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MATERNAL HAEMATOLOGICAL AND BIOCHEMICAL PARAMETERS AND PREGNANCY OUTCOME

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Abstract. An important external risk factor for pregnant women and newborn health is unbalanced nutrition of pregnant women. We have examined how some parameters reflecting nutritional status of a group of mothers delivering are related to the pregnancy outcome. The studied group consisted of 211 fullterm pregnant women who were hospitalized for delivery in "Cuza –Vodă" Maternity from Iaşi. Haemoglobin, haematocrit and erythrocyte count were determined as well as glucose, total proteins, albumin, triglycerides and cholesterol levels. The pregnancy outcome included: duration of gestation, foetal length, birthweight, 5 min Apgar score and head circumference. Laboratory tests showed a low maternal mean level of haemoglobin which emphasizes, beside other factors, an unsatisfactory nutritional status. Mean values of newborns indices were in normal limits. Of the investigated mother parameters, haemoglobin showed positive correlations with newborn length while total protein showed negative correlation with weight.

Key words: pregnancy, maternal haematological and biochemical parameters, newborn data

Rezumat. Nutriția dezechilibrată a femeii gravide este un important factor de risc extern pentru sănătatea sa şi a nou-născutului. Studiul a avut drept scop investigarea unor parametri ai statusului nutrițional al unui grup de femei însărcinate în relație cu datele nou-născutului. Grupul studiat a cuprins 211 femei gravide la termen, internate în vederea naşterii la Maternitatea "Cuza-Vodă" din Iaşi. S-au determinat hematocritul, hemoglobina, numărul de eritrocite, precum şi nivelele de glucoză, proteine totale, albumină, trigliceride, colesterol. După naştere au fost luate în considerare: durata gestației, talia fătului, greutatea la naştere, scorul Apgar la 5 minute şi circumferința capului. Femeile gravide investigate au avut un nivelul mediu scăzut de hemoglobină care reflectă, alături de alți parametri, un status nutrițional nesatisfăcător. Indicatorii medii ai nou-născuților au fost în domeniul normal. Dintre parametrii investigați la mamă, hemoglobina s-a corelat pozitiv cu lungimea nou-născutului, în timp ce proteinele totale s-a corelat negativ cu greutatea nou-născutului.

Cuvinte cheie: sarcină, indicatori hematologici şi biochimici ai mamei, parametrii nou-născutului

INTRODUCTION

Maternal and child health is an important problem of public health, influencing the development of the family and the community. Mother and infant protection is a priority in the health field because these populational groups are the most exposed to the sickness and death, consequently to their low reactivity to the environmental factors and to their high responsiveness to the disorders [1]. The problem of mother and infant is charper nowadays in our country in transition period, when most

people have a precarious financial status afecting all the life domaines including health.

After 1989, natality continously decreased in Romania (from 13.3 $^{0}/_{00}$ in 1990 to 10.5 $^{0}/_{00}$ in 1998) but in Iasi county it remained still high (from 16.4% in 1990 to 13.8 $^{0}/_{00}$ in 1998)[2, 3] but the high natality is taxed in the same time by an increased infant mortality. Meantime there is a significant difference (p=0.0000) between the birth rate in the urban (9.8$^{0}/_{00}$) *vs*. rural area(17.6 $^{0}/_{00}$) [3].

An important external risk factor for pregnant women and newborn health is unbalanced nutrition of pregnant women [4, 5, 6, 7], besides many other factors such as mother age, her height and weight, smoke, alcoholic beverages, social factors, hard work, stress, etc. Otherwise, the women who is in good health and who has maintained good nutrition prior to conception as well as during pregnancy has the best chance for a pregnancy without complications, a healthy baby and the ability to nurse [8].

Several authors found that there is a strong epidemiological association between the inappropiate nutritional status of women (especially proteins, minerals and vitamins intake) and low birth weight of newborn [6, 7], probably because the production of growth factor is regulated by nutrition [9].

According with WHO data [10], 95% of the children with low weight are born in developing countries; so, the influence of the socioeconomic status upon this health problem is obvious.

