independent variables were analyzed as categorical variables:

- Study groups (GI/GII);

- Sociodemographic variables: maternal age at conception(≥35 years, <35 years), marital status (living with a partner, living without a partner), educational attainment (≥ complete high school, < complete high

school - or: complete high school, incomplete high school), self-reported skin color (White, Black, Brown, and other), place of residence (Southern Zone of the city, other regions of Rio de Janeiro), housing sanitation conditions (classified as inadequate when one or more of the following services were absent: piped water, sewage system, and garbage collection; and adequate when all services were present in the household);

- Clinical, obstetric, and prenatal care variables: number of pregnancies (mean and standard deviation – SD, numerical variable), number of deliveries (mean and SD - numerical variable), history of abortion (yes/no), use of vitamin A supplements during pregnancy (yes/no), number of prenatal visits (< 6, ≥ 6 visits), prenatal care performed at ME-UFRJ (yes/no) - available only for GII, number of nutritional care consultations during prenatal care (< 4 consultations, ≥ 4 consultations), presence of gestational complications (yes/no), and occurrence of gestational anemia (yes/no);

- Social habits: cigarette use during pregnancy (yes/no), alcohol consumption during pregnancy (yes/no), and illicit drug use during pregnancy (yes/no);

- Nutritional variables: pre-gestational nutritional status according to pre-gestational BMI categorized as: underweight/normal weight and overweight/obesity; adequacy of gestational weight gain classified as: inadequate, adequate, and excessive;

- Dietary variables (available only for GII) categorized according to weekly consumption of: eggs; liver; green vegetables; orange vegetables; green and orange vegetables; eggs, liver, green and orange vegetables (yes/no).

The assessment of VAD nutritional status was performed using the functional assessment for the investigation of gestational XN for both groups, following the same procedures, through a standardized interview proposed by the World Health Organization[13] and validated,[14] aiming to minimize measurement bias.[8,11] Dietary assessment was available only for GII.

The validated interview for the identification of gestational XN was administered by a trained nutritionist, considering the occurrence of the ocular symptom in any gestational trimester, and consisted of three questions:

1. "Do you have difficulty seeing during the day?", 2. "Do you have difficulty seeing in low light or at night?", and 3. "Do you have night blindness (XN)?"

Cases of XN were considered when the answer to the first question was no and at least one answer to the second or third question was yes.[13,14]For the interpretation of data on the consumption of foods rich in VA, weekly consumption frequency was considered based on the study by Christian *et al*.[15]

Foods of animal and/or plant origin with at least 120 µg of retinol equivalents per 100 g were considered sources of VA, in accordance with Resolution (RDC) No. 54 of November 12, 2012.[16] The Brazilian Food Composition Table was used to consult the amount of retinol equivalents per 100 g of the food.[17] Thus, the frequency of weekly consumption of liver, eggs (yolk), and green and orange vegetables was considered for data interpretation.

For anthropometric assessment, self-reported pre-gestational weight (kg) or weight prior to the 14th week of gestation, height, and pre-delivery weight were collected from medical records. Pre-gestational Body Mass Index (BMI) was calculated and evaluated according to WHO cutoff points.[18] Total gestational weight gain was calculated by subtracting pre-gestational weight from pre-delivery weight. In the absence of pre-delivery weight, the weight from the last prenatal visit was used when the interval between the visit and delivery was less than or equal to one week. Gestational age at delivery was considered for the evaluation of the adequacy of total gestational weight gain during pregnancy.[19]

For clinical assessment, gestational complications (gestational diabetes mellitus, hypertensive disorders of pregnancy, premature rupture of membranes, and urinary tract infection) were identified based on medical records and recommendations from the Brazilian Ministry of Health.[20]

Gestational anemia was defined as hemoglobin (Hb <11 g/dL), regardless of gestational age.[20]

To minimize missing data, medical records were searched to ensure the completeness of the database. Data analysis was adjusted according to the number of available observations for each variable.

