



Iron Deficiency Anemia in Children Younger than Six Months and Time of Umbilical Cord Clamping. Anemia in 6 Months Old Infants and Delayed Clamping of the Umbilical Cord

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Abstract

Iron deficiency anemia is a very common nutritional disorder among pregnant women and children. Although anemia is not identified as the primary cause of death, it is related to the impairment of physical and cognitive development in children and to weakness in the mechanism of immunity, thus increasing morbidity rates. This article aims to discuss the time of umbilical cord clamping and anemia among children under six months of age, analyzing the possible relationships with socio-economic and demographic and biomedical conditions. This is a cohort, with a total study sample of 934 children, but we had losses during follow-up at 150 days of life, resulting in a sample of 592 children aged close to 5 months. Maintaining the parameters established by the study design, this number of children is sufficient to perform the proposed analyses. The variables considered in the study can be divided in variables that deal with socio-economic and demographic conditions, such as: age, schooling and maternal work, in addition to per capita family income. And biomedical variables such as: gestational age, type of pregnancy, birth weight, time of umbilical cord clamping, pre-gestational body mass index, maternal anemia, prenatal follow-up and breastfeeding. The development of the study followed the requirements of the committee standards in Pesquisa CEP/FCM/UNICAMP No. 198/2004). Ducting as significant variables for risk of iron deficiency anemia for children under 5 months of age, gestational age less than 37 weeks, type of pregnancy, being the duo with the highest risk for the disease and birth weight less than 2500grams. The clamping time of the cord was not related to anemia because, in this study, the clamping of the cord of the delivered deliveries was early in 91.6% of the cases, presenting an average of 18.5seconds. In this study, the mean time of umbilical cord clamping was very low and even though no association was observed with anemia among the infants studied, there is already evidence that guides changes in this practice.

Descriptors

- Anemia, iron-deficiency
- Delivery of care
- Newborn
- Epidemiology
- Cord umbilical clamping

Keywords: Iron Deficiency Anemia; Children; Umbilical Cord Clamping

Introduction

Iron deficiency anemia is a very common nutritional disorder among pregnant women and children. Prenatal and childbirth care may contribute to the fall of anemia in the most susceptible population groups, specifically in childbirth, the act of delaying umbilical cord clamping may favor the baby's iron reserve, avoiding anemia in early childhood [1].

Although anemia is not identified as the primary cause of death, it is related to the impairment of physical and cognitive development in children and to weakness in the mechanism of immunity, thus increasing morbidity rates. Ensuring good serum iron concentrations from birth brings benefits, such as better weight gain in babies born with low weight for gestational age, enables better neuropsychomotor development, reduces the incidence of necrotizing enterocolitis and sepsis [2-4].

Many are the determinants of iron deficiency anemia in childhood, and the low socioeconomic level can be highlighted as a factor related to many of the conditions that lead to insufficient intake and iron malabsorption. Thus, it is worth mentioning, the expected time for clamping the umbilical cord, because such practice, if before one minute, can reduce, between 20% and 50%, the volume of blood to be transferred from the placenta to the baby [5-8]. However, if clamping occurs after the first minute the transfusion is approximately 80% and practically complete at the third minute postpartum [6]. Thus, iron deficiency in the child can be determined at the time of birth.

The delay in clamping full-term babies, at least 2 minutes after birth, benefits the newborn, extending throughout childhood [8-10]. Some observational studies suggest that delayed cord clamping may bring some disorders to the newborn, including polycythemia, respiratory symptoms, hyperbilirubinemia, and other neonatal diseases [11-13]. Although a higher prevalence of polycythemia was found in late clamping (2 minutes), this condition does not compromise the health of the newborn [14].

A study conducted with obstetric nurses and midwives showed that 35% of the deliveries performed by them respected the appropriate time for umbilical cord clamping [15]. However, this practice is not part of the routines of obstetric centers and is more common in-home births [7].

In Brazil, the Ministry of Health mentions in the document "Prenatal care - standards and technical manuals" that umbilical cord

clamping should happen "at the appropriate time" [Brazil, 2000. 13p][16], which differs, for example, from world health organization (WHO) standards that clarifies about the early clamping of the umbilical cord, which is performed until the first 60 seconds after birth, and the late one occurs after the first minute of the newborn's life. It is therefore recommended to clamp the umbilical cord, which is performed between the 1st and 3rd minute or after the cord pulsations cease. Ensuring this procedure allows the increase in the values of hematocrit and hemoglobin of the baby, thus leading to an increase in the amount of iron. These values remain high until twelve months of age, reducing the incidence of iron deficiency anemia [17]. This is the need for studies like this to support public health policies that assess hospital routines of childbirth care.

