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The role of prenatal nutrition assistance on the prevalence of night blindness in pregnant adults

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Abstract

Introduction: **In developing countries, night blindness is a very common public health problem among pregnant women.**

Objective: **Evaluate the effect of the changes occurred on prenatal care concerning prenatal nutritional care on the occurrence of night blindness (XN) in adult pregnant women in public maternity hospital in Rio de Janeiro between 1999-2001 and between 2007-2008.**

Methods: **Two cross-sectional studies were conducted, been the first one conducted between 1999-2001 and the second one between 2007-2008. Were studied 402 puerperal women, 225 between 1999-2001 (GI) and 177 between 2007-2008 (GII). The gestational XN was investigated during the immediate puerperium (GI) and during the prenatal/puerperium (GII), diagnosed by the World Health Organization. The study collected sociodemographic, clinical, obstetric, anthropometric and prenatal care information.**

Results: **It verified significant reduce of prevalence of gestational XN (GI = 18.7% e GII = 0.6%, p < 0.001). The occurrence of gestational XN was associated to sanitary conditions, education level, more than six prenatal consultations, miscarriage at last pregnancy, higher average number of deliveries, average number of prenatal care consultations and prenatal nutritional (p < 0.05). There was no association between gestational XN and marital status, skin color, pre-gestational nutritional status, adequacy of gain of total gestational weight, gestational anaemia and average number of pregnancies (p > 0.05).**

Conclusion: **The inclusion of nutritional care in routine prenatal care may have contributed to the reduction of gestational XN. Studies to assess the nutritional intervention in the prevention and treatment of gestational XN at regions at greatest risk are suggested.**

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Key words: *Night blindness. Vitamin A deficiency. Prenatal nutrition. Pregnancy.*

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EL PAPEL DE LA ASISTENCIA NUTRICIONAL PRENATAL SOBRE LA PREVALENCIA DE LA CEGUERA NOCTURNA EN ADULTAS EMBARAZADAS

Resumen

Introducción: **En los países en desarrollo, la ceguera nocturna (CN) es un problema muy común de la salud pública entre las mujeres embarazadas.**

Objetivo: **Evaluar el efecto de los cambios ocurridos en la atención prenatal sobre el cuidado nutricional prenatal sobre la aparición de CN en mujeres adultas embarazadas en una maternidad pública en Rio de Janeiro entre 1999-2001 y entre 2007-2008.**

Métodos: **Se realizaron dos estudios transversales, el primero entre 1999-2001 y el segundo entre 2007-2008. Se estudiaron 402 mujeres puérperas, 225 entre 1999-2001 (GI) y 177 entre 2007-2008 (GII). La CN gestacional fue investigada durante el puerperio inmediato (GI) y durante el prenatal/puerperio (GII), diagnosticada por la Organización Mundial de La Salud. El estudio incluió informaciones sociodemográficas, clínicas, obstétricas, antropométricas y del cuidado prenatal.**

Resultados: **Se verificó reducción significativa de la prevalencia de CN gestacional (GI = 18,7% e GII = 0,6%, p < 0,001). La ocurrencia de CN gestacional se asoció con las condiciones sanitarias, el nivel de educación, más de seis consultas prenatales, abortos espontáneos en el último embarazo, mayor número promedio de partos, el número promedio de consultas de atención prenatal y de nutrición prenatal (p < 0,05). No hubo asociación entre CN gestacional y el estado civil, color de piel, estado nutricional pregestacional, adecuación de la ganancia de peso durante la gestación, incluyendo anemia gestacional y el número medio de embarazos (p > 0,05).**

Conclusión: **La inclusión de la atención nutricional en el cuidado prenatal de rutina puede haber contribuido para la reducción de CN gestacional. Se sugiere más estudios para evaluar la intervención nutricional en la prevención y el tratamiento de CN gestacional en las regiones de mayor riesgo.**

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Palabras clave: *Ceguera nocturna. Deficiencia de vitamina A. Nutrición prenatal. Embarazo.*

Abbreviation list

CN: Ceguera nocturna.
VA: Vitamin A.
VAD: Vitamin A deficiency.
XN: Night blindness.
PNA: Prenatal nutritional assistance.
GA: Gestational age.
GI: Group I.
GII: Group II.
NB: Newborn.
LBW: Low birth weight.
SGA: Small gestational age.
AGA: Appropriate gestational age.
LGA: Large gestational age.

Introduction

Most pregnancies proceed without complications that pose a health risk to either the mother or child. Most complications that do occur during pregnancy and childbirth are preventable, but they require an appropriate health intervention[1].

