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ORIGINAL RESEARCH

PREVALENCE AND ASSOCIATED FACTORS TO ANAEMIA IN CHILDREN

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ABSTRACT:

Objectives: to analyse the prevalence and factors associated with anaemia in children from Rio Branco, Acre. **Methods:** the study included 610 children between 6 and 59 months old. A questionnaire was issued with questions on characteristics of the mother, feeding practices and antecedent morbidity. The anaemia diagnosis was based on haemoglobin levels at 110 g/l. Multiple Poisson regression was used to analyse the associated factors with variables entered into hierarchical blocks. **Results:** the anaemia prevalence was 51.8%. The factors associated with anaemia were the following: age below 24 months (prevalence ratio [PR]: 1.51 and 95% confidence interval [95% CI]: 1.17 to 1.95); years of formal education for the mother between 5-8 years (PR: 1.34 and 95% CI: 1.13 to 1.58) and less than or equal to 4 years (PR: 1.32 and 95% CI: 1.05 to 1.65); anaemia in the mother (PR: 1.28 and 95% CI: 1.08 to 1.51); and consumption frequency less than once a week for meats (PR: 1.35 and 95% CI: 1.03 to 1.77) and fruits (PR: 1.28 and 95% CI: 1.09 to 1.52). **Conclusions:** the prevalence of anaemia among children in Rio Branco is a serious public health problem. The results highlight the need to strengthen policies on family health care and provide mothers with counselling on feeding practices.

Key words: anemia; child health; nutritional status; cross-sectional studies; epidemiologic factors; prevalence.

INTRODUCTION

Anaemia is a global public health problem that often co-occurs with other disorders, such as micronutrient deficiencies and malaria[1]. Children under 5 and women of reproductive age are the groups most vulnerable to anaemia[1,2]. According to the World Health Organization (WHO) report[2] there are approximately 293.1 million anaemic children under 5 years worldwide with an estimated worldwide prevalence at 47.4%.

Although current evidence shows a decline in malnutrition for Brazilian children[3], the prevalence of anaemia has increased for several regions in Brazil[4,5]. The National Research for Demographics and Health of Children and Women 2006[6] revealed a 20.9% anaemia prevalence in Brazilian children. In the Northern Region specifically, 10.4% of children are anaemic. However, research conducted in several Brazilian states showed a higher anaemia prevalence[5,7]. For cities in the state Acre, two population-based investigations on children under 5 years old showed an anaemia prevalence greater than 20.0%[8,9].

As highlighted in national and international investigations, anaemia in children under 5 years is associated with several socioeconomic factors, maternal characteristics, food consumption and antecedent morbidity[10]. However, these factors are differentiated according to geographical context. Thus, it is necessary to identify regionalised factors associated with children's anaemia for preventative actions and effective control.

Because anaemia is important in a national and global context and given the lack of studies on this problem in the Acre capital, the goal of this

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research was to analyse the prevalence of anaemia and factors associated with it in children between 6 and 59 months old in Rio Branco, Acre.

METHODS

This was a cross-sectional study with probabilistic sampling, which was conducted in the first half of 2008. Participants were children 6 to 59 months old living in the Rio Branco municipality (latitude: 9 58'29'', longitude: 69 48'36", altitude: 153 metres), Acre, Brazil. This municipality has a 0.639 Child Development Index, which is near the national average 0.667[11].

Cluster sampling was conducted in two phases; the first comprised a selection of 34 sectors from the municipality's 250, and the second comprised a selection of 75 households in each selected sector. Of the 2550 selected households, 622 formed the sample because they had 6 to 59 month-old children.

The exclusion criterion was presentation of clinical symptoms that could impair blood collection. All children diagnosed with anaemia were sent to the Rio Branco health care service. The study was approved by the Ethics Committee at Acre Federal University (Case No 23107.001150/2007-22).

Professionals and academics in health collected the data and participated in training sessions. A structured questionnaire was given to the child's biological mother for each selected household. Where the biological mother did not live at home with the child, information was collected from the female caregiver responsible for the child.

