

Applied nutritional investigation

## Association between gestational night blindness and serum retinol in mother/newborn pairs in the city of Rio de Janeiro, Brazil

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### Abstract

**Objective:** Gestational night blindness (XN) is associated with increased risk of reproductive morbidity and mortality. This study investigated the prevalence of gestational XN among postpartum women treated in a public maternity hospital in the city of Rio de Janeiro, Brazil and evaluated its association with maternal and neonatal (cord blood) serum retinol concentrations.

**Methods:** XN was evaluated retrospectively, using an interview according to guidelines of the World Health Organization, in 222 postpartum women ( $\leq 6$  h after delivery) after singleton births who had low obstetric risk. Serum retinol concentrations were measured according to the modified Bessey method, with a cutoff point lower than  $1.05 \mu\text{mol/L}$  for inadequate serum retinol concentration.

**Results:** Prevalence of gestational XN was 18%, and inadequate maternal and cord blood serum retinol concentrations were found in 24.4% and 45.5% of samples, respectively. The results associated gestational XN with inadequate maternal serum retinol concentration ( $P = 0.000$ ), and an association was observed between maternal and neonatal serum retinol concentrations ( $P = 0.000$ ). A poor association was observed between maternal XN and serum levels of retinol in newborn children ( $P = 0.06$ ).

**Conclusions:** The results suggest that prevalence of gestational XN and inadequate serum retinol concentration among postpartum women and newborns is a concern, calling attention to the need for studies in other parts of Brazil. In addition, the risk of inadequate serum retinol in newborns was significantly higher among infants of postpartum women with serum retinol levels below  $1.05 \mu\text{mol/L}$ . Gestational XN was associated with inadequate levels of maternal serum retinol, and the results suggest a poor relation between maternal XN and vitamin A nutritional status of newborns. © 2005 Elsevier Inc. All rights reserved.

**Keywords:** Night blindness; Serum retinol; Pregnancy; Postpartum women; Newborn; Vitamin A deficiency; Indicators

### Introduction

The control and eradication of micronutrient, vitamin A, iron, and iodine deficiencies, known collectively as “hidden hunger,” continue to pose a challenge for researchers because some 2 billion individuals are affected worldwide, thus further compromising socioeconomic development in affected countries [1–4]. According to the World Health

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Organization (WHO) [5], Brazil is classified as having major prevalence of subclinical nutritional deficiency.

The functional indicator night blindness (XN), defined as decreased night vision in individuals with normal daytime vision [6], has merited attention in recent years and has been widely employed in population-based studies to detect risk of vitamin A deficiency (VAD). Using an easy, low-cost methodology, it allows the detection of individuals in the population segment most vulnerable to nutritional deficiencies, namely pregnant and nursing women, infants, and preschoolers [4,7–10]. According to the International Vitamin A Consultative Group [6], the extent of XN is unknown in regions such as Africa and Latin America.

One study in Nepal showed that women with XN were at significantly higher risk of dying for up to approximately 2 y after pregnancy declaration compared with women who did not have XN during pregnancy. In addition, weekly supplementation for women with normal dietary amounts of vitamin A/ $\beta$ -carotene markedly decreased this risk. The mechanism is not totally clear but may be due to the importance of an adequate vitamin A nutritional state for the maintenance of epithelial integrity and immunocompetence [11].

Due to the effect of VAD on health, especially that of pregnant and postpartum women, newborns, and infants, detection of individuals at risk is crucial, especially with sensitive indicators with a simple methodology for the subclinical phase. In addition, the indicators should allow monitoring and evaluation of the efficacy of low-cost interventions, especially in populations with scarce available resources for health and in keeping with public health principles.

The present study evaluated the vitamin A nutritional status of postpartum women ( $\leq 6$  h after delivery) and their newborns in a public maternity hospital in the city of Rio de Janeiro, Brazil, according to functional indicators (gestational XN) and biochemical indicators (maternal and neonatal serum retinol concentrations) and assessed the association between these indicators. The hypothesis tested in this study was that gestational XN is associated with serum retinol concentration (measured  $\leq 6$  h postpartum) in mothers and their newborns.

## Materials and methods

### Study design

The study population consisted of postpartum women and their respective newborns, with the mothers having been enrolled in prenatal care at the Maternity Hospital of the Federal University in Rio de Janeiro. The hospital provides free obstetric health care to some 1400 to 1500 women each year from various neighborhoods in the city of Rio de Janeiro, Rio de Janeiro State, in the southeast region of Brazil.

Selection of 222 postpartum women and their newborns in the study occurred on alternate days in four weekly hospital shifts, including 1 d during the weekend and one night shift from 1999 to 2001. Based on the design chosen for the sample and procedures, it was a descriptive, cross-sectional study [12].

Women who were hospitalized ( $\leq 6$  h after delivery) on days when data were collected, who signed the informed consent form, and who met the inclusion criteria (singleton pregnancy, with no disease diagnosed before the index pregnancy, and who had not used vitamin and mineral supplements containing vitamin A during the pregnancy) were interviewed. In addition, medical files were consulted to fill out the pretested questionnaire, and a pretest of the standardized interview for XN was also performed. Five women (2.3%) were excluded from the study because their blood samples were destroyed due to a power failure in the maternity hospital.

After the data-collection procedures, all women received nutritional counseling, and those with serum retinol levels lower than  $1.05 \mu\text{mol/L}$  received daily doses of 10,000 IU of vitamin A for 4 to 8 wk, as recommended by the WHO [5].

Sample size was calculated to allow for a comparison of prevalence of inadequate vitamin A nutritional status diagnosed by means of functional (gestational XN) and biochemical (serum retinol concentration) indicators and to detect a 15% difference between both proportions, based on an estimated 20% VAD prevalence [13]. Thus, with an  $\alpha$ -value of 5% and a  $\beta$ -value of 10%, the minimum estimated sample size was 197 [14].

### Evaluation of vitamin A nutritional status

The evaluation of vitamin A nutritional status in pairs of mothers and their newborns used biochemical indicators, i.e., maternal and neonatal (cord blood) serum retinol concentration, and functional indicators, i.e., gestational XN.

For determination of serum retinol concentration, a fasting 5-mL sample of blood was taken by venipuncture from women immediately postpartum, as was 5 mL of neonatal (umbilical cord) blood by using manual expression [13].

Serum retinol concentration was determined with spectrophotometric dosing based on the modified Bessey method [15]. The standards used were from the Sigma Chemical Company (St. Louis, MO, USA) and the coefficients of variation were 2.5% for a serum retinol concentration below  $1.05 \mu\text{mol/L}$  and 5% for a concentration of at least  $1.05 \mu\text{mol/L}$ . This method has the advantage of being low cost, and the team responsible for the biochemical dosage was trained to maintain quality control procedures and minimize sensitivity [4]. Serum retinol concentrations were classified by intervals of  $0.35 \mu\text{mol/L}$ , and a cutoff value lower than  $1.05 \mu\text{mol/L}$  was used to define inadequate serum retinol concentration [4].

To identify gestational XN assessed retrospectively in

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