Determinants of Hemoglobine Value in Pregnant Women: Results from a Cross-Sectional Study

GINA BOTNARIU[1], ALINA POPA[2]*, VASILICA TOMA[3]

[1] University of Medicine and Pharmacy Grigore T. Popa Iasi, Department of Diabetes, Nutrition and Metabolic Disease, 16 Universitatii Str., 700115, Iasi,Romania

[2] University of Medicine and Pharmacy Grigore T. Popa Iasi, Department of Nursing, 16 Universitatii Str., 700115, Iasi,Romania

[3] University Medicine and Pharmacy Grigore T. Popa, Department of Oral Implantology and Prostodontics, 16 Universitatii Str., 700115, Iasi, Romania

Anemia is a public health problem, being associated with high maternal and fetal morbidity and mortality. Identification of favorable factors in population level is extremely important. We assessed in 400 pregnant women, hospitalized in Maternity Cuza-Voda Iasi, the relationship between sociodemographic, dietary and educational factors and degree of anemia, by using a food frequency questionnaire and a nutritional knowledge questionnaire. The prevalence of anemia in the study group was 20.05%. After multiple regression analysis (made step by) there was shown that anemia is significantly correlated with total iron and calcium intake, total cholesterol and nutritional knowledge.In our group, anemia had a significant incidence, being related with common factors such as iron intake (from food and supplements) and nutritional knowledge. These data highlight the importance of counseling and education in pregnant women in anemia prevention.

Keywords: anemia, hemoglobine, iron deficiency, nutritional knowledge

Anemia is a public health problem that affects both developed and developing countries, having social, economic and on health consequences [1].

Anemia has many causes which can be isolated or most often co-exist and act in the same time. The most common reason of anemia is iron deficiency. These two terms are often used interchangeably, and the prevalence of anemia is used to report iron deficiency.

It is supposed that in 50% of cases , anemia is induced by iron deficiency. However, its frequency varies among different populational groups and geographic areas depending on local conditions [1]. Iron deficiency is one of the most common nutritional deficiencies in developing countries [2]. In Western Europe the prevalence of iron deficiency in pregnant women ranged from 25% in UK to 67% in France. Major risk factors of anemia are lack of adequate iron intake, impaired intestinal absorption of iron from food due to phytates and phenolic compounds and increased need for iron during pregnancy and periods of growth [1].

During pregnancy there is disproportionate increase in plasma volume up to 50%, Red Blood Cells (RBC) 33% and Hemoglobine (Hb) 18-20% mass. In addition there is marked demand of extra iron during pregnancy especially in the second half of pregnancy. So, physiological anemia is due to combined effect of hemodilution negative iron balance. Criteria of Physiological Anemia include Hb% - 10 g/dl or less, R.B.C less than 3.5 million/mm^3, Packed Cell Volume (P.C.V) – 30%,– normal morphology with central pallor [2].

Investigations are done to detect the degree of anemia, the type of anemia the cause of anemia. To ascertain the degree of anemia one must look for Hb%, RBC count, PCV. Mild anemia means Hb- 8-10 gm%; Moderate- less than 7-8 gm%; Severe – Less than 7 gm%.

A typical iron deficiency anemia shows the flowing blood values:

- Hb-less than 10 gm%
- RBC – less 4 million/ mm^3
- PCV – less than 30% (2).

Serum iron is usually below 30 micro gram/ 100 mL. Total iron binding capacity increases to 400 micro gram/ 100mL. Serum ferritin falls below 15 micro gm/L. To find out the cause of anemia, the physician should carefully follow the basic protocols.

- History taking,
- Physical examination,
- Routine examination of stool to detect helminthes or occult blood,
- Urine is examined for the protein, sugar and pus cells,
- Blood for PBF & malarial parasites,
- Kidney function tests like BUN & s. creatinine, etc (2).

Hemoglobin A (HbA) is the major Hb in adults. It is composed of four polypeptide chains: two α and two β chains. It contains two dimers of $\alpha\beta$ subunits, which are held together by non-covalent interactions. Each chain is a subunit with a heme group in the center that carries oxygen. A Hb molecule contains 4 heme groups and carries 4 molecules of O_2. The iron assimilated by the developing red cell is either converted to heme, temporarily stored, or remains permanently as a non-heme fraction within the erythrocyte. Iron enters at the protoporphyrin stage of pyrrole synthesis

Anemia continues to be a cause of maternal mortality in developing countries, estimating that it would be responsible for 6.37% of deaths in Africa, 7.26% in Asia and 3% in Latin America [3]. The data in *Worldwide prevalence of anemia between 1993-2005: WHO global database on anemia* shows that anemia in pregnancy is a public health problem in 33 countries. The prevalence of anemia in pregnancy was estimated at 57.1% in Africa, 24.1% in North and Latin America, 48.2% in South East Asia, 25.1% in Europe, 44.2% in Middle East and globally 41.8% (39.9 to 43.8) [1].