Specific deficiencies of micronutrients such as vitamin A (VA) can aggravate and increase the chance of obstetric problems[2,3]. VA has important functions in the body, particularly in the ocular system. It plays a key role in maintaining the integrity of the eye and visual processes, including adaptation to low light environments[4,5].

Pregnant women with vitamin A deficiency (VAD) are more likely to have obstetric complications such as anemia, malnutrition, urinary tract and reproductive system infections, diarrhea, pre-eclampsia/eclampsia, and gastrointestinal symptom (vomiting, nausea, and loss of appetite). These can increase the chance of maternal and fetal death[3,6].

VAD may progress to advanced stages in which functional changes occur, such as ocular changes[7]. Night blindness (XN) is the first manifestation of xerophthalmia and can occur during pregnancy, most commonly in the 2nd and 3rd trimesters. This is characterized by night vision impairment but normal vision during the day[8,9].

VAD is considered a public health problem, especially in developing countries, and its severity is assessed by the prevalence of XN in both pregnant women and pre-school[10].

XN is considered an indicator of high risk pregnancy, identifying women who need special nutrient requirements and greater attention to prenatal care[11,12]. The occurrence of gestational XN can have profound impacts on the fetus, and mortality rates in children of women who had gestational XN is 90 deaths per 1,000 live births, whereas the rate among children of women without gestational XN is 63 deaths per 1,000 live births[13].

Strategies to combat VAD in pregnant women have been suggested. Many emphasize prenatal nutritional assistance (PNA), which has been shown to reduce the prevalence of VAD among pregnant women who received this intervention along with their prenatal care[14].

Based on these concepts, the objective of this study was to analyze the effect of changes in prenatal care (with respect to PNA) on the occurrence of XN in adult pregnant women treated at the maternity public hospital in Rio de Janeiro during 1999-2001 and 2007-2008.

Methods

Study design

Two cross-sectional studies were performed in pregnant and postpartum women treated in a public maternity hospital in Rio de Janeiro during 1999-2001 and 2007-2008. This maternity hospital serves women with similar characteristics to other pregnant and postpartum women treated at other healthcare facilities in Rio de Janeiro[15,16], and it has a multidisciplinary team in prenatal care. On average, 220-230 deliveries are conducted monthly[16]. Data collection in both studies was performed by trained and qualified researchers.

Changes in prenatal care between 1999-2001 and 2007-2008

Prenatal care was altered for the study in the selected period by modifying PNA. During 1999-2001, PNA was limited. Consultation with a nutritionist only occurred upon referral of pregnant women by obstetricians in cases of weight deviation or pregnancy complications at any gestational age (GA). In these cases, the woman received individualized nutritional care according to events or specific anthropometric characteristics.

In 2006, the process was changed, and PNA was expanded to all pregnant women in the unit, and they received either group or individual sessions. Each woman received at least one group consultation with a nutritionist during pregnancy. These group sessions aimed to optimize maternity human resources (number of nutritionists) and allow the exchange of experiences between the participants and the multidisciplinary team.

All pregnant women in the study received specific guidelines regarding gastrointestinal symptoms, pregnancy complications (including specific nutritional deficiencies, particularly VAD, and consumption of foods fortified with VA and supplementation regimens were encouraged and prescribed by the physician), and breastfeeding.

Patients with risk factors had individual nutrition sessions throughout pregnancy. For these, the nutrition care included a nutrition assessment and detailed dietary planning. After estimating the recommended weight gain, an appropriate energy value of the diet was calculated and a suitable diet plan was developed

considering the dietary habits, sociodemographic status and lifestyle of the pregnant woman.

As part of prenatal care, the obstetrician prescribed supplementation with a multivitamin containing VA. The main focus of supplementation was to correct gestational iron deficiency anemia. The amount of VA contained in the supplement were of 3,000 IU, with a combination of β-carotene and retinol.

Study population and inclusion criteria

The study population consisted of pregnant and postpartum women admitted to the hospital during pregnancy and/or childbirth/puerperium. Data were analyzed from a representative sample during the periods of 1999-2001 and 2007-2008. The women were divided into two groups: group I (GI during 1999-2001) and group II (GII during 2007-2008).

Inclusion criteria were as follows: age ≥ 20 years, women currently receiving prenatal care, single fetus pregnancy, no previous medical history before pregnancy, and receipt of information on the diagnosis of gestational XN.

In GI, information about the puerperal period up to 6 hours postpartum and their newborns (NB) was obtained. This group received routine interventions (historical control), and limited PNA was taken into account in this period. In this group, some women only delivered at the healthcare facility under study and underwent prenatal care at other facilities in the municipality.

