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NUTRITION AS A PREDICTOR OF HEALTH DISORDERS OF MOTHER AND CHILD IN THE REPUBLIC SAKHA (YAKUTIA)

Abstract

As a result of clinical and epidemiological studies on nutrition and health of mothers and children, it was found that the majority of mothers' diets were profoundly deficient in energy value and all food substances. Consumption of basic foods containing animal protein (meat, fish and eggs), vegetables, fruits and berries were significantly lower than the recommended values. Inadequate provision by macronutrients (proteins, fats, carbohydrates) was detected in 80%; minerals – in 90%; vitamins – in 75%, iron – in 100% of the surveyed women.

The interconnection of insufficient supply of maternal dietary by iron, magnesium, calcium, vitamins C, B_2 with the development of anemia, toxemia of pregnancy, phetoplacental insufficiency, prenatal growth retardation syndrome and chronic fetal hypoxia was proved. And relationship of inadequate supply of iron, magnesium, potassium, vitamins B_1, B_2 , PP with a long period of anhydrous in labor, labor abnormalities, delivery stimulation, operative delivery, bleeding and massive blood loss during delivery and the postnatal stage ($p < 0.05$) is also undeniable. It was revealed that the deficit in the mothers' diet of proteins, fats, carbohydrates, phosphorus, calcium, beta-carotene, vitamin B_1 is associated with the development of asphyxia, fetal malnutrition, intrauterine infection of the newborn child ($p < 0.05$).

The result of carried out research revealed that 94% of pregnant women of the native population with deficiency status and low hemoglobulin index in the first trimester of pregnancy and before childbirth had essential health disorders. It was proved that the predictors of a child health disorders are the following: mother's insufficient consumption of beta-carotene with food ($B = 0.1$; $p < 0.05$), low level of hemoglobulin in the first trimester ($B = -0.6$; $p < 0.018$) and before childbirth ($B = 0.4$; $p < 0.01$).

Keywords: diet, diets, macro - and micronutrients, mothers and children, pregnancy, childbirth, prenatal development, fetus, the newborn child.

INTRODUCTION

The organization of proper nutrition for pregnant women and nursing mothers is one of the important conditions for the normal flow and a successful outcome of pregnancy, maintaining the health of women during pregnancy and lactation, ensuring the correct formation, optimal growth and development of the fetus, and then a newborn baby and children in older life times. All the necessary "building materials" (proteins, fats, carbohydrates, various minerals and vitamins) fetus and the child received only from the mother [4, 5].

Special epidemiological and clinical studies have shown that nutrition disorders during pregnancy and while breast-feeding can lead to serious consequences (miscarriage, premature birth, birth of a child with a variety of prenatal defects, retarded physical and psychological development) and various deficiency states [1, 2, 7].

Adequate eating behavior among pregnant and lactating women in this important period, quality products for women and children, are of particular relevance in the Far North, where there are many families with low social status, where the structure of the food of the population has its own national characteristics, and where high maternal and child morbidity and mortality still remain. Unfortunately, to date, the potential possibilities of nutrition as a factor in reducing maternal and child mortality, morbidity and disability are not fully utilized. This explains the

negative trends in demographics, including low life expectancy of the population.

The **purpose** of our research: to study the predictors of health disorders of mothers and children in relation to the actual maternal nutrition in the Far North.

MATERIALS AND METHODS

We have comprehensively examined 138 pregnant women (mean age 27.6 ± 0.41 years), 118 postpartum women and their newborns. Women's groups were formed by simple randomization of the number of women attending antenatal clinics in connection with this pregnancy. All the women and children were examined by a single protocol. The diagnosis of primary and related diseases in the mother and the child is installed in accordance with the International Classification of Diseases the X revision (1990).

Assessment of nutrition and dietary habits was conducted based on a survey of mothers in accordance with the international standards of the WHO integrated non-communicable diseases CINDI program [1, 4]. Calculation of the food set and the chemical composition of food were done in the Laboratory of structure and planning of nutrition study of the Institute of Nutrition RAMS, Moscow.

