Micronutrient Status among Pregnant Women in Zinder, Niger and Risk Factors Associated with Deficiency

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Introduction

Micronutrient deficiencies during pregnancy are associated with adverse health outcomes for the pregnant woman and her newborn. These adverse events include maternal anemia, maternal and perinatal mortality, pre-term birth and intra-uterine growth restriction, among others (1, 2). Micronutrient requirements are increased during pregnancy to meet increased demands for maternal blood volume expansion, metabolism and tissue reserves and fetal requirements for growth and development. Pregnant women in low income countries are particularly at risk of micronutrient deficiencies because of inadequate dietary intakes before and during pregnancy, high rates of infections, pregnancies during adolescence, and high fertility rates (2).

In Niger, the total fertility rate of 7.6 is one of the highest in the world (3). Similarly, the adolescent birth rate in Niger is the highest in the world with 205 births per 1000 women (4). In 2012, 58.6% of pregnant women in Niger were anemic (5), but little is known about maternal micronutrient status. The current Nutrition News for Africa summarizes a paper recently published in Nutrients. The objectives of the study were to assess micronutrient status of pregnant women in the region of Zinder, Niger, and to identify risk factors associated with inadequate micronutrient status (6).

Methods

The present study was integrated into the baseline assessment of the Niger Maternal Nutrition (NiMaNu) project, which was an implementation research project aiming to improve antenatal care services (ANC) and iron-folic acid (IFA) supplementation in rural Niger. Eighteen integrated health centers (IHCs) were selected based on convenience sampling. Within the catchment area of each IHC, the village where the IHC was located was automatically included. One additional village containing a health post was also randomly selected and included. The remaining villages in the IHC catchment area were stratified by distance from the IHC (greater or fewer than 10 km) and 8 were randomly selected (4 > 10 km from the IHC and 4 ≤ 10 km). In each village, 16-20 pregnant women were identified via the random walk method and enrolled until the sample size of approximately 77 women per IHC catchment area was met. A total of 88 villages were included in the survey, with a sample size of 1385 women.

Pregnant women at any stage during pregnancy were eligible to participate in the survey if they provided informed consent (written or fingerprint), had resided in the village for at least 6 months, and had no plans to move within the coming 2 months. Women were ineligible if they required immediate medical attention or were unable to provide consent due to mental disability.

As part of the survey, each woman participated in two visits, of which the first occurred at home and the second occurred one month later at a central location in each village. Information on socio-economic status (SES) of the woman and her household, pregnancy and health status, food security, and knowledge, attitudes and practices regarding ANC, nutrition and health during pregnancy were collected at both visits. Women's weight, height, mid-upper arm circumference (MUAC) and symphysis-fundal height were measured in duplicate at both visits. Capillary blood samples were collected at the second visit for the measurement of hemoglobin (Hb) with a HemoCue 201+ photometer (Hemocue AB, Angelholm, Sweden). In 770 women, 7.5 mL venous blood samples were collected and analyzed for concentrations of plasma ferritin, soluble transferrin receptor (sTfR), zinc (pZn), retinol binding protein (RBP), vitamin B_{12}, folate, α-1-acid glycoprotein (AGP), C-reactive protein (CRP), and histidine-rich protein II (HRP2; indicative of current or recent malaria parasitemia). Plasma ferritin, pZn and RBP were adjusted for elevated CRP

and AGP to remove the confounding effect of inflammation on the assessment of nutritional status and deficiency.