We aimed to investigate, in an observational study, haematological and biochemical parameters of a pregnant women group in possible relationship to the pregnancy outcome.

SUBJECTS AND METHODS

The studied group consisted of fullterm pregnant women with singleton pregnancies, randomly selected, hospitalised for delivery in "Cuza – Vodă" Maternity from Iaşi. 211 subjects out of 227 pregnant women have been included in investigation (we lost 16 pregnant women by discharge before delivery, lack of new-born data, etc.). The mean age of pregnant women was of 24.8 ± 5.3 years and the mean gestational age at the investigation moment was of 39.0 ± 1.7 weeks. 64.9% of pregnant women were from rural area. The women were apparently healthy, without diagnosed diseases which could affect their nutritional status or the newborn health. This sample represents about 4% of the average annual number of deliveries in the last 5 years in "Cuza-Voda" Maternity and almost 2% in Iasi county.

Blood was drawn from the anticubital vein of each subject. Haematological indicators (haematocrit, haemoglobin and erythrocyte count) were determined by usual methods [11]. Total proteins were assessed by refractometric method and the next indicators were colorimetricaly determined: albumin by bromocresol green methode [12], glucose by orto-toluidine method, triglycerides by phenylhydrasine method and cholesterolum by Rappaport - Eichorn method [11].

After delivery, there were recorded: length of gestation, sex, length,

weight, 5 min Apgar score and head circumference of the newborn.

EPI INFO 6 programme has been used for statistical processing. Means and 95 % confidence interval (CI) of the means were calculated. The relation between maternal parameters and pregnancy outcome was verified by Pearson correlation index (r) [13].

RESULTS

The haematological parameters (mean values) of pregnant mothers were in normal limits, excepting haemoglobin level which had a lower one (Table 1).

Table 1. Haematological parameters

Parameter	No of subjects	Mean	95% C.I.	Normal values [14]
Haematocrit (%)	204	35.3	34.9 – 35.7	35-47
Haemoglobin (g/dl)	205	10.7	10.5 – 10.9	11-16
Erythrocyte count (millions/mm^3)	202	3.8	3.7 – 3.8	3.7-5.0

The biochemical parameters (mean values) are shown in (Table 2).

The anthropometric indices of newborns (mean values) presented in Table 3 hanged in normal limits.

Table 2. Biochemical parameters

Parameter	No of subjects	Mean	95% C.I.	Normal values*
Total protein (g/l)	208	75.8	75.1 – 76.5	67-87
Albumin (g/l)	183	39.2	38.8 – 39.6	35-55
Glucose (mg/dl)	209	65.6	63.8 – 67.4	65-100
Triglyceride (mg/dl)	205	152.7	148.6 – 156.7	40-120
Total cholesterol (mg/dl)	205	275.7	269.0 – 282.4	120-220

* acording to the assessment methods

Table 3. Pregnancy outcome

Parameter	No of subjects	Mean	95% CI	Normal values [15]
Gestational age (weeks)	211	39.7	39.6 – 39.8	37-42
Newborn weight (g)	211	3372.2	3315.5 – 3428.8	2500-3500
Newborn length (cm)	211	49.8	49.6 – 50.0	33-50
Apgar score	206	8.8	8.7 – 8.9	8-10
Head circumference (cm)	211	34.0	33.9 – 34.1	33-35

Sex repartition was aproximately equal : 49 % girls and 51% boys.

Among the all assessed mother parameters, haemoglobin positively correlated with newborn length ($p<0.05$) and total protein negatively with newborn weight ($p<0.025$) (Table 4).