The peripheral red blood content was done on the hematology analyzer COULTER COUNTER (Switzerland). Evaluation of anemia in women was conducted by the level of hemoglobin below 112 g / l [7], in the newborns at the first day after birth, according to the WHO, - 194 g / L.

The work was carried out in several stages:

Stage I - comprehensive clinical evaluation of the health of the surveyed pregnant women, postpartum women and their newborns;

Stage II - Assessment of dietary intake and dietary habits of pregnant women in the II half of pregnancy (28. 9 ± 0. 45 weeks);

Stage III - Analysis of iron supply of pregnant women, postpartum women and their newborns during the different periods of observation;

Stage IV - Assessment of the relationship of nutrition and health of mother and child.

RESULTS AND DISCUSSION

Clinical characteristics of the observed women and children

We found toxemia of pregnancy in half of the women from the total number of the surveyed women; the number of mothers with placental pathology increased with pregnancy course and at delivery reached 75. 8% (Cochran Q-Test = 28. 3; $p < 0.000001$). In the III trimester fetal prenatal growth retardation was observed in almost each tenth women (11. 6%, Cochran Q-Test = 19. 7; $p < 0.0001$).

At a comprehensive clinical evaluation of the health of the surveyed pregnant women, postpartum women and their newborns it was revealed that prior to delivery 86.4 % of the patients had a probability of preeclampsia developing, hemorrhage in childbirth and the postpartum period, the weakness of labor forces, abnormal labor, birth tract traumas, retinal detachment, hypoxia, fetus asphyxia, fetal infection, prenatal pathology, septic processes in the postnatal period.

From the 138 studied women 118 women delivered. Herewith, the high rate of complications in childbirth and the postnatal period was noted (Fig.).

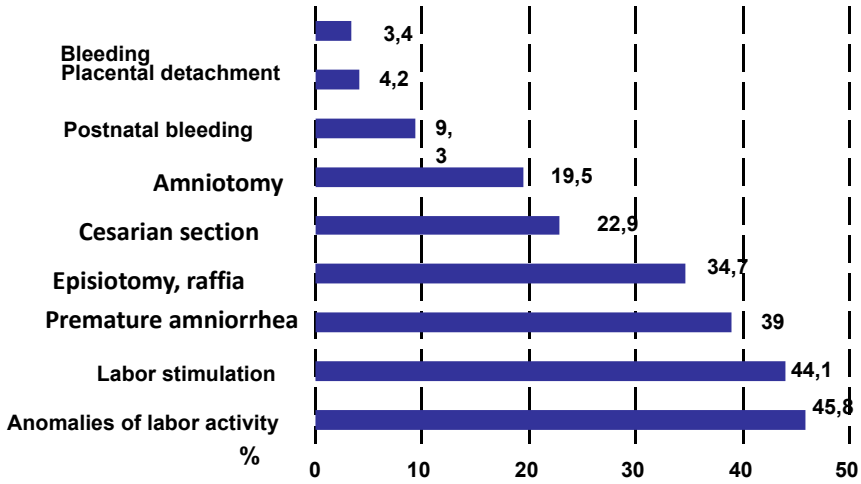

Fig. The frequency of labor disorders among the surveyed women.

Newborn babies were mostly of average length, weight, girth parameters. The exceptions were the children born immature (6.7%), preterm (8.5 %), with prenatal growth retardation syndrome (15.3%).

Satisfactory condition at birth was observed in 48.3 % of children. Almost every second child was born in a state of moderate severity (43.2 %), each 12th - in a serious condition (8.5 %).

Different variations in health status were reported in 51.7 % of children, including in two thirds (72.9 %) of them chronic hypoxia, hypoxia during labor (70.3 %), in 2.5% - asphyxia in labor were revealed. In the early postnatal adaptation period the risk of prenatal infection was diagnosed in 83.1 %, prenatal hypotrophy - in 12.7 %, prolonged jaundice - in41.5 %.