Experimental part

Material and Methods

Data on demographics (age, origin, marital status, level of education), nutritional education, food supplementation with vitamins and minerals; pregestational weight were

*email: roxyal2004@gmail.com

	BETA	Er. std. BETA	B	Er. std. B	t(353)	p
Intercept			1.559	.154	10.135	**.000000**
Total iron	-.161	.054	-.003	.001	-2.979	**.003**
Knowledge on iron importance during pregnancy	-.137	.061	-.143	.063	-2.260	**.024**
Cholesterol	-.161	.059	-.000	.000	-2.741	**.006**
Total calcium	.130	.066	.000	.000	1.982	**.048**
Carbohydrates	.168	.205	.001	.001	.819	.413
Proteins/kgc	-.037	.102	-.034	.092	-.367	.714
Fibers	-.107	.060	-.006	.003	-1.789	.074
Breast-feeding	.067	.051	.073	.056	1.317	.189
Lipids	.080	.133	.001	.002	.603	.547
Estimated energy intake	-.485	.308	-.008	.005	-1.574	.116
Calories	.414	.364	.000	.000	1.138	.256

Tabel 1
SIGNIFICANT FACTORS ASSOCIATED WITH ANEMIA (STEPWISE FORWARD MULTIPLE REGRESSION)

obtained by completing a questionnaire through a direct interview. To assess food intake we used a semiquantitative food frequency questionnaire (FFQ) that was completed by direct interview too, at 48 - 72 h after delivery. The food frequency questionnaire (FFQ) was previously validated on a sample of young women [4].

There were performed hematological and biological analyses in blood for each pregnant woman. Hemoglobin value was determined at admission to maternity, before birth in 389 pregnant woman (97.3%)

For the statistical processing of the data, we applied the SPSS programme (Statistical Package for Social Sciences) version 13.0 for Windows (Chicago, IL, USA).

Results and discussions

Mean hemoglobin value in the study group was 12 g / dL, average = 12.1 g/dL. Anemia was defined according to WHO criteria for the third quarter of pregnancy as a hemoglobin level below 11 g / dl. The prevalence of anemia in the study group was 20.05%. Women with anemia were from rural areas in 53.85% cases. The difference was not statistically significant ($\div 2 = 3.09$, $p = 0.08$).

There was noticed a higher frequency of anemia (Hb <11 g / dL) in women with:

-low level of education (anemia was found in the proportion of 37.18% of pregnant women) and 22.83% for those with higher level of education ($p = .005$);

-single pregnant women (26.92%) compared to married women (17.04%) ($p = 0.016$);

-unwanted pregnancy (16.67%) compared to unwanted pregnancy (7.72%);

-multiparous (> 2 births): 32.8% compared with 17.4% women with fewer or equal to 2 births ($p = .004$);

Women that didn't take food supplements had significantly higher proportion of anemia than those that used folic acid (65.38% vs. 34.62%, $p = 0.008$); iron (58.97% vs. 41.03%, $p = 0.005$) or vitamins (47.44 vs. 52.56%, $p <0.001$). The period in which women took vitamin and mineral tablets was significantly lower in women with anemia at birth (folic acid: 1.1 months vs. 1.55 months ($p = .04$); iron: 1.80 months vs. 1.08 months ($p = 0.004$); vitamins: 3.39 months vs. 1.99 months ($p <0.001$); calcium: 0.63 months vs. 1.17 months ($p = 0.019$).

There were no significant differences in average of energy daily intake, macronutrients, fiber and cholesterol among women with and without anemia. The prevalence of anemia as assessed by using Hb values, was associated with a significantly lower total daily intake in: iron (34.10 mg / day vs.46.69 mg / day, $p <0.001$), calcium (688.23 mg / day vs . 774.77 mg / day, $p = 0.039$) and magnesium (274.82 vs. 301.43 mg / day, $p = 0.01$).

WHO estimated that the prevalence of anemia in pregnant women in Romania was 30% (95% CI 10.2-61.9). The prevalence of anemia in the study group was 20.05%.

We noticed a higher frequency of anemia (Hb <11 g / dL) in women with low levels of education. A study carried out in 2005, Mother and Child Care Institute Alfred Rusescu, in Bucharest, emphasized an increased average and median hemoglobin in the same time with education level [7].

We noticed a significantly higher frequency of anemia in multiparous women (> 2 births). In another study performed in our country which assessed the general risk factors for anemia, such as environment, age, occupation, did not result in significant differences from the main group. [8].

There are several studies that examined the effect of supplementing the intake of iron during pregnancy [9,10, 11-13]. We noticed that women that didn't take food supplements had significantly higher proportion of anemia than those that used them.

American Dietetic Association has formulated some objectives to inform people that are working in the Health System about the healthy lifestyles in pregnancy (weight gain, adequate consumption of food, recommendations of Dietary Guidelines for Americans, supplementation with vitamins and minerals, alcohol, smoking and other harmful substances avoidance, compliance with food hygiene rules) [14-17]. In the study group, anemia was associated with a significantly reduced level of nutritional knowledge.

Anemia was associated with a significantly reduced average intake of iron, calcium and magnesium in the study group. After multiple regression analysis (forward stepwise) we found that anemia was significantly related with iron, calcium, total cholesterol intake, knowing that iron intake is important for the fetus. We found a negative relationship in final regression model, between calcium intake and anemia, which could be interpreted that it inhibits iron absorption in the gut (tabel 1).

$R = .385$; $R^2 = .148$; Adjusted $R^2 = .1069$
$F(17,353) = 3.604$, $p < .00000$ Estimation Standard Error = .372

Conclusions

Administration of iron preparations was a positive predictor of anemia in pregnant women, while inadequate weight gain and diet changes (induced by nausea, vomiting) were negatively associated with hemoglobin value.

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Manuscript received: 24.07.2016