Table 4. Correlations betweeen maternal parameters and pregnancy outcome (r)

Maternal parameters	Pregnancy outcome				
	Duration of gestation	Foetal lenght	Birthweight	Apgar score	Head circumference
Haematocrit	+0.01(205)	+0.11(205)	-0.07(205)	-0.01(205)	-0.05(205)
Haemoglobin	-0.01 (205)	**+0.14(205)[a]**	-0.02(205)	+0.02(202)	-0.06(205)
Erythr. count	-0.04(202)	+0.10(202)	-0.02(202)	0.0 (197)	+0.03(202)
Total protein	-0.10(208)	+0.04(208)	**-0.16(208)[b]**	-0.01(203)	-0.01(208)
Albumin	-0.02(183)	+0.08(183)	-0.02(183)	-0.02(178)	-0.01(183)
Glucose	+0.07(209)	-0.05(209)	-0.09(209)	-0.11(204)	+0.06(209)
Trygliceride	+0.08(205)	+0.08(205)	0.0 (205)	+0.11(200)	0.0 (205)
Total cholesterol	+0.05(205)	-0.03(205)	-0.04(205)	+0.09(200)	-0.02(205)

( ): No of subjects; Significance levels : a=$p<0.05$; b=$p<0.025$.

DISCUSSION

Adaptation to pregnancy involves major changes in maternal metabolism in order to satisfy growing demands of the pregnancy outcome. The continous physiologic adjustements affect the metabolism of all nutrients. The adjustements vary depending on the prepregnancy nutrition of the women, genetic determinants of the fetal size and maternal lifestyle. Thresholds in the capacity to adjust nutrient metabolism depending on the amount suplied exist for all nutrients [16].

In pregnancy, the levels of different parameters generally decrease because of haemodilution and of increased needs. Accordingly, haematological parameters (Table 1) were decreased in our studied group: mean levels of haematocrit and erythrocyte count were in normal range but very close to the lower limit, while mean haemoglobin value was under this limit. As a result of stimulated erythropoiesis, the decrease of erythrocite count was smaller comparing with the decrease of haemoglobin.

The mean total protein and albumin values were in normal range but in the lower half of it (Table 2).

During pregnancy serum glucose level falls by about 15-20% as a result of the energy requirements of the foetus, which are almost exclusively met by the maternal glucose [17]; so, the mean serum glucose level was in normal range but very close to lower limit.

The assessed lipid metabolism indicators (tryglicerides and total cholesterol) usually increase during pregnancy, especially at last quarter, by decreased sensibility to insulin [18] and one can see that the obtained mean values outrun even the upper normal limit value for the unpregnant women.

The newborn weight (Table 3), the main indicator of his health, is higher than the mean values (3200 g) found in 1991, in a study performed in 20 counties and in Bucureşti in collaboration with UNICEF [19].

In our study, maternal haemoglobin level positively correlated with newborn length (Table 4) and did not correlated with weight probably because the length is more stable than weight. Haemoglobin is one of many factors which can determine newborn lenght. It transports oxygen and has a role in energetic metabolism which influences in turn the foetal growth. The degree of foetal growth is mainly reflected by weight and length, two each another related parameters and determined in turn by other factors.

Garn & al. confirmed in a very large sample the morbidogenic nature of low haemoglobin and haematocrit levels during pregnancy and also showed the disavantages of high maternal haemoglobin and haematocrit with respect to pregnancy outcome [20]. So, the optimal haemoglobin levels appear to be in vecinity of 11 to 12 g and the optimal haematocrit appear to be 31 to 35 % packet cell volumes. Taking into account the results of Garn & al., we followed the relationship haemoglobin - length at haemoglobin values > 12. We found a positive nonsignificant correlation

(r=+0.14; p>0.05; n = 30), probably because of not very high haemoglobin values (mean ± S.D. = 12.7 ± 0.5) and the small number of subjects.

Also Yip showed that moderate anaemia is often associated with poor perinatal outcomes [21].

As Kalhan & al. suggest, in pregnancy there is an integral regulation of protein and nitrogen metabolism aimed at conservation and accretion of nitrogen by the mother and the foetus [22]. Literature data are contradictory as concern the relationship between maternal proteins and newborn weight; some authors showed a positive correlation [23,24] and the other ones a negative one [25, 26]. We found also a negative correlation.

CONCLUSIONS

1. A low level of mother haemoglobin which can emphasizes, beside other indicators, an unsatisfactory nutritional status has been found.
2. The mean newborn parameters were in normal range.
3. Haemoglobin showed a positive correlation with newborn length while total mother proteins showed a negative correlation with newborn weight.

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