In GII, data were collected from postpartum women who received prenatal care and delivered at the hospital under study. This group was composed of women that were followed one year after the implementation of new PNA procedures, which were reviewed and updated due to new scientific evidence.

The following information was collected: sociodemographic characteristics (age [20-24, 25-34 or > 35 years], basic sanitation [adequate or inadequate], skin color [white or non-white], marital status [married/living with a partner or living without a partner], education [incomplete primary, complete primary/incomplete high school or complete high school]), clinics and obstetrics (number of pregnancies, interval between pregnancies, parity, history of abortion, frequency of anemia and gestational XN), and prenatal care (length of commute to prenatal care, number of visits to prenatal care [< 6 or ≥ 6 visits] and PNA). The data were collected through interviews and consultation of team records of prenatal care in the medical records.

Anthropometric assessment

The following data were collected: declared pre-pregnancy weight or weight measured up to 13 weeks of gestation and height and weight before delivery or in the last visit before delivery. The following data were collected from the NB: birth weight, birth length and GA at birth.

The taking of anthropometric measurements was performed by nurses, as a routine prenatal care in the unit. In both instances, the procedures were standardized to the purposes of the research, according to international recommendations[17].

For the anthropometric measurements, body mass index was used according to criteria established by the World Health Organization[17]. The total gestational weight gain was calculated by the difference between pre-pregnancy weight and the weight before delivery or registered at the last prenatal visit.

The adequacy of gestational weight gain was ranked as follows: insufficient weight gain (below recommended minimum), suitable (weight gain within recommended range) and excessive weight gain (above recommended maximum)[18]. The analysis of birth weight for GA age was performed according to Pedreira et al. 2011[19].

Gestational and neonatal intercurrences

The following complications were considered: gestational diabetes, hypertensive syndromes during pregnancy, anemia, and urinary tract infection[1,20]. These were identified by asking the obstetrician or interpreting results.

VAD was assessed by functional indicators (gestational XN) based on a standardized interview[7,21] validated for postpartum women[8]. The interview consists of three questions that assess the ability to see the individual in specific situations. They are: 1) "Do you have difficulty seeing during the day?", 2) "Do you have difficulty seeing with decreasing light or at night?", and 3) "Do you have night blindness?"[7]. Cases were defined when there was a NO answer to question 1 and YES to at least one of questions 2 and 3. The interview was conducted using simple language and examples of places with low light common in the city[11].

In GI, this interview was conducted during the postpartum period (up to 6 hours postpartum), but in reference to vision symptoms experienced during pregnancy. In GII, the interview occurred during prenatal care, specifically at the nutrition visits.

In regards to the conditions at birth and neonatal complications, low birth weight (LBW) was considered a birth weight of < 2,500 g and macrosomia was considered a birth weight > 4,000 g[17]. The NB was classified according to GA at birth as preterm (> 21 and < 37 weeks gestation), term (≥ 37 and < 42 weeks gestation), or post-term (≥ 42 weeks of gestation)[20]. Abortions were defined as death or expulsion of the fetus occurring before 22 gestational weeks[22]. The fetuses were classified according to their birth weight for GA as small for gestational age (SGA; <10th percentile),

appropriate for gestational age (AGA; between 10th and 90th percentiles), or large for gestational age (LGA; > 90th percentile)[19].

Statistical analysis

A test of homogeneity between GI and GII was conducted, comparing sociodemographic, obstetric, assistance and anthropometric variables. Measures of central tendency (mean and standard deviation) and *Student's t test* were calculated. For categorical variables, we used the chi-square test (χ^2). The significance level used was $p < 0.05$. The statistical package SPSS for Windows version 17.0 was used for analysis.

Ethical questions

The study was designed respecting the ethical guidelines in Resolution 196/96 of the National Health Council (signer of the Declaration of Helsinki)[23]. The research projects that generated databases were approved by the Ethics in Research of the Maternity School, Federal University of Rio de Janeiro and the National School of Public Health, Oswaldo Cruz Foundation (Registrations nº 75/02 and 35/04).

Results

The final sample consisted of 402 pregnant and postpartum women, 225 in GI (56.0%) and 177 in GII (44.0%). In GI, 96% (n = 216) of the members received prenatal care in the maternity hospital studied. A significant reduction in the prevalence of XN was found, where 18.7% of GI (n = 42) and only 0.6% in GII (n = 1) had ocular manifestations of VAD.

