



## ASSOCIATION BETWEEN NUTRITIONAL BEHAVIOUR AND THE RISK OF IRON DEFICIENCY AMONG PREGNANT WOMEN

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### ABSTRACT

A study on dietary habits of 128 pregnant women from Plovdiv, district of Plovdiv and other regions of South Bulgaria was carried out. An original author's questionnaire was used for the purpose of the study. The iron status of pregnant women was evaluated on the basis of the data of biochemical indicators hemoglobin and ferritin. The results show that omissions in the nutrition of pregnant women are available. The unhealthy nutrition is a risk factor for their health and for the normal fetus development. Concrete recommendations for improvement of nutritional behavior during pregnancy and prevention of iron deficiency and unfavorable consequences for the fetus were made.

**Key words:** pregnant women –nutritional behavior-iron status-hemoglobin-ferritin-questionnaire

### INTRODUCTION

The food intake of pregnant women is one of the most important factors that influence the course and outcome of pregnancy. The deficient and unbalanced nutrition of pregnant women has a negative effect on their personal health and affects the development of the fetus, as well as the outcome of the pregnancy and creates a risk for the offspring to suffer from a number of diseases in maturity. In the period of pregnancy women need additional intake of iron. Iron deficiency anemia in the time of pregnancy can raise the risk of giving birth to an underweight child who can develop iron deficiency in the very first month of his/her life. (1) Recent research on the problem in Bulgaria (2, 3, 4, 5, 6), as well as in other countries (7, 8, 9, 10, 11, 12, 13) has proved the dominant role of healthy diet of the future mother for the flawless development of the fetus and for the reduction of the risks of chronic diseases during maturity including coronary heart disease, hypertonic disease, diabetes type 2, etc. The fact that improvement of nutritional habits of women at fertile age

and pregnant women is embedded in the “Food and Nutrition 2011-2016” National Action Plan emphasizes the importance of the problem.

The aim of this research is to assess the nutritional behaviour and iron status of pregnant women on the basis of the levels of blood hemoglobin and serum ferritin so that recommendations could be made for its optimization.

### MATERIAL AND METHODS

An object of the research is 128 pregnant women from the town of Plovdiv and the district of Plovdiv as well as some coming from other regions in Southern Bulgaria. A study under the form of a questionnaire was made of their dietary habits. An original questionnaire card was designed to serve the purpose of the study. It was designed by the authors and covered questions on the age of the pregnant women, the term and the pregnancy period, their nutritional behaviour, bad habits, etc. The filling-in of the questionnaire was performed during the stay of the pregnant women in the Maternity Ward of the Clinic of Obstetrics and Gynecology, MPHAT “St. George”, Plovdiv. The serum levels of ferritin were determined with an immune-enzyme method. The tests used were those of Minias

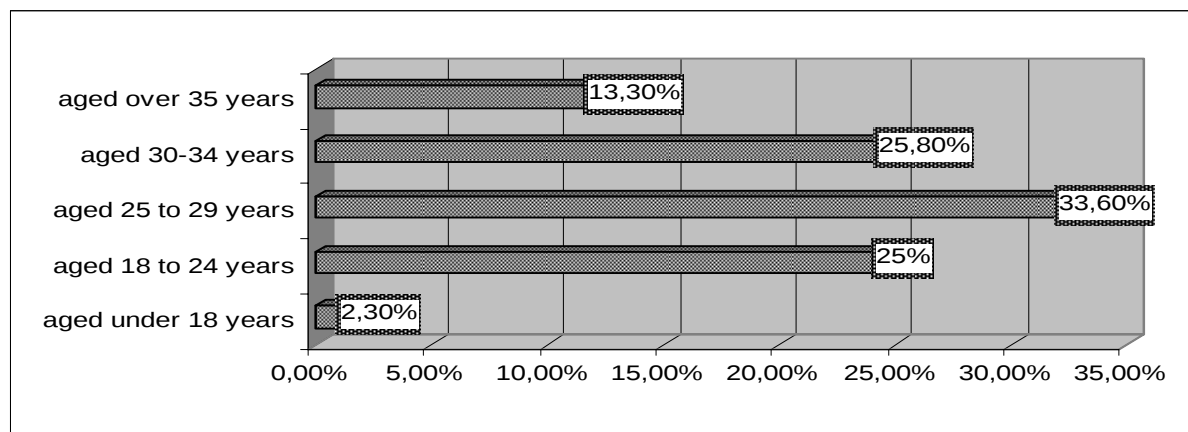
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Globe Diagnostics Srl, Italy. The hemoglobin and the full hematological picture were measured with an automatic hematological analyzer Sysmex SE 9500. The study was made with the informed consent of the tested patients.

The statistical processing of the results was done with the programme software SPSS -11.