This article aims to discuss the time of umbilical cord clamping and anemia among children under six months of age, analyzing the possible relationships with socio-economic and demographic and biomedical conditions.

Materials and Methods

Article based on information from the project "Maternal and Child Health and Nutrition". DMPS-FCM/UNICAMP and Ministry of Health, 2005/06.

The study was carried out at the State Hospital of Sumaré (HES) in Sumaré, State of São Paulo. Data from parturients from the municipalities of Sumaré and Hortolândia were collected. Children whose mothers refused to participate in the study, or those with congenital problems, such as cleft palate or neurological problems, were not selected.

The total study sample and 934 children, however, had losses during follow-up at 150 days of life, resulting in a sample of 592 children aged close to 5 months. Maintaining the parameters established by the study design, this number of children is sufficient to perform the proposed analyses.

Instruments were elaborated and pre-tested for cohort follow-up. Data collection began at the Obstetric Center, after the mother's informed acceptance to participate in the research, where data were collected regarding the procedures performed during delivery. At the time of delivery, blood samples were collected from the mother of the umbilical cord to identify the hematological conditions (Blood Count and Ferritin of the cord and Blood Count of the mother). At the Gyneco-Obstetrics Clinic, during hospitalization, interviews were conducted with the puerperal women and anthro-

pometric, biochemical and intercorreal data were collected from the prenatal card of the women selected for the study. At 5 months of life, the babies were observed in the outpatient clinic of the hospital and their mothers interviewed. On this occasion, at 5 months, biochemical tests (blood count and ferritin) were performed.

Anemia was considered when hemoglobin less than 11g/dl + ferritin (reference of normality values). The blood count collection and analysis technique was done with a hematological analyzer ABX Pentra-60 and the material analyzed was blood. Ferritin was analyzed by the chemiluminescent method and the material analyzed was blood plasma without fibrinogen (serum).

The variables considered in the study can be divided in variables that deal with socio-economic and demographic conditions, such as: age, schooling and maternal work, in addition to per capita family income. And biomedical variables such as: gestational age, type of pregnancy, birth weight, time of umbilical cord clamping, pre-gestational body mass index, maternal anemia, prenatal follow-up and breastfeeding.

The development of the study followed the requirements of the standards of the Faculty of Medical Sciences of the State University of Campinas, which regulate research involving human beings (Cep/FCM/UNICAMP Project No. 198/2004).

Results and Discussions

The mean age of the mothers was 25.3 years (SD = 6.3 years). The proportion of adolescent mothers (under 21 years) was 27.5%, a very similar proportion to that found in the Novellino study (2011), which was 25.58%. About 54.3% of the mothers had only elementary or lower schooling. (Table 1).

The household characteristics of the families of the children studied, described in Table 2, show that 99.5% lived in masonry houses, and 59.0% were finished, 97.9% had piped water and 85.3% had sanitary sewage, showing a good housing condition of these children. According to the 2017 National Basic Sanitation Survey (PNSB), "... access to adequate water supply and sanitation, " is a fundamental right of citizens, essential to ensure them decent housing conditions, care and maintenance of health and preservation of the environment. " [IBGE-PNSB, 2020, p.9] [19].

In chart 1, the factors related to anemia in the first five months of age were low birth weight and not receiving breastfeeding, indicating the importance of the mother's follow-up during prenatal care, ensuring health care that favors the baby's weight gain during pregnancy and the importance of ensuring breastfeeding support and management for children under five months of age.

Table 2 highlights as significant variables for risk of iron deficiency anemia for children under 5 months of age, gestational age less than 37 weeks, type of pregnancy, being the double being the highest risk for the disease and birth weight less than 2500 grams. The clamping time of the cord was not related to anemia because, in this study, the clamping of the cord of the delivered deliveries was early in 91.6% of the cases, presenting an average of 18.5seconds (SD - 21.49 seconds) (Graph 1).

Characteristics	N	%
Maternal age*		
13 to 21 years	251	27,5
21 to 29 years old	426	46,7
More than 30 years	235	25,8
Mother's schooling**		
No	12	2,2
Elementary (1st to 8 th grade)	295	53,2
Medium	204	36,8
Superior	44	7,9
Maternal work (away from home) ***		
No	462	79,4
Yes	120	20,6
Family income per capita		
Less than 1 minimum salary	499	82,9
More than 1 salary	103	17,1
Total	934	100,0

Table 1: Distribution of children, according to socio-demographic characteristics. Sumare - SP - Brazil, 2007.