Table I shows the comparison between the groups in regards to sociodemographic characteristics and history of miscarriage. There was a decrease in the proportion of women living in households with unsatisfactory sanitation (p = 0.018). The proportion of non-white (p < 0.001) and married/stable (p = 0.009)

Table I
Maternal sociodemographic and obstetrics characteristics of the groups GI (1999-2001) e GII (2007-2008). Rio de Janeiro, RJ, Brazil (n = 402)

	Study groups					
	GI (n = 225)		*GII (n = 177)*			
Variables	*n*	*%*	*n*	*%*	*Total*	*p*
AGE GROUP						
20-24 y	84.0	37.3	60.0	34.1	144.0	0.726
25-34 y	115.0	51.1	97.0	55.1	212.0	
>35 y	26.0	11.6	19.0	10.8	45.0	
CONDITIONS OF SANITATION						
Satisfactory	211.0	93.8	145.0	98.6	356.0	0.018
Inadequate	14.0	6.2	2.0	1.4	16.0	
SKIN COLOR						
White	100.0	44.5	19.0	18.8	119.0	<0.001
Nonwhite	125.0	55.5	82.0	81.2	207.0	
MARITAL STATUS						
Married/Living with partner	152.0	67.5	119.0	79.8	271.0	0.009
Living without partner	73.0	32.5	30.0	20.2	103.0	
EDUCATION						
Incomplete elementary	83.0	36.9	35.0	20.3	118.0	<0.001
Complete primary and incomplete secondary	78.0	34.7	43.0	25.0	121.0	
High school graduate	64.0	28.4	94.0	54.7	158.0	
HISTORY OF ABORTION						
Yes	33.0	14.7	38.0	21.7	71.0	0.045
No	192.0	85.3	137.0	78.3	329.0	

P: significance level ($p < 0.05$).

women increased. There was also an increase in women who had completed secondary school ($p < 0.001$). History of abortion in the previous pregnancy ($p = 0.045$) decreased between the periods analyzed. There was similarity between the groups with respect to age of the subjects ($p = 0.726$) (table I).

Between GI and GII, we observed an increase in the proportion of women who were overweight pre-pregnancy ($p < 0.001$), which reduced the inadequacy of total gestational weight gain ($p = 0.001$). There was an increased number of women who had more than six visits for prenatal care ($p < 0.001$), and the percentage of participants with access to PNA increased, from 20.4% in GI to 92.6% in GII ($p < 0.001$) (table II). There was similarity between the groups in regards to the frequency of gestational anemia ($p = 0.511$), adequacy of birth weight ($p = 0.133$), and GA at birth ($p = 0.285$). However, there was an increase in pregnancy complications ($p = 0.016$) and a decrease in the number of cases of infants with SGA ($p = 0.001$) between the periods analyzed (table III).

Table IV shows the factors associated with the occurrence of gestational XN. There was no association between XN with marital status ($p = 0.504$), ethnicity ($p = 0.694$), pre-pregnancy nutritional status ($p = 0.348$), adequacy of total gestational weight gain ($p = 0.592$), gestational anemia ($p = 0.411$), or mean number of pregnancies ($p = 0.053$). Among women who developed gestational XN, there were three times more who had inadequate sanitation than those without XN ($p = 0.012$). The level of education was also associated with the outcome ($p = 0.018$). Women who received less than six prenatal visits more frequently developed gestational XN ($p < 0.001$). Among women with XN, the history of miscarriage in previous pregnancy was proportionally higher than those without XN ($p = 0.019$). The prevalence of XN in GII was significantly lower than in GI ($p < 0.001$). Among those without XN, there was a lower average number of births ($p = 0.002$) and prenatal visits ($p = 0.005$). Women who developed gestational XN went to one third of the number of PNA visits than women without XN ($p < 0.001$).

Due to the low prevalence of XN in GII, it was not possible to perform multivariate logistic regression to evaluate the possible factors that could have influenced the associations that were found.

Discussion

The evaluation of PNA importance in reducing specific nutritional issues is not much studied in Brazil. However, these studies show important evidences which support the assumption that the nutritional care during prenatal is effective in reducing obstetric adversities concerning maternal nutritional state[14,24,25].

