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ESTADO NUTRICIONAL E PREVALÊNCIA DE ANEMIA EM CRIANÇAS MENORES DE 36 MESES
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NUTRITIONAL STATUS AND PREVALENCE OF ANEMIA IN CHILDREN UNDER 36 MONTHS

Estado nutricional e prevalência de anemia em crianças menores de 36 meses

Estado nutricional y prevalencia de anemia en niños menores de 36 meses

Original Article

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ABSTRACT

Objective: To estimate the prevalence of anemia associated with nutritional status in children under 36 months of age. **Methods:** This is an observational, cross-sectional, analytical study conducted in 2007 comprising 374 children under 36 months of age enrolled at municipal daycare centers of Vitória, ES. Anthropometric assessment and blood sample collection were performed, being measured Hemoglobin (Hb), serum iron (SFe) and serum ferritin (SF). For statistical analysis, chi-square and Fisher's exact test were used. **Results:** The prevalence of anemia among preschool children was of 10.9% (n=19). Inadequate levels of serum ferritin and serum iron were present in 7.5% (n=13) and 27.6% (n=48) of the children, respectively. The children's nutritional status showed no statistically significant association with anemia. **Conclusion:** The prevalence of anemia in the studied population features a mild public health problem, without association with the nutritional status.

Descriptors: Anemia, Iron Deficiency; Nutritional Status; Child Health.

RESUMO

Objetivos: *Estimar a prevalência de anemia correlacionando com o estado nutricional de crianças menores de 36 meses.* **Métodos:** *Estudo observacional, transversal, retrospectivo e analítico, realizado com 374 crianças com idade inferior a 36 meses, de creches municipais de Vitória, ES. Foi realizada antropometria e coletadas amostras de sangue para dosagem de hemoglobina (Hb), ferro sérico (FeS) e ferritina sérica (FS). Para análise estatística utilizou-se o teste qui-quadrado e o teste exato de Fisher.* **Resultados:** *A prevalência de anemia nos pré-escolares foi de 10,9% (n=19). Níveis inadequados de ferritina estiveram presentes em 7,5% (n=13) das crianças e de ferro sérico em 27,6% (n=48). O estado nutricional da criança não mostrou associação estatisticamente significante com a anemia.* **Conclusão:** *A prevalência de anemia na população estudada caracteriza um problema leve de saúde pública, não sendo observada associação do estado nutricional a essa deficiência.*

Descritores: *Anemia Ferropriva; Estado Nutricional; Saúde da Criança.*

RESUMEN

Objetivo: *Estimar la prevalencia de anemia y correlacionar con el estado nutricional de niños menores de 36 meses.* **Métodos:** *Estudio observacional, trasversal, retrospectivo y analítico realizado con 374 niños abajo de 36 meses, de guarderías municipales de Vitória, ES. Se realizó antropometría y fueron recogidas muestras de sangre para la dosificación de hemoglobina (Hb), hierro sérico (HS) y ferritina sérica (FS). Para el análisis estadístico se utilizó las pruebas de chi-cuadrado y el exacto de Fisher.* **Resultados:** *La prevalencia de anemia en los pre-escolares fue del 10,9% (n=19). Niveles inadecuados de ferritina estuvieron presentes en el 7,5% (n=13) de los niños y de hierro sérico en el 27,6% (n=48). El estado nutricional del niño no mostró asociación estadísticamente significativa con la anemia.* **Conclusión:** *La prevalencia de anemia en la población estudiada se caracteriza un problema leve de salud pública, no siendo observada la asociación del estado nutricional y esa deficiencia.*

Descriptores: *Anemia Ferropénica, Estado Nutricional, Salud del Niño.*

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NTRODUCTION

Anemia is a global public health issue, affecting approximately 1.62 billion people in the world, both in developed countries and in developing ones, with serious consequences for human health as well as for the social and economic development[1].

In Brazil, the Ministry of Health estimates that 4.8 million preschool children are affected by the disease[2], coming from iron deficiency (DFe), for which the risk factors include: low dietary intake, poor absorption in diets rich in phytate and phenolic compounds, and/or period of life when the needs are particularly high (growth and pregnancy)[1,3].

Anemia due to iron deficiency (IDA) is characterized by decreased levels of hemoglobin, low serum iron concentration, low transferrin saturation, and decreased hematocrit, causing insufficient supply of iron to tissues and possible functional damage to the body[3].