## RESULTS AND DISCUSSION

**Fig. 1** represents the age structure of the interviewed pregnant women. It demonstrates that their greatest number is in the age range of 25-29 years of age. The portion of those aged under 18 and those above 35 statistically significantly differs ( $u_1=7,11$ ;  $u_2= 3,94$ ;  $P<0,05$ ) from the group aged 25-29.

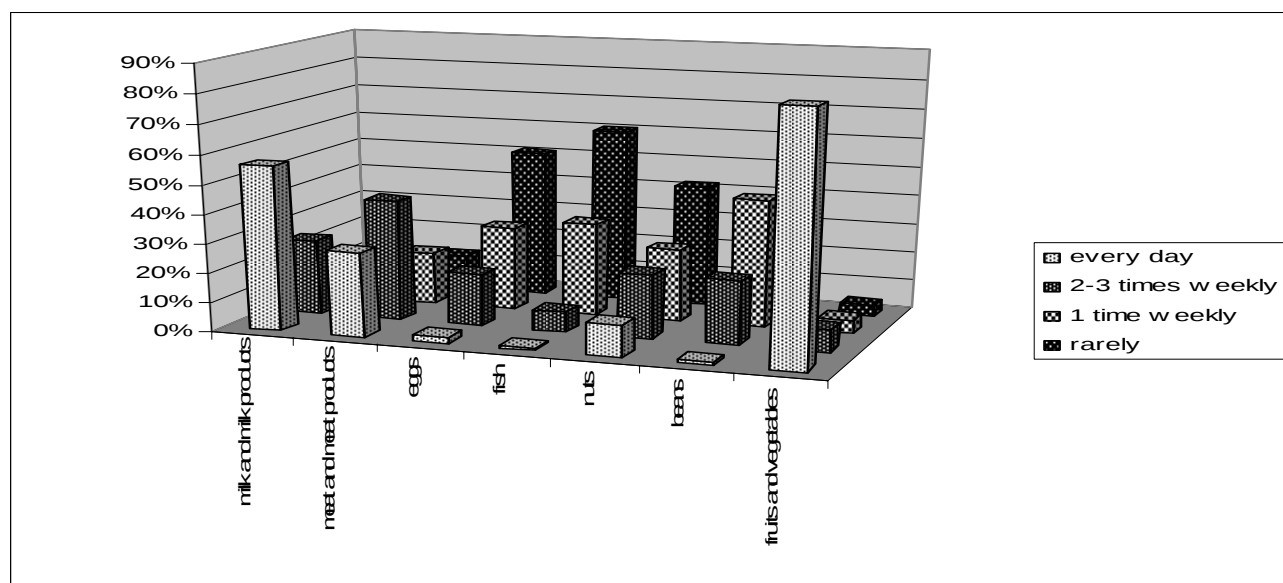


**Fig. 1.** Age structure of the pregnant women

For about half of the pregnant women (54,7%) that was their first pregnancy. 29,7% of the interviewed women reported that their pregnancy was fluently developing while 70,3% reported complications during pregnancy. Only 21,9% of the pregnant women reported an increase in their blood pressure. At the question "How many times a day do you eat?" the predominant part (39,8%) of the interviewed pregnant women answered that

they ate 4 times a day, while 23,4% answered that they ate 5 and more times during the day. Two pregnant women (1,6%) reported a less than a tree-time food intake, that actually contradicts the physiological demands for healthy diet during pregnancy.

**Fig. 2** represents the portions of food depending of the frequency of its in-take:



**Fig. 2.** Distribution of the food consumed depending on the frequency of its intake

What is noticeable is that a little more than a half of the pregnant women (56,2%) consumed milk and dairy products every day, which is a favourable fact. At the same time 10,2 % reported an intake of this type of food once a week, and 7,8% - more rarely than once a week. The lack of substantial protein nutrition can affect negatively the normal development of the fetus' brain. It has been proven that when the energy levels and the proteins in the food of the pregnant woman are reduced, the structure of her bones and those of the fetus is affected (11, 12, 13). Suitable sources of substantial proteins in addition to dairy products are meat, fish, eggs, as well as the traditional for our country vegetable protein sources – a diversity of cereal, beans and nuts. A great part of the food mentioned is rich in iron, which is necessary for the prevention of the often met iron deficiency during pregnancy.