Results and conclusions

In 88 villages, 1385 eligible pregnant women were enrolled and 940 completed both visits. The majority of women, who dropped out between visit 1 and 2, had given birth. Among those who completed visit 2, 787 were eligible for the above described biomarker assessment and biomarkers were analyzed in 770 women. Women had a mean age of 26.5 years (95% confidence interval (CI) 26.0-26.9), and the majority were in their second (30.3%) and third trimester (69.6%). More than half of the women (58.2%) had no education, 21.7% had attended Koranic school and only 14.2% and 5.8% had attended primary and secondary school, respectively. The mean age at first pregnancy was 16.9 years (95% CI 16.7-17.0) and for 11.2% of women the present pregnancy was their first. Reported ANC attendance was 71.4% in the current pregnancy, but only 42.3% reported having consumed IFA supplements daily during the past 7 days. Adequate minimum dietary diversity (MDD-W), defined as having consumed at least 5 of 10 defined food groups in the previous 24 hours (7), was met by only 18.7% of the women, and 53.8% of women were moderately to severely food insecure (8).

Anemia and micronutrient deficiencies were very common among the study participants, indicative of a severe public health problem. In particular, anemia was found in 79% of women (Hb < 10.5 g/dL in 2nd trimester, < 11.0 g/dL in 3rd trimester). Prevalence of iron deficiency was 20.7% when defined by plasma ferritin (<15 µg/L) and 35.7% by sTfR (>8.3 mg/L), respectively; 40.7% of women had low zinc status (pZn <50 µg/dL), 79.7% had marginal vitamin A status (RBP <1.32 µmol/L), 44.3% had low folate status (<10 nmol/L), and 34.8% had low vitamin B_{12} concentrations (<148 pmol/L). Considering all measured micronutrient deficiencies together, 96.5% of women were affected by at least one micronutrient deficiency, and 46.5% had 3 or more concurrent micronutrient deficiencies. Malaria antigenemia (i.e. elevated HRP2) was found in 12.6% of women. Common risk factors associated with micronutrient status included gravidity, MUAC, geophagy (i.e consumption of clay), malaria, and result of the woman's last pregnancy.

Policy implications

The study shows that anemia and micronutrient deficiencies are common among pregnant women in rural villages in the Zinder region of Niger (6). Considering the risks of adverse pregnancy outcomes associated with anemia and micronutrient deficiencies, these results suggest an urgent need to strengthen and expand existing programs targeting pregnant women. Interventions at multiple levels should be considered, such as strengthening ANC services (improving health agent knowledge and counseling skills and reducing supply stock-outs of essential commodities such as IFA supplements, intermittent prophylactic treatment of malaria and antihelminthics) and behavior change communication to promote early and regular ANC services and to encourage the consumption of micronutrient dense foods. Fortification of wheat flour (with iron and zinc) and vegetable oil (with vitamin A) has been mandatory since 2012 in Niger. Although food fortification of staple foods, oils and condiments may be a useful strategy to increase micronutrient intakes, it may not be sufficient to fill identified micronutrient gaps during pregnancy. Nevertheless, strengthening the existing food fortification program, and possibly expanding it to further food vehicles, should be considered.

The most recent WHO recommendations on antenatal care did not include a recommendation of prenatal multiple micronutrient supplements (9). But considering the high prevalence of micronutrient deficiencies in the study population, targeted interventions of multiple micronutrient supplementation should be considered in this and other similarly high risk populations. Considering the high fertility rates, and early age of first pregnancy, interventions targeting all women of reproductive age (including preconception and during lactation) would seem important.

NNA Editors' comments*

This study showed that iron, iodine, zinc, vitamin A, B_{12} and folate deficiencies are a severe public health problem among pregnant women in rural Zinder (6, 10), and that many women suffered from 3 or more co-existing deficiencies. Importantly, this study was part of a larger project, requiring a study design that was not representative of Niger nationally or of Zinder regionally. Consequently, the present findings cannot be considered to reflect the micronutrient status of all pregnant women in Niger. However, considering the high fertility rates and food insecurity in Niger (3, 11), micronutrient deficiencies are likely to be a concern in other parts of Niger as well. Considering the critical role of micronutrients during pregnancy, effective interventions are urgently needed as outlined by the authors.

* These comments have been added by the editorial team and are not part of the cited publication.

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