Based on that, it is important to consider that the results of this study collaborate with these evidences and also notes that this is the first study conducted in Brazil that aimed an evaluation of the changes of the care routines in a public maternity hospital, under an

Table II
Maternal anthropometric and prenatal assitance characteristics of groups GI (1999-2001) e GII (2007-2008). Rio de Janeiro, RJ, Brazil (n = 402)

	Study groups					
	GI (n = 225)		*GII (n = 177)*			
Variables	*n*	*%*	*n*	*%*	*Total*	*p*
NUTRITIONAL STATUS PRE-GESTATIONAL						
Underweight	41.0	19.3	8.0	4.7	49.0	< 0.001
Eutrophic	130.0	61.3	88.0	51.8	218.0	
Overweight	22.0	10.4	55.0	32.3	77.0	
Obesity	19.0	9.0	19.0	11.2	38.0	
ADEQUACY OF WEIGHT GAIN						
Insufficient	72.0	35.0	35.0	20.2	107.0	0.001
Appropriate	71.0	34.4	57.0	33.0	128.0	
Excessive	63.0	30.6	81.0	46.8	144.0	
NÚMBER OF CONSULTATIONS OF PRENATAL ASSISTANCE						
< 6	49.0	21.8	14.0	8.0	63.0	< 0.001
≥ 6	176.0	78.2	163.0	92.0	339.0	
PNA CONSULTATION						
Yes	46.0	20.4	164.0	92.6	210.0	< 0.001
No	179.0	79.6	13.0	7.4	192.0	

PNA: Prenatal nutritional assistance. *P*: significance level ($p < 0.05$).

Table III
Maternal clinical and conditions at birth characteristics of groups GI (1999-2001) e GII (2007-2008). Rio de Janeiro, RJ, Brazil (n = 402)

	Study groups					
	GI (n = 225)		GII (n = 177)			
Variables	*n*	*%*	*n*	*%*	*Total*	*p*
PREGNANCY COMPLICATIONS						
Yes	98.0	43.6	97.0	54.8	195.0	0.016
No	127.0	56.4	80.0	45.2	207.0	
GESTATIONAL ANAEMIA						
Yes	64.0	28.4	51.0	28.8	115.0	0.511
No	161.0	71.6	126.0	71.2	287.0	
ADEQUCY OF BIRTH WEIGHT						
Low birth weight	13.0	5.8	6.0	4.0	19.0	0.133
Appropriate	203.0	91.0	130.0	88.5	333.0	
Macrossomia	7.0	3.1	11.0	7.5	18.0	
GESTATIONAL AGE AT BIRTH						
Preterm	14.0	6.3	12.0	8.4	26.0	0.285
At term and post-term	209.0	93.7	131.0	91.6	340.0	
CORRELATION BW/GA TO CHILDBIRTH (PERCENTILE)						
Small for gestational age	16.0	7.1	3.0	1.7	19.0	0.001
Appropriate for gestational age and large for gestational age	209.0	92.9	174.0	98.3	383.0	

BW/GA: Birth weight to gestational age. *P*: significance level ($p < 0.05$).

important nutritional deficiency that occurs in developing countries: VAD.

The difference in prevalence of XN in GI and GII shows that VAD was a serious problem and that the significant decrease in prevalence may be associated to the changes in prenatal routines. Since 1999, World Health Organization[3] recognizes the importance of nutrition for woman's health for her to have adequate pregnancy and delivery, considering this as one of the actions aiming a maternity without risk. Once PNA was very restricted and XN was a serious problem at the first period of the study, the results have great importance.

The reduction of gestational complications such as VAD by PNA has a lot of implications, once informal assessments suggest that the cost-benefit of this strategy can be compared to or even higher than the standard practices of traditional prenatal routines in developing countries[26].

Even though this study presents some limitations such as the small sample size, the inability to run the multivariate regression (due to the low prevalence of XN in GII), and the use of a historical control group (instead a control group that not received the PNA, simultaneously with the intervention group), which could have some implications regarding baseline characteristics of the study participants, the methodological strategy was adopted to meet the ethics of research, once the positive impact of nutritional intervention during pregnancy is evident, and none of the pregnant women in the study would be without the intervention's benefit[23].

As seen, the groups were different regarding some sociodemographic characteristics and regarding the pre-gestational nutritional state, as the increase of overweighed women in GII. However, this is not an exclusive characteristic of this sample, but it concerns to all Brazilian population, according to Demographic Census 2010 (Censo Demográfico 2010)[27] and Family Budget Research (Pesquisa de Orçamentos Familiares)[28]. The women using the maternity hospital studied have similar characteristics to those pregnant women and puerperal women who use the public health service in Rio de Janeiro. Because of that, the chances of change in the population studied were minimized, reducing a possible selection bias[14-16].