In food iron exists in two forms – heme and non-heme iron. 40% of heme iron is derived from meat, poultry and fish. Non-heme iron represents 60% of the iron in the animals' tissue and the iron in the plants (fruit, vegetables, cereal, nuts). The recommended daily intake of iron for women at fertile age is 33 mgr. per day (14). It can be seen in **Fig. 2** that meat and meat products were daily consumed by 28,9% of the pregnant women, 41,4% of them ate it 2-3 times a week and in the rest of the cases – once a week or even more rarely. About the consumption of fish once a week report 32% of the pregnant women, and in 60,2% of the cases – more rarely. The results obtained in other surveys are similar (4). Fish is precious food for the pregnant, it is rich in macro and micro elements and biologically active substances, but there is a lack of tradition in its consumption. Eggs were eaten 2-3 times per week only by 18% of the pregnant women and in the rest of the cases – once a week or even more rarely which goes against the recommendations for healthy nutrition and

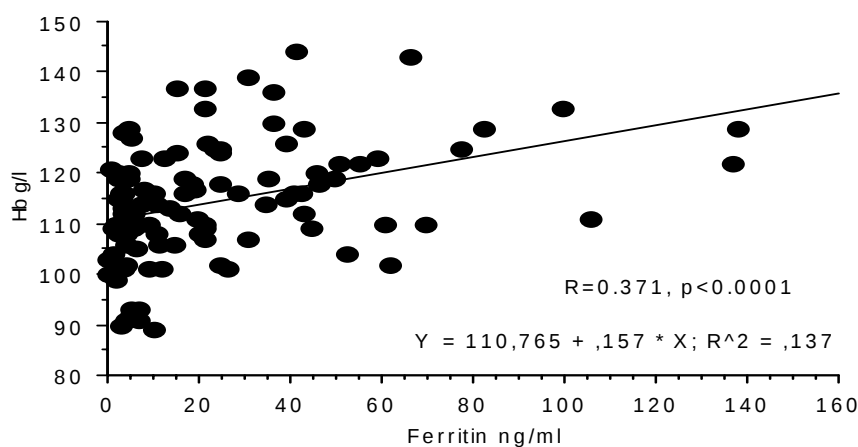
prophylactics of iron deficiency anemia of pregnant women. The period of pregnancy creates the most serious risks for the development of folic acid and iron deficiency which have the decisive role for the development of the fetus, the outcome of pregnancy and the health of the newly born (15, 16, 17, 18). Legumen (peas, beans, lentils, etc.), which are rich in vegetable proteins and iron were reported present in the diet once a week for 43,8% or even more rarely (33,5%) for the bigger number of future mothers. Nuts (walnuts, peanuts, etc.) are rich in polyunsaturated fatty acids (PUFAs) as 30% of the imported fats should be of vegetable origin. They are the energy reserve being rich in vitamin E and are of vital importance for the normal development of pregnancy. Only 10,9% of the women consumed nuts daily, 21,9% took them 2-3 times a week, 25% -1 once a week, and 42,2 % - more rarely than once a week. It is a favourable fact that a bigger part of the pregnant women (83,6%) daily ate fruit and vegetables in amounts that meet the recommended standards of 400-450gr. daily. In addition to vitamins and minerals, the fruit and vegetables are important with them containing pectin, cellulose and other nutritious fibers and organic acids which are of importance for the good digestion and some metabolic processes in the organism.

When an assessment of the iron status of the pregnant women was made, it was found out that almost 1/3 (32,1%) of them had the level of hemoglobin lower than 110 g/L (6,19), which corresponds with the insufficient intake of food that is rich in iron. The relative risk of iron deficiency among the pregnant women under research is  $RR=5,703$  (95% CI 2,577-12,622),  $\chi^2=28,40$ ,  $P<0,05$  with a significant positive correlation ( $r=0,51$ ) between the low level of hemoglobin and the insufficient intake of food that is rich in iron. **Table 1** is presents the data about hemoglobin and ferritin of the pregnant women under research:

**Table 1.** Biochemical indicators for the assessment of the iron status of the pregnant women

| Indicators                           | Hemoglobin (g/l)   | Ferritin (ng/ml)  |
|--------------------------------------|--------------------|-------------------|
| n                                    | 109                | 119               |
| Mean $\pm$ SD                        | 114.95 $\pm$ 11.79 | 23,85 $\pm$ 27,27 |
| Median (50 <sup>th</sup> percentile) | 115.0              | 14,63             |
| 95% confidence interval              | 112.71 - 117.19    | 18,90-28,80       |
| Min                                  | 89.0               | 0,13              |
| Max                                  | 144                | 137,79            |

A correlation is observed ( $R=0,371$ ,  $P<0,0001$ ) between the levels of hemoglobin and serum ferritin of pregnant women (**fig. 3**):



**Fig. 3.** Correlation between the level of hemoglobin and ferritin of the pregnant women under research

One hundred and one ( 85% ) of the pregnant women have ferritin lower than the average reference indicator (49 ng/ml), almost half of them ( $n=44$ ) have ferritin under the lower reference limit 7 ng/ml. When interpreting the data about the serum ferritin of the pregnant women it should be taken in account the fact that the increased amounts above the reference indicator of this biomarker may be due to some process of infection. For this reason C-reactive protein was studied aiming at the exclusion of such a process. During the conducted research only 3 of the cases where the indicators of ferritin were above the average, the C-reactive protein was above the reference number and only they can eventually be associated with existing of infectious process.