In the statistical analysis, measures of dispersion, central tendency, mean, and SD were calculated. Chi-square or Fisher's exact tests were employed to evaluate the association between categorical variables and the outcome. For tables with small expected frequencies, Fisher's exact test was used. The Phi coefficient, when presented, was used solely as a descriptive measure of the magnitude of association in 2 x 2 tables. Crude odds ratios (OR) and 95% confidence intervals (CI) were calculated for variables that showed association in the tests. A significance level of 5% was considered for all applied tests. It is noteworthy that this is a convenience sample, and any and all statistical methodology applied in this study should be viewed with caution, as it does not necessarily possess an inferential character, but rather serves as exploratory and descriptive analyses of the data from the studied sample.

The analyses were performed using the statistical software packages Statistical Package for the Social Sciences (SPSS) version 25, Stata SE 19.0, or BioEstat 5.0.

The study followed the guidelines established by the Declaration of Helsinki and was approved by the

Research Ethics Committee (CEP) of ME/UFRJ (CAAE: 45619521.6.0000.5275), approval nº. 4.676.129, dated April 28, 2021. It is noteworthy that the study approved by the CEP included the use of secondary data from GI. Participants from both groups (GI and GII) signed the Informed Consent Form (ICF).

All participants received information regarding their nutritional diagnosis along with dietary counseling on fortified foods and sources of VA. VA supplementation, at a safe dose for women of reproductive age (10,000 IU/day), was prescribed to those diagnosed with gestational XN, as recommended by the World Health Organization (WHO).[21,22]

Results

The sample was composed of 436 postpartum women, with 172 evaluated in the 2007–2008 period (GI – 39.5%) and 264 evaluated in 2021–2023 (GII – 60.5%). The overall prevalence of gestational XN was 2.8% (n=12, Tables 1 and 2), accounting for 4.2% in GII and 0.6% in GI, with a significant difference observed in the crude comparison using Fisher's exact test (p=0.033). The small number of events (n=12) requires a cautious interpretation of this finding.

The mean number of pregnancies and deliveries was 2.27 (SD=1.45) and 1.48 (SD=1.31), respectively. Of the participants, 20.0% reported a history of abortion, 13.6% had no gestational complications, and gestational anemia was the most prevalent complication (23.9%). Cigarette smoking, alcohol consumption, and illicit drug use during pregnancy were reported by 6.7%, 14.4%, and 2.5% of the women, respectively. It was observed that the majority of postpartum women exhibited excess pre-gestational weight (53.1%, Table 1), and 37.7% presented weight gain above recommendations.

The sample flowchart is presented in Figure 1, and the characteristics of the study participants are described in Table 1.

Table 1

Sociodemographic, nutritional, obstetric, prenatal care, and social habits characteristics of postpartum women in groups GI (2007–2008) and GII (2021–2023). Rio de Janeiro, RJ, Brazil.

Variables	Study group				*p*
	GI (N=172)		GII (N=264)		
	n	%	n	%	
Gestational XN (n=436)					
Yes	1	0.6	11	4.2	0.033[a]
No	171	99.4	253	95.8	
Sanitation conditions (n=436)					
Inadequate	2	1.2	22	8.3	<0.001[a]
Adequate	170	98.8	242	92.0	
Marital status (n=404)					
Lives with a partner	115	79.9	206	79.2	0.881[b]
Lives without a partner	29	20.1	54	20.8	
Place of residence (n=436)					
Other regions of RJ	42	24.4	132	50.0	<0.001[b]
Southern zone	130	75.6	132	50.0	
Skin color (n=340)					
Black, Brown and others	67	87.0	186	70.7	0.004[b]
White	10	13.0	77	29.3	
Educational attainment (n=432)					
CHS	75	44.6	88	33.3	0.018[b]
IHS	93	55.4	176	66.7	
Maternal age (years) (n=435)					
>35	19	11.1	52	19.7	0.018[b]
<35	152	88.9	212	80.3	
Pre-gestational BMI (n=431)					
OW/OB	73	43.2	156	59.5	<0.001[b]
LW/E	96	56.8	106	40.5	
Abortion history (n=425)					
Yes	37	21.8	48	18.8	0.458[b]
No	133	78.2	207	81.2	