*22 blank data (high protocol data)

**37 blank data (tracking protocol data) - 379 total bank missings
10 blank data (tracking protocol data) - 352 missings of the total bank

332 blank data (high protocol data).

Characteristics	N	%
Masonry*		
Finished	338	58,7
Unfinished	238	41,3
Water**		
With internal channeling	563	97,9
No internal channeling	12	2,1
Sewer***		
General network	500	85,3
Septic fossa	43	7,3
Rudimentary fossa	22	3,8
Other	16	2,7
It has no	5	0,9
Total	592	100,0

Table 2: Distribution of children according to household characteristics. Sumare - SP - Brazil, 2007.

*1 blank data (follow-up protocol data)

**17 blank data (tracking protocol data) - 359 total bank missing

**6 blank data (tracking protocol data) - 348 total bank missing.

	n	OR	95% CI
Low birth weight*			
Yes	25	2.90	1.13-7.47
No	389	1.00	
Full breastfeeding**			
Yes	50	0.53	0.28-0.98
No	364	1.00	
Early Clamping Time - 1 minute			
Yes	402	2.14	0.63-7.26
No	12	1.00	
Mother's educational level			
Fundamental and Medium	382	1.83	0.86-3.88
Superior	32	1.00	

Table 2a: Factors related to anemia at 5 months of age: multiple logistic regression - Sumaré, São Paulo, Brazil, 2007.

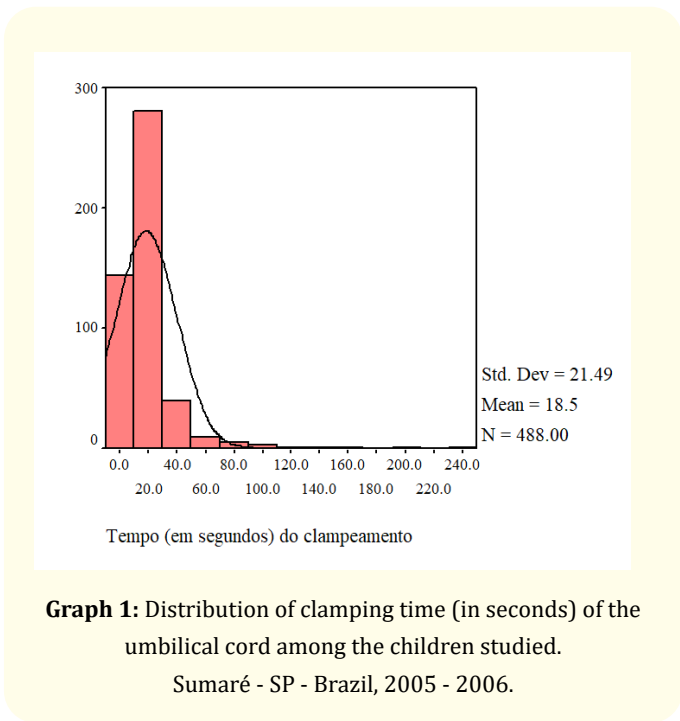
Anemia defined using Hb of 11g/dl as the cut-off point.

* sig. 0.027

** sig. 0.041.

	n	%	p
Significant variables			
Gestational age			
Less than 37 weeks	22/31	71,0	0,020
Greater than 37 weeks and equals	214/433	49,4	
Type of pregnancy			
Only	235/464	50,6	0,025
Couple	10/12	83,3	
Low birth weight			
Smaller 2500 grams	22/28	78,6	0,003
Greater than or equal to 2500 grams	221/447	49,4	
Non-significant variables			
Baby sex			
Male	133/242	55,0	0,082
Femino	109/232	47,0	
Clamp with 30 seconds			
Less than 30 seconds	204/402	50,7	0,478
30 seconds and more	35/63	55,6	
Clamper with 1 minute			
Less than 60 seconds	234/450	52,0	0,155
60 seconds and more	5/15	33,3	
Clamper with 2 minutes			
Less than 120 seconds	239/462	51,7	0,074
120 seconds and more	0/3	0%	
Have made the pre-natal			
IFM	243/467	52,0	0,415
No	3/8	37,5	
Having a diagnosis of anemia in the pre-natal			
IFM	38/71	53,5	0,658
No	192/379	50,7	
IMC pre gestational			
Less than 19kg/m ²	7/12	58,3	0,899
19 and 24.9kg/m ²	47/91	51,6	
Greater than or equal to 25kg/m ²	40/78	51,3	

Table 2b: Probability of anemia according to some biomedical conditions: Sumaré, São Paulo, Brazil, 2007.