In the diet of the pregnant woman the intake of cooking salt should be moderately restricted. This contributes to the reduction of the increased hydrophilicity of tissues which is favourable at birth. It is considered that the moderate intake of salt with the food (4-5 gr. daily) is not hazardous not only during normal pregnancy but during toxicose either. And what is more, it should be taken into consideration that there is an acting national strategy for overcoming the iodine deficiency which includes iodinating of the cooking salt. In this way the optimal iodine intake for pregnant women is secured. To the question „Do you add salt to your food?” 42,9% of all the women said “Yes”, which required some additional instruction of the pregnant women

aiming at prevention of eventual complications during pregnancy. 19,5% of the pregnant women consumed spicy food. A little more than the half of the interviewed (60,2%) reported they had some favourite food.

In the cases of iron deficiency, food and drinks that hamper resorption of iron should be excluded from the diet – tea, coffee, medication, etc. A substitute therapy with iron additives is conducted. In **fig. 4** we have visualized the consumption of coffee and alcoholic drinks of the pregnant women depending on the frequency of their intake.

From the figure it becomes clear that a significant number of the pregnant women drank coffee every day (27,3%) or more rarely (29,7%), 31,3% reported that they did not take coffee at all. One of the recommendations for healthy diet for women during pregnancy is restriction in the consumption of drinks that contain caffeine. The effects of caffeine are connected with the unfavourable consequences such as premature birth, spontaneous abortion, low weight of the newly-born and raised levels of excitability of the infant. Alcohol under the form of wine and beer is consumed more rarely than once a week by 43,7% of the interviewed and 50% do not take alcohol at all. To the question „Do you smoke?” 87,5% answered negatively. Only 4,7% answered that they smoke and 7,8% smoke occasionally. To the question “Do you take synthetic vitamins and minerals?” 53,9% of the pregnant women

gave a positive answer. In the recent years the intake of multi-vitamins is connected by some authors (20, 21) with the prevention from the risk of premature birth. To the question “Do

you take medicines?” 77,3% of the pregnant women gave a positive answer, especially those who have had complications during their pregnancy.

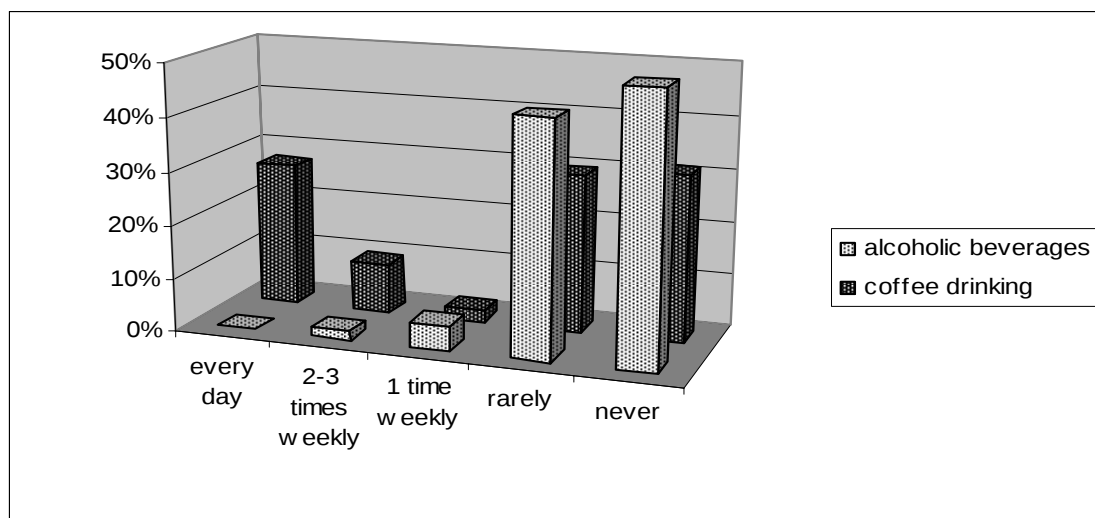


Fig. 4. Consumption of coffee and alcoholic drinks of the pregnant women

## CONCLUSION

On the basis of the results from the survey we can conclude that certain omissions can be observed in the nutrition and the dietary habits of the pregnant women. Aiming at reduction of the risk of iron deficiency anemia some recommendations were provided to the future mothers so that their nutrition was improved during pregnancy and some complications and unfavourable consequences for the fetus were prevented.

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