Almost in the each fourth child movement disorders syndrome was classified. The normal course of neonatal period in only 58.5 % of children was noted.

Clinical manifestations of iron deficiency in the form of IDA before 13 weeks of pregnancy were diagnosed in a third of the surveyed pregnant women, at 14-26 weeks time – in more than 70 %, in the III trimester - in 77,5% (Cochran Q-Test = 89 75 , $p < 0.000000$) [4].

In the course of pregnancy, there was a decrease in hemoglobin in the peripheral blood (ANOVA Fridman $\chi^2 = 73.37$; $p < 0.00000$) (Table 1). Hemoglobin level below normal was recorded in 26.8 % of women in the I trimester; in 61.7% in the II one; in 70.0 % and more women in the III trimester before delivery, in total in 62.9% of women in labor and in 47.3 of the newborns.

Table 1

The dynamics of blood hemoglobin (HBG) at different stages of pregnancy and the postpartum period

The observation period	n	HBG, g / l						Reference values
		M	s	m	Min	Max	95% CI	
1 Trimester	138	121,3	12,4	1,1	81	147	119,2–123,4	120–145
2 Trimester	125	114,7	10,1	0,9	86	144	112,9–116,5	115–130
3 Trimester	118	111,8	9,9	0,9	85	133	109,9–113,6	112–130
Before labor	92	111,6	9,9	1,0	82	128	109,6–113,7	112–130
In women in labor	118	113,8	15,6	1,4	73	156	110,9–116,7	115–130
In the newborns	118	186,9	26,5	2,5	97	256	181,9–191,9	194–208

Note. M - the arithmetic mean, s- standard deviation, m - standard error of the mean.

Nutrition and dietary habits among the surveyed women

We studied how mothers were informed about the healthy diet products and found that women who believed the basis of healthy eating to be fish and meat products represented 83. 6 %, dairy products - 60.7%. The share of cereals, bread and potatoes had respectively 36.1 %, 44.3 % and 41 %, fats and sweets - 21.3 %.

The results show the discrepancy of actual consumption to the SanPin recommended standards [6].

The results showed inadequate intake by pregnant women of basic foodstuffs, such as meat (actual consumption - 155.9, the recommended amount - 180 g / day) and fish (33.5 and 100), vegetables (127.5 and 500) and fruits (143.5 and 250 g / day respectively). An increased intake of certain food groups such as milk (actual consumption - 435.6, recommended amount - 250 g / day), bread and bakery products (185.1 and 100 g / day) was revealed. The consumption of sweets was almost in 1.5 times higher than recommended values (77.7 and 50 g / day).

In this research, we studied the energy and macro - and micronutrients consumption. The actual energy consumption, nutrients by the surveyed women was compared with the norms of the physiological requirements for nutrients and energy for pregnant women (Table 2).

Table 2

The average daily intake of energy and nutrients

Macronutrients	Recommended norms	The actual value of consumption	
		M	m
Protein, g / d	96	72	2,4
Fat, g / d	85	77	3,3
Carbohydrates, g / d	348	240	8,4
Energy value (kcal)	2550	1939	62,9

With regard to the average daily intake of protein, fat, carbohydrates, we found insufficient dietary intake of almost all the macronutrients. Normal energy value of the diet is noted only in 18 % of pregnant women.

In this study, we have examined thoroughly the consumption by pregnant women vitamins (B1, B2, PP, A, C) and minerals (iron, calcium, magnesium, phosphorus, potassium, sodium). The average daily intake of vitamin B1 was 55 %, Vitamin B2 - 72 %, PP – 7%, and C-63, A – 77% of the recommended values. It should be noted that a lack of the average daily intake of vitamin B1 was found in 91.8%, B2 - in 77.1%, C – in 77.9, A – in 88.5, PP – in 72.9 % of women (Table. 3). Therefore, the consumption of vitamins in accordance with the rules was registered only in 20% of surveyed women.