Number of prenatal visits (n=433)					
<6	14	8.1	32	12.3	0.173[b]
>6	158	91.9	229	87.7	
Received prenatal care at the ME/UFRJ (n=261)					
Yes	-	-	85	32.6	-
Alcohol consumption during pregnancy (n=432)					
Yes	15	8.9	47	17.8	0.010[b]
No	153	91.1	217	82.2	
Smoked during pregnancy (n=432)					
Yes	6	3.6	23	8.7	0.037[b]
No	162	96.4	241	91.3	

GI = group consisting of postpartum women evaluated between 2007 and 2008; GII = group consisting of postpartum women evaluated between 2021 and 2023; ME/UFRJ = *Maternidade Escola da Universidade Federal do Rio de Janeiro*; XN = night blindness; RJ = Rio de Janeiro; IHS = incomplete high school; CHS = complete high school; LW = pre-gestational low weight; E = pre-gestational eutrophy; OW = pre-gestational overweight; OB = pre-gestational obesity; [a]Fisher's exact test; [b]Chi-square test. Analyses were performed using valid cases for each variable, and variations in sample size may occur due to missing data.

Table 2

Association between sociodemographic, anthropometric, obstetric, clinical, prenatal care, and social habits characteristics of postpartum women with gestational XN. Rio de Janeiro, RJ, Brazil (2007–2008; 2021–2023).

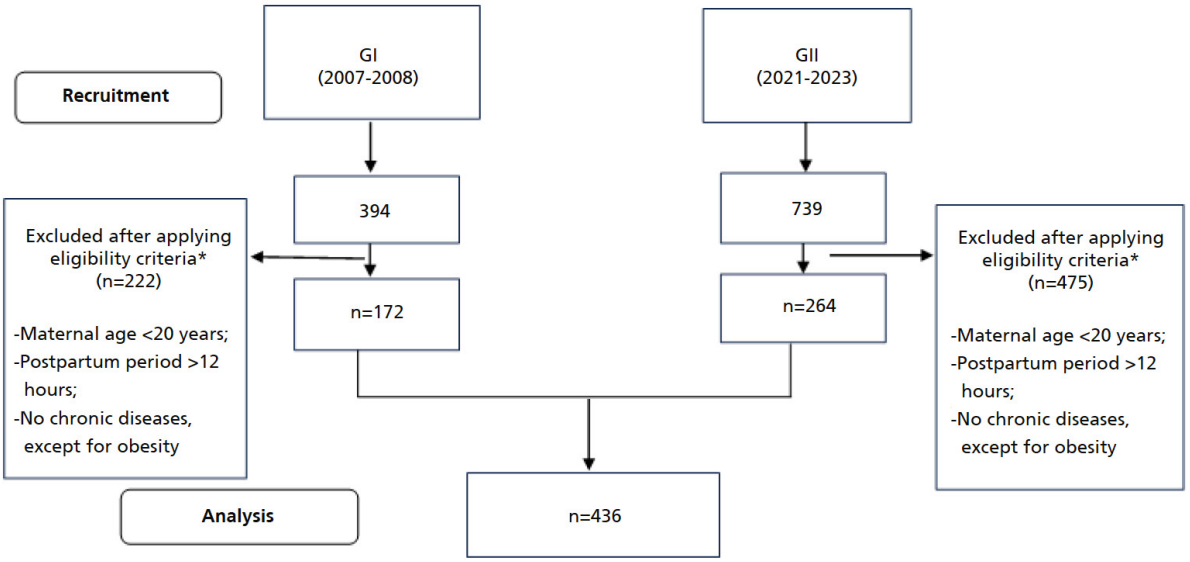
Variables	Gestational XN				p[a]/ OR_{crude}[b]; 95%CI rϕ [e]
	Yes		No		
	n	%	n	%	
Study groups (n=436)					
GI	1	88.3	1171	440.3	0.033[a]
GII [e]	11	91.7	2253	559.7	
Sociodemographic characteristics					
Maternal age (years) (n=435)					
>35	1	88.3	770	116.5	0.700[a]
<35	11	991.7	3353	883.5	
Marital status (n=404)					
Lives with a partner	1	88.3	882	220.9	0.473[a]
Lives without a partner	11	991.7	3310	779.1	
Educational attainment (n=432)					
IHS	5	441.7	1158	337.6	0.770[a]
CHS	7	558.3	2262	662.4	
Skin color (n=340)					
Black, Brown, and others	8	772.7	2245	774.5	inconclusive[a]
White	3	227.3	884	225.5	
Place of residence (n=436)					
Other regions from RJ	4	333.3	1170	440.1	0.770[a]
Southern zone	8	666.7	2254	559.9	
Sanitation conditions (n=436)					
Inadequate	3	225.0	221	55.0	0.023[a]
Adequate[c]	9	775.0	4403	995.0	OR_{crude} [b]= 6.4. (0.018; 1.6 – 25.4) rϕ = 0.13 [e]
Clinical, obstetric, and prenatal care characteristics					
Abortion history (n=425)					
Yes	11	99.1	884	220.3	0.701[a]
No	110	990.9	3330	779.7	
Number of prenatal care visits (n=433)					
<6	11	88.3	445	110.7	inconclusive[a]
>6	111	991.7	3376	889.3	