Negative consequences for human health have been reported such as effects on cognitive performance; changes in behavior and growth of infants, preschoolers, and school-age children; immunological status and morbidity from infections in all age groups; reduced physical and work capacity in adolescents and adults[3,4]. Furthermore, studies have reported that the highest prevalence occurs in children of preschool age[3,4], where the effects are not likely to be adjusted by subsequent iron therapy[5].

To combat and prevent iron deficiency anemia, the Ministry of Health, through the *Sistema Único de Saúde - SUS* (Unified Health System), has adopted as strategies the supplementation in vulnerable groups, through the *Programa Nacional de Suplementação de Ferro - PNSF* (National Program of Iron Supplementation), mandatory fortification of flour and corn, and nutrition education in the health network and in schools, encouraging breastfeeding and timely complementary feeding with healthier dietary diversification, food guidance in schools and daycare centers[6].

Considering the relevance of the theme to public health in Brazil, the aim of this study was to estimate the prevalence of anemia, correlating the nutritional status of children under 36 months attending the *Centros Municipais de Educação Infantil - CMEI* (Municipal Child Educational Centers) of Vitoria, ES.

METHODS

Observational, cross-sectional and retrospective analytical study, held from March to August 2007, with 374 children under 36 months, enrolled and attending 43 *Centros Municipais de Educação Infantil - CMEI* (Municipal Child Educational Centers) of Vitória, ES, Brazil. For determination of the minimum sample size, for statistical significance, the general equation for sampling calculation in all populations, which estimates an outcome with prevalence of 50% - with significance level of 5% and confidence interval (CI) of 95%, adopting a "*p*" value that would result in the larger amount[7].

The study included all children properly enrolled in a CMEI, of both sexes, who at the first evaluation were aged 6-36 months, healthy and who carried the permission of their parents or guardians to participate in the study.

Initially, the one legally responsible for the child responded to a structured questionnaire containing information about birth conditions and breastfeeding. The data of the child's registration record was used to obtain the socioeconomic markers: the mother's educational level and family income in minimum wages (MW), transformed into monthly income per capita.

The nutritional status assessment was made through the following variables: weight and length/height. A Plena® portable electronic scale was used for measurement of weight, being used an infantometer to measure the length/height (for children under 2 years old), and a stadiometer (for children over 2 years old), both of Alturaexata® brand.

The children were naked or using lightweight underwear at the moment of weight measurement. Children under 2 years remained in the supine position and, from this age on, standing in the erect position, for the length/height measurement, taking precautions to maintain the spine and legs straight[8].

The nutritional status assessment was performed through the weight for age (W/A), weight for height (W/H) and height for age (H/A) ratios. The cut-off limit of - 2 standard deviations (SD) was adopted for characterization of W/A, W/H and H/A deficit, according to Z scores; for diagnosis of overweight/obesity, in W/A and W/H, + 2 SD was used, as recommended by WHO[9,10].

The children's relatives received instructions regarding the performance of biochemical testing, and were sent to the Henry Tommasi Clinical Laboratory, which funded the biochemical measurements of Hb, SF and SFe, employed for the diagnosis of anemia, which is defined by Hb <11 g/dL, iron depletion by SF <12 mg/l and SFe <50 mg/dL[11]. To define the degree of anemia, the following categories were adopted: mild anemia (Hb between 9.0 and 11.0 g/dL), moderate anemia (Hb between 7.0 and <9.0 g/dL) and severe anemia (Hb <7.0 g/dL)[12].

Statistical analysis was performed using SPSS (Statistical Package for Social Sciences for Windows version 10.0). The relationship between several independent variables and each of the dependent variables was performed using the chi-square and Fisher's exact test.

Calculation of central tendency and variability measures for descriptive statistical analysis (prevalence, median, mean and standard deviation) were used, being considered statistically significant $p<0.05$ and confidence interval (CI) of 95%.

This study received approval from the Ethics Committee of Research of the *Faculdade Salesiana de Vitória* (Salesian College of Vitoria) under the number 01/2006 as well as from municipal authorities. The involvement of each family was formalized by signing the Free Informed Consent Form (FICF) after receiving information relevant to the project, such as purpose, benefits for the child and the community in general, and minimal risk to child resulting from the adopted procedures. For ethical reasons, all children with diagnoses of anemia were referred to the reference health unit for monitoring.