The following information was collected for the children: demographic characteristics, exclusive breastfeeding, eating habits, birth weight and morbidity in the 15 days prior to interview, which was reported by the mother. The children were categorised into the following age groups: 6 to 23 months, 24 to 47 months and 48 to 59 months. Exclusive breastfeeding was defined as less than or equal to 180 days and over 180 days. The birth weight variable was categorised as low (less than or equal to 2,500 g) and adequate (greater than 2,500 g).

Feeding practices were ascertained from questions on the weekly intake frequency of meat, beans, vegetables and fruits. For data analysis, the variables were categorised into consumption frequencies less than one a week and equal to or greater than one a week.

Maternal information studied included age, years of formal education, occupational status and living with a partner. Maternal age was categorised as less than or equal to 20 years and greater than 20 years. Years of formal education was split into three categories (0-4 years, 5-8 years and 9 or more years). The mother's occupational status was categorised as working (paid activities) and not working. The mother's marital status was categorised as no partner (single, separated or widowed) and with partner (married or in a consensual union).

The children's height and body length were measured using a child anthropometer and stadiometer, respectively, both with a 0.1 cm accuracy and using the procedures recommended by WHO[12]. With help of the *WHO Anthro 2005 programme,* the Z index score height for age was generated based on the WHO 2006 standard for children's growth[13]. The Z score cut-off was equal to or less than -2 and was used to classify stunted growth[12]. The investigated antecedent morbidities include diarrhoea and blood in the stools 15 days prior to the interview. The categories for both variables were absence and presence.

A sample drop of blood after the finger was punched was used for haemoglobin quantitation using a portable hemoglobinometer (HemoCue®, Ängelhom, Sweden). As established by WHO[1], anaemia was determined using a cut-off at less than 110 g/l haemoglobin for the children and less than 120 g/l haemoglobin for the mothers.

Data were entered into the *Epi-Info* 6.01 program following a double entry procedure. The data were then transferred into the *Stata™* 9.2 statistical program. The factors associated with anaemia were analysed in two stages. Initially, independent variables associated with an anaemia variable $p<0.20$ (chi-square test for heterogeneity) were selected to construct the multiple models. Subsequently, multivariate analysis and hierarchical Poisson regression were used to identify factors associated with anaemia[14,15]. The following conceptual model, which was adapted from Osorio[16], was used to enter variables for data analysis: 1st block (characteristics of the mother); 2nd block (eating habits); 3rd block (birth weight); and 4th block (height for age and antecedent comorbidities). The children's gender and age were introduced in the first block and retained in subsequent steps.

RESULTS

Haemoglobin was quantitated in 610 of the total of 622 children living in homes from the selected sectors (98% the eligible children). The losses were from refusal of the person responsible to allow a child's participation in the research. Respectively, 50.3% and 49.7% of the eligible children were male and female.

The anaemia prevalence was 51.8% for children in Rio Branco, Acre 6 to 59 months old. For both sexes, the highest anaemia prevalence was in the younger age groups (Figure 1). The highest anaemia prevalence was in the 6 to 11 months age group at 65.7% and 87.8% in males and females, respectively.

The anaemia prevalence by characteristics of the mother, exclusive breastfeeding, birth weight, nutritional status and antecedent morbidities are shown in Tables 1 and 2.