Number of nutritionist consultations (n=434)					
<4	110	883.3	3350	882.9	inconclusive[a]
>4	22	116.7	772	117.1	
Vitamin A supplements during pregnancy (n=419)					
No	99	881.8	3361	888.5	[d]
Yes	22	118.2	447	111.5	
Gestational anemia (n=431)					
Yes	22	116.7	1101	224.1	0.739[a]
No	110	883.3	3318	775.9	
Social habits					
Alcohol consumption during pregnancy (n=432)					
Yes	55	441.7	57	113.6	0.018[a]
No[c]	77	558.3	3363	886.4	OR_{crude} [b] = 4.5 (0.020; 1.4 – 14.8) rϕ = 0.14[e]
Smoking during pregnancy (n=432)[f]					
Yes	11	88.3	228	66.7	0.570[a]
No	111	91.7	3392	993.3	
Nutritional data					
Pre-gestational BMI (n=431)					
OW/OB	9	775.0	2220	552.5	0.150[a]
BP/E	3	225.0	1199	447.5	

XN = night blindness; GI = Group I, consisting of postpartum women evaluated between 2007 and 2008; GII = Group II, consisting of postpartum women evaluated between 2021 and 2023; *p*-value = significance level; ME/UFRJ = *Maternidade Escola da Universidade Federal do Rio de Janeiro;* IHS = incomplete high school; CHS = complete high school; BMI = Body Mass Index; LW = pre-gestational low weight; E = pre-gestational eutrophy; OW = pre-gestational overweight; OB = pre-gestational obesity; OR_{crude} = crude odds ratio; CI = confidence interval; [a]Fisher's exact test; [b]Chi-square test; [c]reference group – adequate sanitation conditions; non-use of alcohol during pregnancy. [d]For the variable vitamin A supplementation during pregnancy, neither the Chi-square test nor Fisher's exact test could be applied because the test assumptions were not met. [e]Phi coefficient test. Analyses were performed using valid cases for each variable, and variations in sample size may occur due to missing data.

Figure 1

Sample Flowchart.



GI = Group I, consisting of postpartum women evaluated between 2007 and 2008; GII = Group II, consisting of postpartum women evaluated between 2021 and 2023; XN = gestational night blindness; APN = prenatal care.

*Eligibility criteria were applied to 739 postpartum women in GII, and only 264 met the criteria. This ensured that the same inclusion criteria used for GI were applied.

Exploratory data from the studied sample suggest that inadequate sanitation conditions and alcohol consumption during pregnancy showed an exploratory association with gestational XN (Table 2). Specifically, pregnant women living in inadequate sanitation conditions were 6.4 times more likely to develop XN compared to those living in

adequate conditions (crude OR=6.4; 95%CI=1.6–25.4; r_ϕ=14.4%), and alcohol use during pregnancy increased the odds of developing XN by 4.5 times compared to women who did not consume alcohol (crude OR = 4.5; 95%CI=1.4–14.8; r_ϕ=13.2%).