RESULTS

The sample consisted of 374 children, comprising 50.8% (n=190) female. In the distribution by age, there was higher prevalence of children aged between 24 and 36 months, and high prevalence of breastfeeding was observed at some point in their lives, although only 17.1% (n=64) have been exclusively breastfed until sixth month of life. Regarding nutritional status indices W/A, H/A and W/H, the majority of the children were eutrophic (Table I).

In W/A and W/H indices, 11.8% (n=44) of children were underweight, while 23.5% (n=88) had high weight/age, and 22.7% (n=85) high weight/height. Regarding the low W/A, similar prevalences were found in both sexes. The female children had a higher prevalence (8.0%) (n=15) of high weight; however, the W/H ratio showed 2.8% (n=5) male children with low weight. The H/A deficit was observed in 14.2% (n=53) of children, with the highest prevalence observed in males. Table I also shows that 8.8% (n=33) of mothers were adolescents at childbirth.

Levels of Hb, SF, and SFe were assessed in 46.5% (n=174) of the sample, in which 50% (n=87) were male. Characterization of the hematological variables in the sample is shown in Table II.

Anemia (Hb <11.0 g/dL) was observed in 10.9% (n=19) of the children, with the highest prevalence in males (12 and 6.9%). Severe anemia was not observed in this sample and inadequate levels of SFe and SF were present in 27.6% (n=48) and 7.5% (n=13) of children, respectively (Table III).

The children's nutritional status did not show statistically significant association with anemia (Table IV).

Table I - Distribution of biological, nutritional and socioeconomic variables in children under 36 months of public daycare centers. Vitória-ES, 2007.

Variables	n	%
Sex		
Male	184	49.2%
Female	190	50.8%
Age range		
<24 months	112	30.0%
24 - 36 months	262	70.0%
Weight at birth (in grams)		
< 2500	15	4.0%
2500 - 4000	328	87.7%
> 4000	31	8.3%
Exclusive breastfeeding*		
< 6 months	179	47.9%
6 - 24 months	184	49.2%
Absent	11	2.9%
Complementary feeding		
≤ 6 meses	310	82.9%
> 6 meses	64	17.1%
Nutritional status		
W/A		
Low weight	44	11.8%
Eutrophic	242	64.7%
High weight	88	23.5%
H/A		
Eutrophic	321	85.8%
Low height	53	14.2%
W/H		
Low weight	44	11.8%
Eutrophic	245	65.5%
High weight	85	22.7%
Per capita income		
< 0.5 MW	210	56.1%
0.5 to 1 MW	102	27.3%
> 1 MW	62	16.6%
Mother's age at childbirth		
< 18 years	33	8.8%
18 to 35 years	310	82.9%
> 35 years	31	8.3%
Maternal schooling		
< 8 years	67	17.9%
8 to 11 years	261	69.8%
> 11 years of schooling	46	12.3%
Total	374	100.0%

* absence of any other food but breastmilk
W/A: Weight for Age; H/A: height for age; W/H: Weight for Height; MW: Minimum Wage

Table II - Distribution of hematological variables in children under 36 months of public daycare centers. Vitória-ES, 2007.

Variables	Minimum	Maximum	Median	Mean	Standard deviation
Hemoglobin (g/dL)	7.20	14.61	12.11	12.11	1.04
Serum Iron (µg/dL)	10.00	343.00	66.00	73.61	40.44
Serum Ferritin (µg/L)	1.50	167.00	31.05	37.96	27.19

Table III - Prevalence of iron deficiency anemia by hematological variables in children under 36 months of public daycare centers. Vitória-ES, 2007.

Variables	n	%
Hemoglobin		
Anemia	19	10.9
Normal	155	89.1
Serum Iron		
Anemia	48	27.6
Normal	126	72.4
Serum Ferritin		
Anemia	13	7.5
Normal	161	92.5
Total	174	100

Table IV - Association of nutritional status with levels of iron deficiency anemia in children under 36 months of public daycare centers. Vitória-ES, 2007.