Table 3

The average daily intake of essential vitamins, mg / day

Vitamin	Recommended amounts	Actual consumption	
		M	m
A	1,5	0,8	0,2
B_1	1,7	0,9	0,03
B_2	1,8	1,3	0,1
PP	19	13,1	0,5
C	90–100	63,3	4,5
Beta - carotene	3,5	1,9	0,2
Retinol ret.ekv	1200 - 1400	1087,6	193,6

A similar situation is observed with the average daily intake of minerals (Table 4). The average daily calcium intake was 59 %, Magnesium - 60%, Phosphorus - 88%, potassium - 83 % of the recommended norm. As for the intake of sodium, its average daily consumption was 121 % of the recommended norm. Insufficient average daily calcium intake was observed in 90.2 %, magnesium - at 95.1 %, phosphorus - at 88.5 %, potassium - 73% of surveyed women. Women consumed iron in 3 times less than the norm (36% of norm) and its insufficient intake was observed in all surveyed women. Thus, consumption of minerals in accordance with the recommended values for pregnant women was observed only in 10% of the women under study.

Table 4

The average daily intake of essential minerals, mg/day

Mineral	Recommended amounts	Actual consumption	
		M	m
Fe	38	14,7	0,5
Ca	1100	649,2	28,6
Mg	450	278	8,8
P	1650	1136,6	35,7
K	3500	2905,9	93,7
Na	2400	2914	112,3

Thus, by studying actual nutrition of pregnant women by the daily food recall, we revealed an expressed lack of supply of all the studied macronutrients (proteins, fats, carbohydrates) and micronutrients (vitamins, micro and macroelements), except for sodium.

We made the correlation analysis of the relationship of actual nutrition of pregnant women, alimentary substances (macro- and micronutrients) with the morbidity level, frequency of complications of pregnancy and childbirth, disorders of adaptation and neonatal morbidity.

So, we have proved the relationship of the diet of the pregnant with low supply of iron, magnesium, calcium, vitamins C, B2 with the development of anemia, gestosis, prenatal growth retardation syndrome and chronic fetal hypoxia ($p < 0.05$). Also we found a strong correlation in the diet deficient in iron, magnesium, potassium, vitamins B1, B2, PP with the pathology of labor (prolonged fluidless period, an abnormality of labor activity, labor stimulation, operative delivery, bleeding and massive blood loss during delivery and the postpartum period) ($p < 0.05$). We proved a close correlation of low supply of the diet of pregnant women with main nutrients (proteins, fats, carbohydrates), phosphorus, calcium, beta- carotene, vitamin B1 with the development of asphyxia, fetal hypotrophy, intrauterine infection of the newborn child ($p < 0.05$).

The correlation analysis revealed a close relationship to a statistically significant hemoglobin (HGB) linkage in postpartum women and newborns with energy value of the diet of the mother and the supply of the diet with B vitamins (B1 , B2) (Canonical $R = 0,87$, $\chi^2 = 37,92$, $p < 0.09$) .

Taking into account the clinical and laboratory indicators of maternal and child's states we have developed a mathematical model that predicts the baby's condition at birth with accuracy up to 94%. The results of the logistic regression analysis revealed that the state of the newborn is most closely connected with the supply of the mother with beta- carotene ($B = 1.015$, $p < 0.05$), hemoglobin level of women in the first trimester ($B = -0.573$, $P < 0.018$), and prior birth ($B = 0.423$, $p < 0.014$).

CONCLUSIONS:

1. We found that health disorders of mother and child in the Republic of Sakha (Yakutia) are formed on a background of malnutrition.
2. The actual diets of mothers have a low energy value, the content of all diets with studied macro- and micro-nutrients (proteins, fats, carbohydrates, vitamins and minerals).
3. We revealed a high level of iron deficiency and anemia among pregnant women in different periods of pregnancy, childbirth and newborn related to poor nutrition of mothers.
3. In pregnant women, nursing mothers and their babies health disorders are associated with insufficient consumption of essential nutrients from food ($p < 0.05$).

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