The Phi coefficient was calculated for these variables, and both showed a weak exploratory association with gestational XN (14.4% and 13.2%, respectively; Table 2), which should be interpreted as hypotheses.

Regarding VA-rich foods, the weekly consumption of eggs; liver; green vegetables; orange vegetables; green and orange vegetables; and liver, eggs, green and orange vegetables was reported by 87.5%, 30.3%, 62.9%, 80.7%, 56.8%, and 16.3% of the postpartum women, respectively (data not shown in tables). The consumption of VA sources was not associated with gestational XN (eggs: p=0.37; liver: p=0.66; green vegetables: p=0.96; orange vegetables: p=0.50; green and orange vegetables: p=0.87; liver, eggs, green, and orange vegetables: p=0.69; data not shown).

Discussion

The overall prevalence of gestational XN was 2.8%, accounting for 0.6% in GI (2007-2008) and 4.2% in GII (2021-2023). Although the crude proportion was higher in GII, the small number of events and resulting imprecision preclude a robust conclusion regarding the temporal trend of this finding.

Inadequate sanitation conditions and alcohol consumption during pregnancy emerged as potential factors associated with gestational XN; however, establishing a definitive association was precluded by the small number of outcome events observed in the study (n = 12).

Regarding limitations, considering the 2007–2008 period (GI), the lack of information on the weekly consumption of VA-rich foods should be noted. It is noteworthy that the study was single-center, and therefore the data must be interpreted with caution. The sample was convenience-based, with data collection restricted to weekdays, which may have caused a systematic exclusion of postpartum women and resulted in limited generalizability of the findings. Furthermore, the assessment of VA-rich food consumption was performed using a non-validated instrument, although one adopted in studies involving pregnant and postpartum women. Another limitation is the small number of gestational XN cases, which precluded the use of multiple regression and more robust analyses. Additionally, missing data were observed, especially in GI; however, it was not possible to retrieve this information since secondary data from the 2007–2008 period were analyzed. Despite these limitations, the results of the study underscore the importance of monitoring gestational XN during prenatal care, particularly among pregnant women living in areas with inadequate sanitation and those who consume alcohol.

When evaluating sample characteristics, differences in basic sanitation conditions were observed between the studied periods. The proportion of postpartum women with inadequate sanitation conditions was higher in the 2021–2023 period (8.3%) than in the 2007–2008 period (1.2%). The 2021–2023 period was marked by the COVID-19 pandemic, which aggravated the poor living conditions of the Brazilian population by compounding prior political, economic, and social crises.[23] The differences observed between the study groups may have affected the comparability of the findings.

Regarding the location of prenatal care visits, in the 2021–2023 period, less than half of the postpartum women in GII received prenatal care at the studied maternity hospital, whereas the majority came from other primary healthcare units, where gestational XN screening is not routinely performed. This fact highlights the need to expand this screening to other healthcare services. We also note that postpartum women with inadequate sanitation conditions had the lowest mean number of nutritionist consultations, suggesting reduced access to nutritional care among women from more disadvantaged socioeconomic backgrounds. Chagas *et al*.[24] demonstrated that prenatal nutritional care was a protective factor against gestational XN, corroborating the importance of permanent nutritional surveillance. In their study, a significant reduction in gestational XN was observed among pregnant women who received, on average, four nutritionist consultations, with nutritional follow-up starting concurrently with prenatal care.[24]

In the same maternity hospital, in a study published in 2015, the prevalence of gestational XN of 9.9% signaled the vulnerability of women of reproductive age in the city of Rio de Janeiro to the development of Vitamin A deficiency (VAD).[8] History of abortion, anemia in the first and second trimesters, and not residing in the southern zone of the city were associated factors. It is known that episodes of abortion during reproductive life can affect VA nutritional status, depleting hepatic retinol stores for future pregnancies.[8]