Variables	Anemia						*p*
	Absent		Mild		Moderate		
	n	%	n	%	n	%	
W/A							
Low weight	4	2.6	0	0.0	0	0.0	0.812
Eutrophic	143	92.3	17	100.0	2	100.0	
High weight	8	5.2	0	0.0	0	0.0	
W/H							
Low weight	6	3.9	0	0.0	0	0.0	0.078
Eutrophic	139	89.7	17	100.0	1	50.0	
High weight	10	6.5	0	0.0	1	50.0	
H/A							
Eutrophic	152	98.1	16	94.1	2	100.0	0.574
Low H/A	3	1.9	1	5.9	0	0.0	
Total	**155**	**100.0**	**17**	**100.0**	**2**	**100.0**	-

W/A: Weight for Age; H/A: height for age; W/H: Weight for Height

DISCUSSION

The prevalence of anemia (Hb <11.0 g/dL) observed in this study was 10.9%, which features a mild public health problem[12]. It is noteworthy that such prevalence presents an upward trend, since it was higher than the one found in a similar study conducted in Vitória, ES, in 2004[13]. However, higher prevalence of anemia was found in localized national studies, whose values range from 25.0% to 63.0% among children under three years of age[14-16].

The temporal variation in anemia prevalence and its associated factors has been studied in children 6-59 months, period from 1997 to 2006, in the state of Pernambuco, with data revealing an optimistic scenario, since a decrease of 19.3% in the occurrence of this nutritional deficiency was detected - a decline of 40.9% to 33.0%[16]. The explanation for this can be linked to public policies for the control of anemia[17] implemented in Brazil.

The *Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher*[18] (National Research on Demographics and Health of Children and Women), performed with 3455 children under five years, noted that the lowest prevalence of anemia occurred in North region (10.4%), a value that corroborates the present study. The Northeast region diagnosed 25.5% of children as anemic. Results superior to the present study were found in the states of Paraíba[19] (25.1%), Minas Gerais[20] (30.6%), Acre[15] (29.2%), Pernambuco[21] (55.6%) and São Paulo[22] (43.6%), for a similar age range.

There is a concurrence among authors that the age of a child is one of the predisposing factors in the genesis of anemia[13,19,23], especially in the age group of 6 to 24 months[23,24], due to the short period of exclusive breastfeeding, low intake of iron-rich foods, accelerated growth, and early introduction of cow's milk, in which the iron quantity is small and has low bioavailability[25]. In this study, one notes that the majority of children (82.9%) started complementary feeding under six months old, which is considered a predictor of potential risk for the prevalence of iron deficiency anemia in preschool children[23,25,26].

The distribution of anemia according to sex, in this study, showed a heterogeneous character, whose highest prevalence (6.9%) occurred in males compared to females (4.0%), similarly to the result achieved with preschool children in Paraíba[19], which observed lower levels of hemoglobin in males, also found in regional studies[15,27]. The highest prevalence of anemia in men may be explained by the higher growth speed exhibited by boys, resulting in greater demand for iron by the body, not supplied by the diet[28]. In contrast, it is demonstrated that, in children, there is no difference in the prevalence of anemia by sex[29,30].

The nutritional risks diagnosed in this study, namely, low weight/age; low height/age and low weight/height have lower prevalence than the occurrences of anemia, corroborating the study in CMEI of the city of Cascavel, PR[31]. Low height in relation to age was observed in 2.3% of the sample in the current research, a result similar to that found in a study conducted in Rio Grande do Sul, which was 3.7%[32].

Regarding the W/A parameter, 2.6% of the children investigated in the present study were underweight, and, of these, none was associated with the diagnosis of anemia. In return, all the anemic children (10.9%) of the current research had nutritional diagnosis of eutrophy. As for the W/H index, 3.9% of children diagnosed with low weigh, none had anemia, while 6.3% of those who showed high weight, 0.6% had moderate anemia (Hb <9.0 and > 7.0 g / dl). The overall nutritional diagnosis of low weight was not associated with anemia, corroborating other studies[20,33,34]. This demonstrates that iron deficiency may be coming from a diet with low availability of this nutrient, not always accompanied by low protein-calorie intake[26,35]. It is important to highlight that, in this study, children presented higher prevalence of overweight/obesity than underweight in W/A and W/H indices, reinforcing the nutritional transition in this age group, whose care with complementary feeding should be prioritized.

Among the risk factors comprised in anemia in children under five years of age, there was a significant association of anemia with maternal age[25], with a higher prevalence of the disease in children of adolescent mothers, possibly due to greater probability that teenage mothers have to conceive children with low weigh, aspect directly linked to lower iron stores. However, in this study the highest prevalence of anemia was found in children of mothers aged between 18 and 35 years, who were born with appropriate weight, similar to that observed by other authors[36,37].