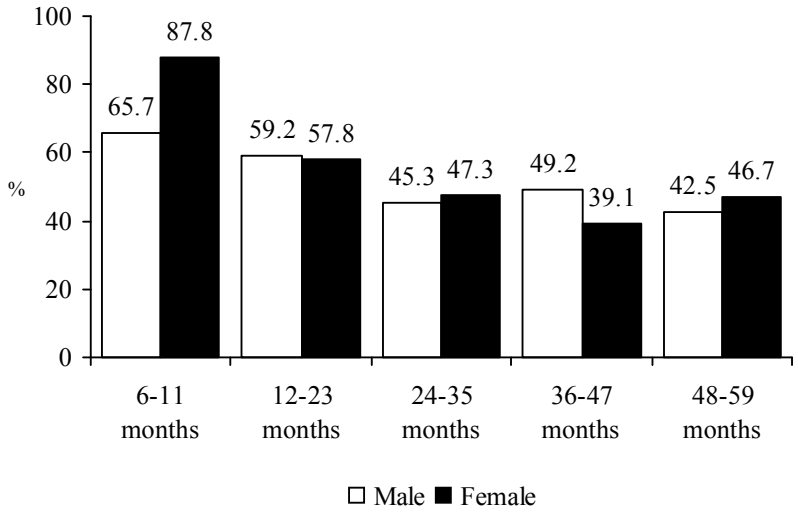

Figure 1 - Anaemia prevalence by sex and age in children from Rio Branco, AC, 2008.

Analysis of associated factors revealed that 1.51 times more children under 24 months had anaemia compared with older children. Children with mothers that had eight years or less of schooling were more susceptible to anaemia. For mothers with anaemia, prevalence in children increased 1.28 times (Table 3).

Table 1: Anaemia prevalence and prevalence ratio in children from Rio Branco, AC according to characteristics of the mother, 2008

	n	%	Prevalence Ratio	CI 95%	p
Sex					
Male	308	51.6	1		
Female	302	51.9	1.00	(0.87 ; 1.16)	0.922
Age					
48-59 months	124	42.7	1		
24-47 months	287	46.6	1.09	(0.83 ; 1.42)	0.500
6-23 months	199	64.8	1.51	(1.17 ; 1.95)	0.002
Age of mother					
Older than 20 years	505	50.1	1		
Equal to or less than 20 years	101	59.4	1.18	(0.97 ; 1.44)	0.089
Mother's years of formal education					
9 years or more	302	44.0	1		
5 - 8 years	192	59.9	1.36	(1.15 ; 1.60)	0.001
0 - 4 years	109	57.8	1.31	(1.03 ; 1.66)	0.027
Occupational status of mother					
Works	418	51.9	1		
Does not work	190	51.5	0.99	(0.86 ; 1.14)	0.927
Marital status of the mother					
With partner	438	50.2	1		
Without partner	169	56.2	1.11	(0.95 ; 1.31)	0.165
Anaemia in mother					
Not anaemic	378	46.5	1		
Anaemic	215	60.0	1.28	(1.07 ; 1.53)	0.007

Table 2: Anaemia prevalence and prevalence ratio according to breastfeeding, food consumption frequency, birth weight, antecedent morbidities and stunted growth in children from Rio Branco, AC, 2008

	n	%	Prevalence Ratio	CI 95%	p
Exclusive breastfeeding					
180 days or more	235	51.0	1		
Less than 180 days	358	51.9	1.01	(0.87 ; 1.17)	0.813
Meat consumption frequency					
Once a week or more	93	34.4	1		
Less than once per week	444	52.2	1.51	(1.13 ; 2.02)	0.006
Beans consumption frequency					
Once a week or more	448	46.6	1		
Less than once per week	90	62.2	1.33	(1.09 ; 1.62)	0.006
Vegetable consumption frequency					
Once a week or more	172	45.3	1		
Less than once per week	365	50.9	1.12	(0.91 ; 1.38)	0.261
Fruit consumption frequency					
Once a week or more	419	44.8	1		
Less than once per week	118	64.4	1.43	(1.23 ; 1.67)	0.000
Birth weight					
Above 2,500 g	543	51.7	1		
Equal to or less than 2,500 g	48	54.1	1.04	(0.75 ; 1.45)	0.781
Diarrhoea in last 15 days					
Absence	455	49.2	1		
Presence	154	59.0	1.20	(0.99 ; 1.44)	0.054
Blood in stools in last 15 days					
Absence	581	51.1	1		
Presence	29	65.5	1.28	(0.95 ; 1.72)	0.098
Height for age					
Adequate	547	50.8	1		
Stunted growth	41	68.2	1.34	(1.07 ; 1.67)	0.010