Despite the distinction in the pre-gestational state among the groups, such difference brings no basis to believe that the reduction of low pre-gestational weight with an increase of pre-gestational overweight may affect the results of the study. It is reinforced if we consider some points, such as the existence of studies conducted in Brazil which indicate that the VA status has no association with a pre-gestational nutritional state[15,29]. The National Research for Demography and Health of Children and Women 2006 (Pesquisa

Table IV
Variables associated with the occurrence of night blindness in pregnant adults at maternity public hospital (1999-2001 and 2007-2008). Rio de Janeiro, RJ, Brazil

Variables	*Gestational night blindness*			*p*
	Yes (n = 43) n (%)	*No (n = 359) n (%)*	*Total*	
Categorical variables				
CONDITIONS OF SANITATION				
Adequate	38.0 (88.4)	318.0 (96.7)	356.0	0.012
Inadequate	5.0 (11.6)	11.0 (3.3)	16.0	
MARITAL STATUS				
Married/Living with partner	33.0 (12.2)	238.0 (87.8)	271.0	0.504
Living without partner	10.0 (9.7)	93.0 (90.3)	103.0	
SKIN COLOR				
White	17.0 (15.75)	91 (84.25)	108.0	0.694
Nonwhite	25.0 (14.05)	153 (85.95)	178.0	
EDUCATION				
Incomplete elementary	11.0 (9.3)	107.0 (90.7)	118.0	0.018
Complete primary and incomplete secondary	21.0 (17.3)	100.0 (82.7)	121.0	
High school graduate	11.0 (6.7)	147.0 (93.3)	158.0	
NUTRITIONAL STATUS PREGESTATIONAL				
Underweight	5.0 (10.2)	44.0 (89.8)	49.0	0.348
Eutrophic	29.0 (13.3)	189.0 (86.7)	218.0	
Overweight	6.0 (7.8)	71.0 (92.2)	77.0	
Obesity	2.0 (5.3)	36.0 (94.7)	38.0	
NUMBER OF CONSULTATIONS OF PA				
< 6	15.0 (34.9)	48.0 (13.4)	63.0	0.001
≥ 6	28.0 (65.1)	311.0 (86.6)	339.0	
HISTORY OF ABORTION				
Yes	12.0 (27.9)	22.0 (12.0)	34.0	0.019
No	31.0 (72.1)	161.0 (78.0)	192.0	
STUDY GROUPS				
GI (1999-2001)	42.0 (18.7)	183.0 (81.3)	225.0	<0.001
GII (2007-2008)	1.0 (0.6)	176.0 (99.4)	177.0	
ADEQUACY OF TOTAL GESTATIONAL WEIGHT GAIN				
Insufficient	14.0 (13.1)	93.0 (86.9)	107.0	0.592
Appropriate	14.0 (11.0)	114.0 (11.0)	128.0	
Excessive	13.0 (9.0)	131.0 (9.0)	144.0	
GESTATIONAL ANAEMIA				
Yes	10.0 (23.3)	105.0 (29.2)	115.0	0.411
No	33.0 (76.7)	254.0 (70.8)	287.0	
Numerical variables				
	μ	*SD*	*μ*	*SD*	*P*
AVERAGE OF BIRTHS	1.36	0.53	1.06	0.83	0.002
AVERAGE OF PREGNANCIES	2.56	1.69	2.22	1.36	0.053
AVERAGE OF PA CONSULTATIONS	6.95	2.77	8.15	2.60	0.005
AVERAGE OF PNA CONSULTATIONS	0.42	0.91	1.48	1.79	0.001

PA: prenatal assistance. PNA: prenatal nutritional assistance. μ: mean. SD: standard deviation. *P*: significance level ($p < 0.05$).

Nacional de Demografia e Saúde da Criança e da Mulher 2006) also reveals a very worrying scenario concerning VA's biochemical status[30]. This research showed that the women at reproductive age (15 to 49 years old) living in Southeast (where Rio de Janeiro is located) present the higher inadequacies of serum retinol in Brazil[30]. It might reflect a continuous deficiency during the pregnancy with possibility to present clinical and functional manifestations of VAD such as XN, even when health and socioeconomic scenarios is being improved in the country, but without any specific intervention to eradicate gestational VAD, as recommended by the Ministry of Health. Other important issue is that transition of the pre-gestational nutritional state may not mean the occurrence of a increase of nutritionally adequate food has happen, with micronutrients being more consumed, for example. It is a common situation of the nutritional transition process, which is normally followed by a low quality feeding[31].

Despite some limitations of the report presented by the study in order to allocate the significant reduction of XN gestational occurred mainly by changes in routine prenatal unit is possible to suggest that the implementation of nutritional care occurred during the prenatal extended to all pregnant women in the unit, may have contributed significantly to the reduction of XN pregnancy.

