Risk Factors of Anemia in Children and Prognosing of IT

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Abstract: *The articles provide data about the risk factors of anemia in children, and have been composed prognostic tables in order to early diagnosis of anemia in children. Anemia is one of the most common not only medical, but also a socio-economic problem of modern medicine and public health on a global scale. According to the World Health Organization (WHO), the prevalence of anemia in the world is 22.9-26.7%. The results of the study showed that the main risk factors are the mother's social situation, living conditions, diet, eating meat foods, breastfeeding, anemia in the mother,, helminthiasis, irrational use of antibiotics.*

Keywords. Anemia, children, risk factors, prevalence rate

1. Introduction

Anemia is one of the most common not only medical, but also a socio-economic problem of modern medicine and public health on a global scale. [1,2,3,4,6]. Anemia refers to a condition in which the blood hemoglobin concentration is lower than normal [1], resulting in poor cognitive and motor development in children and loss of work productivity in adulthood [2, 3]. According to the World Health Organization (WHO), the prevalence of anemia in the world is 22.9-26.7%. [11,12,13]. Risk factors - a group of factors that threaten human health, have a biological, genetic, ecological, medical-social character, which results in the origin, development, and adverse effects of disease, and depends on home, production and living conditions. Identification of anemia's risk factors is of great importance on its prevention [5, 7]. In 2011, it was estimated that 273.2 million children aged 6 to 59 months had anemia, which represents 42.6% of this population globally. Africa is the region with highest prevalence of anemia in preschool children (62.3%), followed by the Southeast Asia region (53.8%) and the Eastern Mediterranean region (48.6%) [6] Studies have shown that children under 24 months of age are at high risk for anemia [9,10]. This can be explained by the rapid growth in this age group with a consequently increased demand for iron and other micronutrients as well as a higher susceptibility to infections [9,11]. Several longitudinal studies have been linked iron deficiency and iron-deficiency anemia to poor cognitive, socio-emotional and psychomotor development among these children, which can produces long-lasting and irreversible effects on their development, even if the iron deficiency has been corrected [12].

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There is a lack of data in the literature that identifies the risk factors for anemia in children younger than 2 years of age, but socioeconomic and environmental factors seem to be closely associated with anemia in these children [9, 13, 14].

Given the importance of the crucial period from conception to the first 2 years of life—the first 1000 days—to prevent adverse effects later in the life course [15], it is important to systematically investigate the predictors for anemia in early childhood. In addition, focusing on children assisted at primary health care facilities in different regions of the country is relevant because it is an important place to develop actions for prevention and control of anemia in childhood.

2. Objective

Study the risk factors of anemia in children and to compose a prognostic table.

3. Materials and Methods

We used a case-control research method to study the effects of anemia on children (B.Mamatkulov, 2013).

A case-control research method is one of the analytical methods, used to investigate the relationship between the cause and the outcome, and therefore is a retrospective method.

Of the 1388 children involved in the study (851 cases of anemia and 537 healthy children without anemia), for the study of the frequency of factors which influence to the development of anemia in children, via method of control-case, we divided 1276 children into the group of cases - 765 and controls group - 511 children, and developed a questionnaire called "The study of socio - biological factors, housing conditions and lifestyle, influencing to the development of anemia in children". In this case we analyzed 19 factors, that probability of leading to children's anemia is high (Table 1). It is important for a physician – scientific researcher to determine whether there is a link between the disease development and the risk factors.

In order to answer, whether has a relationship between the cause and outcome, the researcher should calculate the relative risk (cohort research method) or the odds ratio (case-control research method). Odds ratio (OR) indicates the degree of relationship between the risk factor and the outcome of the disease or the significance of the factor influencing the result of the study.

Odds ratio - represents the probability of disease progression in the implementation of preventive measures against the disease under study or in case of non-implementation of these measures and is individually assessed for each factor's gradation.

In the first stage (Table 1), firstly, all children in the case and control group are classified by the grading of each factor (columns 1.2).

In the second stage, for the gradation of each factor: the absolute risk is calculated by determining the ratio of a case and control group (column 6).

In the third stage, the odds ratio is calculated in order to determine the effect of each factor on the studying outcome: The highest absolute risk indicator, determined by the gradation of each factor, is divided by the lowest risk indicator in the gradation of this factor (Table 1).

Findings and their discussion. The 19 factors we have studied (Table 1) by some ways, affect to the developing of anemia in children. In that, if the influential power of the factor on the outcome is higher than 1, then it is significant, if it is lower than 1, then this influence is not proved by the statistical method. The more influential power of a factor shows the stronger its influence on the outcome being studied.

Table 1: Socio-biological factors, factors depending on the living conditions and life style of the family, influencing to the developing of anemia in children.