Table 3: Factors associated with anaemia in children from Rio Branco, AC, 2008

	Adjusted Prevalence Ratio	CI 95%	p
Sex			
Male	1		
Female	1.02	(0.88 ; 1.18)	0.758
Age			
48-59 months	1		
24-47 months	1.09	(0.84 ; 1.42)	0.494
6-23 months	1.51	(1.17 ; 1.95)	0.002
Mother's years of formal education *			
9 years or more	1		
5 - 8 years	1.34	(1.13 ; 1.58)	0.001
0 - 4 years	1.32	(1.05 ; 1.65)	0.017
Presence of anaemia in mother *			
Not anaemic	1		
Anaemic	1.28	(1.08 ; 1.51)	0.005
Meat consumption frequency †			
Once a week or more	1		
Less than once per week	1.35	(1.03 ; 1.77)	0.027
Fruit consumption frequency †			
Once a week or more	1		
Less than once per week	1.28	(1.09 ; 1.52)	0.004

* Adjusted: age and sex.
† Adjusted: age, sex, years of mother's formal education and mother's anaemia status.

DISCUSSION

A high anaemia prevalence (51.8%) was observed for children 6 to 59 months old in Rio Branco, indicating a serious public health problem. The frequency of anaemia in children from Rio Branco is associated with variables such as socio-familial context and less than weekly consumption of foods rich in iron and that stimulate iron absorption.

The alarming number of Rio Branco children affected by anaemia is consistent with cross-sectional surveys for various regions in Brazil[5,7]. Investigations on anaemia prevalence in children from inner cities in Acre that are accessible via paved roads differ from the prevalence for children in Rio Branco; the former has prevalence rates between 24.5% and 36.3%[8,17]. Furthermore, in the municipality Jordão, which has no road access, a high anaemia prevalence 57.3% was observed[9]. Whilst there are different degrees of anaemia prevalence in children 6 to 59 months old, most surveys conducted in Brazil have revealed a grave public health situation (defined as anaemia prevalence over 40%[1]).

Several population-based and day-care studies conducted in Brazil, including in Acre, have identified higher anaemia prevalence in the age group below 24 months compared with older children[8,10,18,19]. Exclusive breastfeeding is terminated for the age range with the highest iron requirement per kilogram of body weight, which results from accelerated growth rate[20]. At this stage, a diet with low iron bioavailability is introduced[21,22]. Thus, these circumstances may have produced the high anaemia prevalence observed in children 6 to 11 months old in Rio Branco.

In parallel with the results shown herein, population-based investigations conducted in the states Pernambuco and São Paulo observed that a lower number of years in the mother's education was associated with childhood anaemia[22,23]. This suggests that school facilitates better feeding practices, and more years of study by the mother can produce more appropriate child-feeding practices. Nonetheless, lower levels of education lead to lower paid work, which results in less access to food, goods and services that are beneficial to a child's health[16].

Herein, anaemia in the child's mother was associated with anaemia in the child. A similar association was observed in research conducted in northeast Brazil[24] and Acre[9]. A mother living in the same household as the child shares similar conditions, such as poverty, low bioavailability of iron and vitamin B12 in food as well as susceptibility to infectious diseases. Thus, socio-familial context may concomitantly influence anaemia frequency in the mother and child. Furthermore, hereditary anaemia may influence this association[25].

Feeding practices are associated with anaemia in children[21,26]. In particular, fruits contain minerals and vitamins that stimulate iron absorption[20]. Data from the Consumer Expenditure Survey for 2002-03[27], which considered the state capitals, showed that Rio Branco had the second lowest household availability of fruits and natural juices. Consequently, this situation exposes children from Rio Branco to an anaemia risk, especially through iron deficiency.

Meats have high heme iron bioavailability and facilitate absorption of non-heme iron from vegetables[28,29], which provides protection against anaemia. Thus, children in Rio Branco that consumed meat less than once a week were more susceptible to anaemia. Corroborating data were observed for a population-based study in the state Pernambuco[22], where lower consumption of heme iron was associated with anaemia in children. Similarly, in Rio de Janeiro children 12-18 months old with anaemia in an outpatient hospital that specialised in paediatrics had low meat consumption in their diet compared with non-anaemic children[26].