Corroborating such information, recent studies show that in the absence of PNA, the number of gestational issues is higher when compared to women who received this assistance, among them XN[14,15,32], which reinforces the results. Another issue that reinforces the results concerns the reduction of pregnant women which present insufficient gestational weight gain. It is another sign that restructuring the prenatal in the maternity resulted in an improvement of the health of the pregnant women at that moment.

In the context of PNA, regardless the individual education level, it is important to highlight the role that instruction in nutrition plays when fighting VAD[10]. It may bring changes in dietary patterns and reduce the number of cases in which this deficiency is found and its consequences. The higher knowledge about causes and treatment/prevention of XN plays a significant role on reducing the prevalence of this ocular symptomatology[33]. In this study, it is directly related to PNA, once the instruction in nutrition is part of the actions of the nutritionist to obtain a better nutritional state, individual or collective.

The functional indicator, gestational XN, is effective in identifying the pregnant women in nutritional risk related to VAD and it is easy to be applied, cheap and there is no need to have specific ophthalmological knowledge for its application. It is also recommended by World Health Organization[10]. The incorporation of the evaluation of gestational XN during prenatal may contribute in preventing and controlling VAD, bringing more health for the mother-child binomial and for the fact that it can be easily incorporated in health routines[4,14]. The use of the functional indicator was validated for puerperal women by Saunders et al.[8], where the authors suggest the use of standardized interview for evaluation of the nutritional state of gestational VA, identifying women with low serum levels of retinol, which interfere in maternal and fetal health.

It is important to highlight the relation between VAD and iron-deficiency anemia. The study found that 28,8% of GII developed anemia during pregnancy and that this complication was not associated to XN. The occurrence of VAD is considered a factor related to anemia[14]. A decrease was expected in the prevalence of gestational anemia with PNA, once it was founded by other authors[14]. One possible explanation may be related to the amount of VA intake to meet the nutritional needs during pregnancy be more easily achieved[34] to the recommendations of iron[35] compared to the same time biological. The inadequate use of iron supplements during pregnancy may also have influenced this result. However, this problem could be occurring in GI, not only in GII. So, the relation between VA and anemia in this study seems to be without an explanation.

Conclusion

Before the results, the study concludes that the changes in prenatal care routine, counting with the nutritional care for every pregnant woman, may have contributed for the reduction of gestational XN. We suggest the elaboration of studies testing the impact of the nutritional intervention on preventing and treating gestational XN, especially in Brazilian regions with high risk.

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References

1. Ministério da Saúde. Gestação de alto risco: manual técnico. Brasília: MS; 2010.
2. World Health Organization. Trends in maternal mortality: 1990 to 2008. Estimates developed by WHO, UNICEF, UNFPA and The World Bank. Geneva: WHO; 2010.
3. Organización Mundial de la Salud. Reducción de la mortalidad materna. Declaración conjunta OMS/FNUAP/UNICEF/Banco Mundial. Ginebra: OMS; 1999.
4. Saunders C, Ramalho A, Padilha PC et al. A investigação da cegueira noturna no grupo materno-infantil: uma revisão histórica. *Rev Nutr* 2007; 20: 95-105.
5. Wolf G. The discovery of the visual function of vitamin A. *J Nutr* 2001; 131 (6): 1647-50.
6. Christian P, West Jr KP, Khatry S et al. Night blindness of pregnancy in rural Nepal –nutritional and health risks. *Int J Epidemiol* 1998; 27 (2): 231-7.