No	Factor	Factors gradation	The case group (anemia) n = 765 (%)	Control group (healthy) n = 511 (%)	Absolute risk	Odds ratio (relative risk)
1.	Mother's age	Up to 20 years	3.8	2.7	1.4	1.6
		20-24 years	9.8	11.2	0.9	
		25-29 years	25.2	24.3	1.0	
		30-34 years	26.9	27.4	1.0	
		35-39 years	30.1	29.5	1.0	
		40 years and	4.2	4.9	0.9	
2.	Mother's education	High	5.1	3.7	1.4	1.4
		medium special	90.3	92.0	1.0	
		Middle	4.6	4.3	1.0	
3.	Mother's social status	Worker	22.7	17.6	1.3	2.2
		Employee	8.8	14.1	0.6	
		Housewife	68.5	68.3	1.0	
4.	Child's living conditions	Good	61.0	79.4	0.8	3.0
		Satisfactory	26.4	15.3	1.7	
		unsatisfactory	12.5	5.3	2.4	
5.	The child's diet	Follows	71.9	87.6	0.8	2.8
		does not follow	28.1	12.4	2.3	
6.	Hot meals a day	1 time	8.4	7.7	1.1	1.1
		2 times	79.6	81.2	1.0	
		3 times and more	12.0	11.1	1.1	
7.	The character of eating	Different	86.2	88.0	1.0	1.8
		Boiled	2.9	3.7	0.8	
		Fatty	6.2	4.3	1.5	
		Roasted	4.7	4.0	1.2	
8.	Evaluate the flour products, used in family	Enough	78.0	84.3	0.9	1.6
		more than necessary	22.0	15.7	1.4	
9.	Croup	Enough	94.0	96.5	1.0	1.1
		Not enough	6.0	5.5	1.1	
10.	Meat dishes	Enough	82.3	61.2	1.4	2.8
		Not enough	17.7	38.8	0.5	
11.	Dairy	Enough	89.0	89.4	1.0	1.0
		Not enough	11.0	10.6	1.0	
12.	Fruits and Vegetables	Enough	26.9	29.9	0.9	1.2
		Not enough	73.1	70.1	1.0	
13.	Fishes	Enough	85.6	87.7	1.0	1.2
		Not enough	1 4.4	12.3	1.2	
14.	Does he consume fortified flour products or bread?	Enough	57.3	64.0	0.9	1.3
		more than necessary	42.7	36.0	1.2	
15.	Was the child born prematurely?	No	97.4	97.2	1.0	1.1
		Yes	2.6	2.8	0.9	
16.	Has iron deficiency anemia been observed in the mother	No	34.4	65.8	0.5	3.8
		Yes	65.6	34.2	1.9	

	during pregnancy?					
17.	Was the baby breastfed?	No	22.5	12.1	1.9	2.1
		Yes	77.5	87.9	0.9	
		Yes	73.0	73.2	1.0	
18.	Does the child has helminth infections	No	8 1.6	93.9	0.8	3.9
		Yes	18 , 4	6.1	3.0	
19.	Did he use antibiotics irregularly	No	91.8	95.9	0.9	2.2
		Yes	8.2	4.1	2.0	

However, it should be taken into account the reliability of the influence of these factors on the studying result. And for this, using the criterion of statistical compatibility – X2, we determined the significanse of the influence of the factor under study on the development of anemia in children, that is, the degree of risk.

When we calculated the compatibility criterion – X2 of the influence of mother's age on the development of anemia in children: we got X2 = 1.51; P> 0.05 indices.When studying the influence of mother's education on the development of anemia in these children, we got X2 = 1.52; P> 0.05. When studying the influence of mother's social status, the child's living conditions on the development of anemia in children, we respectively had X2 = 44,77; P<0,001; X2 = 48.57; P<0,001 values. As can

be seen from the above, the ratio of odds of anemia in studying of mother's age is 1.6; Although the odds ratio in mother education was 1.4, we determined that this influence is not statistically significant. The odds ratio of the mother's social status was 2.2, the child's living conditions — 3.0, and statistically proved their significance. So, to take into account each factor, it is needed to assess the confidence level.

For the early detection of children with a high probability of anemia and children with anemia, carrying out diagnostic and therapeutic work, to develop measures of integrated, individual, differentiated primary, secondary prevention, to keep children under regular check-up and monitoring them, it is needed to get general data.

Table 2: Factors linked with social – biological, living conditions and lifestyle, that influence to the developing of anemia in children

No	Factor	Factors gradation	Case group (anemia) n = 765 (%)	Control group (healthy) n = 511 (%)	Absolute risk	Odds ratio (factor loading)
1	2	3	4	5	6	7
1.	Mother's social status	worker	22.7	17.6	1.3	2.2
		employee	8.8	14.1	0.6	
		housewife	68.5	68.3	1.0	
2.	Child's living conditions	good	61.0	79.4	0.8	3.0
		satisfactory	26.4	15.3	1.7	
		unsatisfactory	12.5	5.3	2.4	
3.	The child's diet	Follows	71.9	87.6	0.8	2.8
		does not follow	28.1	12.4	2.3	
4.	Taking of meat products	Not enough	82.3	61.2	1.4	2.8
		enough	17.7	38.8	0.5	
5.	Has iron deficiency anemia been observed in the mother during pregnancy?	No	34.4	65.8	0.5	3.8
		Yes	65.6	34.2	1.9	
6.	Was the baby breastfed?	No	2 2.5	12.1	1.9	2.1
		Yes	7 7.5	8 7 , 9	0.9	
7.	Does the child has helminth infections	No	8 1.6	93.9	0.8	3.9
		Yes	18 , 4	6.1	3.0	
8.	Did he use antibiotics irregularly	No	91.8	95.9	0.9	2.2
		Yes	8.2	4.1	2.0	
Min (R)		6.1	Risk range			
Max (R)		16.2	10.1			