No publications specific to Rio Branco were identified on effectiveness of the National Iron Supplementation Programme (Programa Nacional de Suplementação de Ferro - PNSF). However, investigations in certain Brazilian cities showed factors that influence effective implementation of PNSF, such as management and organisation of human and material resources[30] as well as low awareness among families of the importance for ferrous sulphate supplementation[31,32]. In 2008, there was low coverage (49.6%) of the Family Health Strategy[33] in Rio Branco. Consequently, there are implications for PNSF operation in this municipality given the limited distribution of ferrous sulphate and supplementation monitoring.

In conclusion, the anaemia prevalence in Rio Branco children is a serious public health problem. Children with mothers that had few year of education and were affected by anaemia were more susceptible to anaemia. Inadequate feeding practices (meat and fruit consumed less than once per week) were also associated with anaemia in Rio Branco children.

REFERENCES

1. WHO (World Health Organization). Iron Deficiency Anaemia. Assessment, Prevention and Control. Geneva: WHO; 2001.
2. Benoist B, McLean E, Egli I, Cogswell M. Worldwide prevalence of anaemia 1993-2005: WHO global database on anaemia. Geneva: WHO; 2008.
3. Monteiro CA, Benicio MHA, Konno SC, Silva ACF, Lima ALL, Conde WL. Causes for the decline in child under-nutrition in Brazil, 1996-2007. Rev Saude Publica. 2009;43:35-43.
4. Batista Filho M, Assis AMO, Kac G. Transição nutricional: conceitos e características. In: Kac G, Sichieri R, Gigante DP, organizadores. Epidemiologia nutricional. Rio de Janeiro: Editora Fiocruz/São Paulo: Editora Atheneu; 2007. p. 445-60.
5. Lira PIC, Ferreira LOC. Epidemiologia da anemia ferropriva. In: Kac G, Schieri R, Gigante DP, organizadores. Epidemiologia nutricional. Rio de Janeiro: Editora Fiocruz/São Paulo: Editora Atheneu; 2007. p. 337-23.
6. Brasil. Ministério da Saúde. Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher – PNDS 2006: dimensões do processo reprodutivo e da saúde da criança. Brasília: Ministério da Saúde; 2009.
7. Jordão RE, Bernardi JLD, Barros Filho AA. Prevalência de anemia ferropriva no Brasil: uma revisão sistemática. Rev Paul Pediatr. 2009;27:90-8.
8. Castro TG, Silva-Nunes M, Conde WL, Muniz PT, Cardoso MA. Anemia e deficiência de ferro em pré-escolares da Amazônia Ocidental brasileira: prevalência e fatores associados. Cad Saude Publica. 2011;27:131-42.
9. Oliveira CC, Cardoso MA, Araújo TS, Muniz PT. Anemia em crianças de 6 a 59 meses e fatores associados no Município de Jordão, Estado do Acre, Brasil. Cad Saude Publica. 2011;27:1008-20.
10. Leal LP, Osório MM. Fatores associados à ocorrência de anemia em crianças menores de seis anos: uma revisão sistemática dos estudos populacionais. Rev Bras Saude Matern Infant. 2010;10:417-39.
11. UNICEF (Fundo das Nações Unidas para a Infância). Situação da infância brasileira 2006. Brasília: UNICEF; 2005. [acesso em 11 jun 2011]. Disponível em: http://www.unicef.org/brazil/pt/Pags_001_007_Abre.pdf
12. WHO (World Health Organization). Physical Status: The Use and Interpretation of Anthropometric Indicators of Nutritional Status. Geneva: WHO; 1995. (Technical Report Series 854).
13. WHO (World Health Organization). WHO Multicentre Growth Reference Study Group. WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age. Geneva: WHO; 2006.
14. Barros AJD, Hirakata VN. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. BMC Med Res Methodol. 2003;3:21. [Acesso em: 5 Dez. 2008]. Disponível em: http://www.biomedcentral.com/1471-2288/3/21
15. Victora C, Huttly S, Fuchs S, Olinto M. The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. Int J Epidemiol. 1997;26:224-7.
16. Osório MM. Fatores determinantes da anemia em crianças. J Pediatr. 2002;78:269-78.
17. Muniz PT, Castro TG, Araújo TS, Nunes NB, Silva-Nunes M, Hoffmann EEE, et al. Child health and nutrition in the Western Brazilian Amazon: population-based surveys in two counties in Acre State. Cad Saude Publica. 2007;23:1283-93.
18. Souto TS, Oliveira MN, Casoy F, Machado EHS, Juliano Y, Gouvêa LC et al. Anemia e renda per capita familiar de crianças freqüentadoras da creche do Centro Educacional Unificado Cidade Dutra, no Município de São Paulo. Rev Paul Pediatria. 2007;25:161-6.
19. Silva DG, Priore SE, Franceschini SC. Fatores de risco para anemia em lactentes atendidos nos serviços públicos de saúde: a importância das práticas alimentares e da suplementação com ferro. J Pediatr. 2007;83:149-56.
20. Stekel A. Iron nutrition in infancy and childhood. New York: Raven; 1984.
21. Garcia MT, Granado FS, Cardoso MA. Alimentação complementar e estado nutricional de crianças menores de dois anos atendidas no Programa Saúde da Família em Acrelândia, Acre, Amazônia Ocidental Brasileira. Cad Saude Publica. 2011:27;305-16.
22. Oliveira MA, Osório MM, Raposo MC. Fatores socioeconômicos e dietéticos de risco para a anemia em crianças de 6 a 59 meses de idade. J Pediatr. 2007;83:39-46.
23. Monteiro CA, Szarfarc SC, Mondini L. Tendência secular da anemia na infância na cidade de São Paulo (1984-1996). Rev Saude Publica. 2000;34:62-72.
24. Miglioli TC, Brito AM, Lira PIC, Figueroa JN, Filho MB. Anemia no binômio mãe-filho no Estado de Pernambuco. Cad Saude Publica. 2010;26:1807-20.
25. Melo-Reis PR, Araújo LM, Dias-Penna KG, Mesquita MM, Castro FS, Costa SH. A importância do diagnóstico precoce na prevenção das anemias hereditárias. Rev Bras Hematol Hemoter. 2006;28:149-52.
26. Lacerda E, Cunha AJ. Anemia ferropriva e alimentação no segundo ano de vida no Rio de Janeiro, Brasil. Rev Panam Salud Publica. 2001;9:294-301.

27. Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares – 2002-2003: Análise da disponibilidade domiciliar de alimentos e do estado nutricional no Brasil. IBGE: Rio de Janeiro; 2006.
28. DeMayer EM. Preventing and controlling iron deficiency anemia through primary health care: a guide for health administrators and programmer managers. Geneve: WHO; 1989.
29. Hurrell RF. Biovailability of iron. Eur J Clin Nutr. 1997;51:54-8.
30. Stulbach TE. Avaliação do Programa Nacional de Suplementação de Ferro no controle da anemia, em crianças de 6 a 24 meses, assistidas nos centros de educação infantil do município de Guarujá [Tese]. São Paulo: Faculdade de Saúde Pública da Universidade de São Paulo; 2009.
31. Bertolini GA, Vitolo MR. Baixa adesão à suplementação de ferro entre lactentes usuários de serviço público de saúde. Pediatria. 2007;29:176-82.
32. Azeredo CM, Silva LS, Franceschini SCC, Sant'ana LFR, Ribeiro RCL. Implantação e impacto do Programa Nacional de Suplementação de Ferro no município de Viçosa - MG. Cienc Saude Colet. 2011;16;4011-22.
33. Secretaria Municipal de Saúde. Relatório Anual de Gestão: Exercício de 2010. Rio Branco, 2011. [Acesso em: 03 mai 2012]. Disponível em: http://www.riobranco.ac.gov.br/v4/images/stories/2011/Julho_2011/relatorio_gestao_2010_semsa.pdf.