The parents' schooling can also be considered an important socioeconomic factor in determining anemia[16], bearing in mind that higher schooling level leads to a greater chance of employment and hence income, which, in turn, provides improved access to foods[23]. In addition, the higher level of maternal formal knowledge seems to influence on practices related to child care[23]. When studying subgroups at higher risk for anemia in children attending daycare centers in Belo Horizonte, there was a higher prevalence of anemia in children of parents with less education[30]. In the present study, only maternal education was considered, and it was not associated with the prevalence of anemia. Similar results were also found in other studies[29,32].

In São Paulo, a study held in public and philanthropic daycare centers concluded that per capita income was one

of the indicator variables of the society structural processes, which was associated with anemia with statistical significance, for children whose family income per capita was up to 0.5 MW had an additional 56% risk of developing anemia[22]. Despite not having been associated with anemia, it was observed in this study that the lower the income, the higher the prevalence of anemia, this finding also reported in other studies[14,30,38].

Although the Hb concentration is the most reliable indicator of anemia at the population level[1], it is not specific for iron deficiency[11]. The SF level is the most specific biochemical test, which correlates with the total body iron stores. A low level of SF reflects low iron stores and is therefore a precondition for DFe, in the absence of infection[11]. Nevertheless, when exhausted the iron reserves, any additional body level decline is accompanied by a reduction in the concentration of serum iron[12], which makes it important also to evaluate this biochemical parameter in the diagnosis of DFe.

According to WHO, when the prevalence of anemia in the population is up to 40%, iron deficiency is about 2.5 times higher. Subsidizing such estimates, the prevalence of inadequate concentrations of SFe in the population investigated in this study was 27, 6%. A similar result was found in daycare centers of the public network of Cascavel, PR, where the prevalence of anemia was observed in 29.7% of the studied population, in contrast with low levels of SFe in 77.3% of children[31].

As for the SF levels, this study found lower prevalence (7.5%) in relation to anemia, although other studies have reported higher prevalence[27,39]. In Rio Grande do Sul[27], iron deficiency assessed by SF was observed in 91.0% and 89.3% of male and female, respectively, in children population aged 12-16 months. However, at the age of 3 to 4 months such deficiency was diagnosed in 19.5% males and 11.6% females.

Even though iron deficiency is probably the most common cause of anemia, there are other causes such as acute and chronic infections that cause inflammation; other micronutrient deficiency, especially of folate, vitamin B12 and vitamin A; and genetically inherited traits such as thalassemia[24], which were not evaluated in this study.

The absence of relevant information, such as the use of iron supplementation, assessment of children's food intake, and presence of infection, can be considered limitations of the study, since these factors are directly related to the prevalence of iron deficiency anemia.

In sum, the prevalence of anemia (10.9%), assessed by Hb, figured a mild public health issue. Nevertheless, when such nutritional deficiency is evaluated by SFe, a higher amplitude of the problem was detected in children enrolled in the CMEI of Vitória, ES. The nutritional status did not show association with such disturbance, but nutritional monitoring of children in this age range becomes necessary due to the diagnosed nutritional risks, notably low weight (11.8%), low height (14.2%), and, on the other hand, excess weight observed in almost 23.0% of the studied sample. It were also identified high occurrence of breastfeeding interruption before six months of life, and early introduction of complementary feeding, inadequate practices facing the prevention of iron deficiency anemia.

Given the above, it is suggested that more drastic and immediate practices aimed at nutritional education to educators and mothers of children attending daycare centers should be adopted for better quality of life, especially of those children under 5 years of age. Considering the relevance of iron deficiency anemia in health promotion, it is suggested that managers of public policy give special attention to this disorder, in order to detect failures of the proposed policies through surveillance actions focused on anemia, looking for more effective solutions, whether in terms of prevention, treatment, and monitoring of this health problem.

CONCLUSION

Though public health measures have been implemented to prevent and combat anemia, such as prophylactic supplementation of ferrous sulphate and food fortification, it is observed that the prevalence of anemia in infants and preschool children in Vitória, ES (10.9%) still features a public health problem, not being this disorder associated with the child's nutritional status.

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