Our studies have shown that important factors that influence to the development of anemia in children are: the social status of the mother, the living conditions of the child, diet, eating meat dishes, breastfeeding, the presence of iron deficiency anemia in the mother, the presence of helminthiases in the child, inappropriate use of antibiotics for the purpose of treating a child. And for this we recommend to predict only the odds ratio of factors with risk ratio at least 2 of the studied risk factors for the

compilation of a prognostic table. The table should be simple, reliable, easy to use. To do this, it suffices to select 8-10 factors (table 6). For an integrated assessment of risk factors and the compilation of prognostic tables (table 6), the summ or indicator of the lowest risk (Rmin) is determined by adding the smallest indicators of absolute risks from the gradation of each risk factor, and the summ or indicator of the highest risk (Rmin) is determined by

adding the largest indicators absolute risks from the gradation of each risk factor.

The lowest risk ($\sum$Rmin) = $R1^{min}$ + $R2^{min}$ + $R3^{min}$ + ... Rn^{min} = 6.1

The largest risk is ($\sum$Rmax) = $R1^{max}$ + $R2^{max}$ + $R3^{max}$ +…. Rn^{max} = 16.2

Based on the values obtained, the total risk range is determined:

Rmax - Rmin = In our example, this was 10.1.

Then, depending on their level, during the formation of risk groups, three groups are classified: groups of low, medium, high risk.

For each group, a range of risk values is calculated:

1. Low risk group: the sum of the lowest risk indicators ($\sum$Rmin) + ($\sum$ Rmax-$\sum$ Rmin) × 30: 100 = 6.1 + 3.03 = 9.13, thus the range of low risk groups was 6.1 - 9.13.
2. Group of moderate risk: the sum of the lowest risk indicators ($\sum$Rmin) + ($\sum$ Rmax-$\sum$ Rmin) × 60: 100 = 12.2 the range of the moderate risk group was 9.14–12.16.
3. High risk group: from the highest indicator of moderate risk group to $\sum$ Rmax, that is, 12.17 - 16.2.

Thus, the range of small risk groups is (10.1) 30% of the total risk, the moderate risk group is also 30%, the high risk group is 40%.

On prognosing the outcome, it is recommended to name 3 risk groups:

1. Low risk group - favorable forecast
2. Group of moderate risk - the forecast requiring attention
3. The high risk group - an unfavorable prognosis

To study the complex effects of the above-mentioned risk factors and to prevent anemia in children , attending in an outpatient clinic, it is needed to divide them into the above-mentioned groups.

Thus, according to the results of our study, we divided the total risk ranges into three smaller ranges. The lowest risk group was (6.1 - 9.13); moderate (9.14 - 12.16) and the highest risk groups (12.17 - 16.2).

Table 3: Risk groups for small ranges and the development of anemia in children

Small risk ranges	Small ranges		Risk groups
	values indicator		
Minimum risk	6.1	- 9.13	Favorable
			prognosis
Medium Risks	9,14	- 12,16	Attention
Maximum risk	12,17 - 16,2		Unfavorable
			prognosis
Total range	6.1	- 16.2	

Depending on the level of the risk range for anemia, children can be divided into favorable, requiring attention, unfavorable groups of prognosis (Table 3). Consequently, the higher the risk of the disease in a child, it will be a reason of adding him to the group of unfavorable prognosis.

When conducting a survey-control in each individual case, in order to determine the risk of the disease and establish medical, social and preventive measures, after identifying the risk factors of the child and indicating the relevant indicators from the 6th table, according to the 3rd table it is determined which group risk enters the child and appropriate scientific decisions are made.

For example: Akhmedov. A., 2 years old, mother is an employee, the child's living conditions are satisfactory, follows the diet, does not consume meat dishes in sufficient amount, during pregnancy the mother had iron deficiency anemia, the mother fed the baby with breast milk, the child did not have helminth infections, did not take antibiotics irregularly.

Risk group = 1.3 + 1.7 + 1.4 + 1.9 + 0.9 + 0.8 + 0.9 = 8.9

Thus, Akhmedov A, included into the low risk group, the prognosis is favorable.

4. Conclusion

The prognostic table developed by us allows a comprehensive assessment of risk factors, which plays a large role in the development of anemia in children. And it helps general practitioners, working in primary health care, for the prevention of anemia, early diagnosis and for the development of individual, differentiated, scientifically based measures.

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