7. Organización Panamericana de la Salud. Manual ver y vivir sobre los transtornos por deficiencia de vitamina A (VAAD). Washington, DC: OPAS; 1999.
8. Saunders C, Ramalho A, Lima APT et al. Association between gestational night blindness and serum retinol in mother/newborn pairs in the city of Rio de Janeiro, Brazil. *Nutrition* 2005; 21 (4): 456-61.
9. West Jr KP. Extent of vitamin A deficiency among preschool children and women of reproductive age. *J Nutr* 2002; 132 (Supl. 9): 2857S-66.
10. World Health Organization. Global prevalence of vitamin A deficiency in populations at risk 1995-2005. WHO Global Database on Vitamin A Deficiency. Geneva; WHO; 2009.
11. Christian P. Recommendations for indicators: night blindness during pregnancy – a simple tool to assess vitamin A deficiency in a population. *J Nutr* 2002; 132 (Supl. 9): 2884S-88S.
12. International Vitamin A Consultative Group. Maternal night blindness: A new indicator of vitamin A deficiency. Washington, DC: IVACG Statement; 2002.
13. Christian P, West Jr KP, Khatry SK et al. Maternal night blindness increases risk of mortality in the first 6 months of life among infants in Nepal. *J Nutr* 2001; 131 (5): 1510-2.
14. Chagas CB, Ramalho A, Padilha PC et al. Reduction of vitamin A deficiency and anemia in pregnancy after implementing proposed prenatal nutritional assistance. *Nutr Hosp* 2011; 26 (4): 843-50.
15. Saunders C, Leal MC, Gomes MM et al. Gestational nightblindness among women attending a public maternal hospital in Rio de Janeiro, Brazil. *J Health Popul Nutr* 2004; 22 (4): 348-56.
16. Santos MMAS, Baião MR, Barros DC et al. Estado nutricional pré-gestacional, ganho de peso materno, condições da assistência pré-natal e desfechos perinatais adversos entre puérperas adolescentes. *Rev Bras Epidemiol* 2012; 15 (1): 143-54.
17. World Health Organization. Physical status: the use and interpretation of report anthropometry: report of a WHO Expert Committee. Geneva: WHO; 1995.
18. Institute of Medicine. Weight gain during pregnancy: Reexamining the guidelines. Washington, DC: IOM; 2009.
19. Pedreira CE, Pinto FA, Pereira SP et al. Birth weight patterns by gestational age in Brazil. *An Acad Bras Cienc* 2011; 83 (2): 619-25.
20. Ministério da Saúde. Pré-natal e puerpério. Atenção qualificada e humanizada: manual técnico. Brasília: MS; 2006.
21. World Health Organization. Indicators for assessing Vitamin A Deficiency and their application in monitoring and avaluating intervention programmes. Micronutrient Series. Geneva: WHO; 1996.
22. Saunders C, Accioly E, Lacerda EMA. Saúde do grupo materno-infantil. In: Nutrição em obstetrícia e pediatria. 2ª ed. pp. 3-25 [Accioly E, Saunders C, Lacerda EMA, editores] Rio de Janeiro: Cultura Médica/Guanabara Koogan; 2012.
23. Ministério da Saúde. Diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. Resolução 196/96 do Conselho Nacional de Saúde. Rio de Janeiro: Fundação Oswaldo Cruz; 1998.
24. Padilha PC. Contribuições teórico-práticas para a assistência nutricional pré-natal [tese]. Rio de Janeiro (RJ): Universidade Federal do Rio de Janeiro; 2011.
25. Vítolo MR, Bueno MSF, Gama CM. Impacto de um programa de orientação dietética sobre a velocidade de ganho de peso de gestantes atendidas em unidades de saúde. *Rev Bras Ginecol Obstet* 2011; 33 (1): 13-9.
26. Rouse DJ. Potential cost-effectiveness of nutrition interventions to prevent adverse pregnancy outcomes in the developing world. *J Nutr* 2003; 133 (5 Supl. 2): 1640S-4S.
27. Instituto Brasileiro de Geografia e Estatística. Censo Demográfico 2010. *Características da população e dos domicílios: resultados do universo*. Rio de Janeiro; IBGE; 2011.
28. Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares 2008-2009. *Antropometria e estado nutricional de crianças, adolescentes e adultos no Brasil*. Rio de Janeiro; IBGE; 2010.
29. Ramalho RA, Saunders C, Accioly E et al. A associação entre antropometria materna e o estado nutricional de vitamina A materno e dos recém-nascidos. *Rev Cienc Med* 2001; 10: 5-10.
30. Ministério da Saúde. *Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher 2006*. Brasília: MS; 2009.
31. Kac G, Pérez-Escamilla R. Nutrition transition and obesity prevention through the life-course. *Int J Obes Suppl* 2013; 3: S6-S8.
32. Niquini RP, Bittencourt SA, Lacerda EMA et al. Avaliação do processo da assistência nutricional no pré-natal em sete unidades de saúde da família do município do Rio de Janeiro. *Cienc Saude Colet* 2012; 17 (10): 2805-16.
33. Jones KM, Specio SE, Shrestha P et al. Nutrition knowledge and practices, and consumption of vitamin A–rich plants by rural Nepali participants and nonparticipants in a kitchen-garden program. *Food Nutr Bull* 2005; 26 (2): 198-208.
34. World Health Organization. Safe vitamin A dosage during pregnancy and lactation: recommendations and report of a consultation. Geneva: WHO; 1998.
35. Institute of Medicine. Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. Washington, DC: IOM; 2001.