A study conducted in the western Brazilian Amazon revealed the presence of significant public health problems in the region.[10] In the city of Cruzeiro do Sul, Acre, the prevalence of gestational XN and anemia was 11.5% and 39.4%, respectively. Sociodemographic characteristics (five or more inhabitants per household), environmental factors (smoking during pregnancy), and obstetric characteristics (fewer than six prenatal care visits) were

factors associated with XN.[10] Neves *et al*.[25] investigated the relationship between biomarkers of VA nutritional status (serum retinol and beta-carotene) and anemia in these pregnant women. Inadequacy of VA nutritional status during pregnancy, considering low serum retinol concentrations, has been associated with maternal anemia at delivery.[25] The authors' findings are consistent with meta-analyses conducted in low- and middle-income countries and reinforce the evidence that mitigating VAD during pregnancy improves maternal hemoglobin levels, while also reducing the prevalence of anemia and its deleterious effects during pregnancy and childbirth.[25]

Despite the international committees' recognition of its severity, the epidemiological control of VAD remains a challenge, as evidenced by recent findings from Brazil and other developing countries.[1,2,4,5,6,7,8,10,22,25,26]

Regarding alcohol consumption during pregnancy, it was found that the odds of developing gestational XN were potentially higher among women who engaged in this risk behavior during gestation. In China, women who consumed alcohol during pregnancy had a higher likelihood of developing VAD compared to those who did not,[27] corroborating our findings. Evidence indicates that XN can be a consequence of chronic alcohol consumption, and with the persistence of this habit, the ocular symptom can progress to irreversible blindness. Furthermore, alcohol is a teratogen that can easily cross the placenta and cause damage to the fetal brain and other organs.[28] In the study conducted by Saunders *et al*.[5] with adolescents in Rio de Janeiro, those who used alcohol during pregnancy also showed lower adherence to prenatal guidance, which includes reducing smoking and alcohol consumption.[5] Alcohol consumption, even in small amounts, poses a health risk.[29] Healthcare professionals involved in prenatal care are responsible for warning pregnant women, and it is strongly recommended that pregnant and lactating women abstain from alcohol in any amount.[29]

Regarding the weekly consumption of VA-rich foods, we observed in our sample that 30.3%, 62.9%, and 80.7% of the interviewees reported consuming liver, green vegetables, and orange vegetables at least once a week, respectively.

According to research on food consumption markers during pregnancy, most Brazilian pregnant women receiving primary healthcare consumed beans (80%), fruits (76%), and vegetables (74%) on the day prior to their appointment, and these foods are considered markers of a healthy diet.[30] In view of these findings, healthcare professionals should promote actions that encourage adequate and healthy eating, including the inclusion of VA-rich foods and the weekly consumption of liver as part of a main meal.

Neves *et al*.[10] consider that prenatal counseling can lead to positive lifestyle changes, such as improving diet quality by including VA food sources, thereby enhancing the nutritional status of this micronutrient.[10] The authors demonstrated that actions such as encouraging the weekly consumption of regional fruits rich in provitamin A among pregnant women in the Amazon were an effective intervention to improve the VA nutritional status of these women.[7]

In a population-based study in Nepal, the consumption of VA-rich foods, such as dark-green leafy vegetables, was a protective factor against maternal mortality in the first year postpartum.[15] These foods represent an important source of provitamin A with potent antioxidant properties, and therefore should be part of the regular diet of these women.

The findings of this study suggest a low prevalence of gestational XN in the two assessed periods. Although a higher proportion of cases was observed in the period from 2021 to 2023, the imprecision of the estimates and the small number of events preclude a robust conclusion regarding the temporal trend. In the crude comparison, the exploratory associations with inadequate sanitation and alcohol consumption during pregnancy should be interpreted as hypotheses to be investigated in studies with greater statistical power. These findings reinforce the pertinence of incorporating the screening for gestational XN symptoms into prenatal care.

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Authors' contribution

Abras AAD: conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, supervision, validation, visualization, writing – original draft, writing – review and editing.

Vieira Ma: investigation, project administration, supervision, writing – review and editing.

Lacerda ASSPN, Rodrigues LR, Leitão KBM, Moraes MC, Santos BMB: writing – review and editing.

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All authors approved the final version of the article and declare no conflicts of interest.

Data availability

All datasets supporting the results of this study are included in the article.

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