Conclusions

In this study, the mean time of umbilical cord clamping was very low and even though no association was observed with anemia among the infants studied, there is already evidence that guides changes in this practice.

The studied population of children younger than six months presented a high prevalence of anemia, close to the values found in other national studies.

We observed an association between anemia in children at 150 days of life and prematurity and low birth weight.

The observation of low mean times of umbilical clamping indicates the need for modification of this practice in hospitals.

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Conflict of Interest

We declare that this person has no financial interest or conflict of interest.

Bibliography

1. Chopra A., et al. "Early versus delayed cord clamping in small for gestational age infants and iron stores at 3 months of age - a randomized controlled trial". *BMC Pediatric* 18 (2018): 234.
2. Mercer JS., et al. "Effects of Delayed Cord Clamping on 4-Month Ferritin Levels, Brain Myelin Content, and Neurodevelopment: A Randomized Controlled Trial". *The Journal of Pediatrics* 203 (2018): 266-272.e2.
3. Steffen EL., et al. "Effect of late umbilical cord clamping on serum ferritin levels of children aged 0, 3 and 6 months of life". *Journal of the Adolfo Lutz Institute* 71.1 (2012): 160-165.
4. GL Stained Glass. "TIMELY CLAMPING OF UMBILICAL CORD AND ITS REPERCUSSIONS ON NEONATAL HEMOGLOBIN CONCENTRATION". *SaBios* 12.1 (2018): 35-41.
5. Grajeda R., et al. "Delayed clamping of the umbilical cord improves hematologic status of Guatemalan infants at 2mo of age". *American Journal Clinical Nutrition* 65 (1997): 425-431.
6. World Health Organization. "Care of the Umbilical Cord: a review of the evidence". Geneva, Switzerland; 1998b:11-12. WHO/RHTMSM/98.4.
7. Mercer JS. "Current best evidence: a review of the literature on umbilical cord clamping". *Journal Midwifery Women Health* 46 (2001): 402-414.
8. Chaparro CM., et al. "Effect of timing of umbilical cord clamping on iron status in Mexican infants: a randomised controlled trial". *Lancet* 367 (2006): 1997-2004.
9. Van Rheenen P and Brabin BJ. "Late umbilical cord-clamping as an intervention for reducing iron deficiency anaemia in term infants in developing and industrialized countries: a systematic review". *Annals of tropical paediatrics* 24 (2004): 3-16.
10. Mercer J and Erickson-Owens D. "Delayed cord clamping increases infants 'iron stores". *Lancet* 367 (2006): 1956-1958.
11. Oh W., et al. "The effects of placental transfusion on respiratory mechanics of normal term newborn infants". *Pediatrics* 40 (1967): 6-12.
12. Yao AC., et al. "Expiratory grunting in the lateclamped normal neonate". *Pediatrics* 48 (1971): 865-870.
13. Saigal S., et al. "Placental transfusion and hyperbilirubinemia in premature". *Pediatrics* 49 (1972): 406-419.

14. Hutton EK and Hassan ES. "Late vs early clamping of the umbilical cord in full-term neonates - systematic review and meta-analysis of controlled trials". *JAMA* 297 (2007): 1241-1252.
15. Mercer JS., *et al.* "Umbilical cord clamping: beliefs and practices of American nurse-midwives". *Journal Midwifery Women Health* 45 (2000): 58-66.
16. Brazil, Ministry of Health. Prenatal Care: Technical Manual/ preparation team: Janine Schirmer et al. - 3rd edition - Brasilia: Health Policy Secretariat - SPS/Ministry of Health (2000).
17. Matos LL., *et al.* "Late umbilical cord clamping: interference in the development of neonatal iron deficiency anemia and other benefits". *Brazilian Journal of Development, Curitiba* 7.8 (2021): 86135-86142.
18. Novellino and Maria Salet Ferreira. "A study on Brazilian adolescent mothers. Physis". *Journal of Collective Health* 21.1 (2011): 299-318.
19. Brazilian Institute of Geography and Statistics (IBGE). National Basic Sanitation Survey 2017: water supply and sewage/ IBGE, Population Coordination and Social Indicators. - Rio de Janeiro: IBGE (2020).