



Submitted on: 09/03/2019  
Approved on: 10/21/2019

ORIGINAL ARTICLE

## Head circumference: an anthropometric parameter underreported in child health card

Ieda Regina Lopes Del-Ciampo<sup>1</sup>, Mariane Pizato Zerezuella<sup>2</sup>, Luiz Antonio Del-Ciampo<sup>3</sup>

### Keywords:

Anthropometry,  
Cephalometry,  
Child Care.

### Abstract

**Introduction:** Head circumference (HC) is directly related to the speed of brain growth. The usual record in the child health card (CHC) would help its longitudinal interpretation by health professionals. Hypothesis: HC would be less registered in the CSC than Weight (W) and Length (L) in the first two years of life. **Objectives:** To describe the frequency and the correlation between HC, W and L records in infants CHC. **Methods:** A cross-sectional, descriptive study included children up to 2 years of age attending the basic health center. Data were collected by interviews and records from the CHC. The moments of the anthropometric records of the 77 children were categorized as 0 (birth), I, II, III and IV, respectively. Comparison between qualitative variables was calculated by chi-square test or Fishers exact test, significance level  $p = 0.05$ ; software: EPI-INFO 7. **Results:** There was a progressive decrease in the frequency of HC records in relation to W at moments I-100% and 72.8% ( $p = 0.001$ ); II-96.9% and 56.2% ( $p = 0.0002$ ); III-96.1% and 50% ( $p = 0.003$ ); and IV-100% and 50% ( $p = 0.004$ ), respectively. The HC record was also smaller than the L record at moments I-86.5% and 72.8% ( $p = 0.247$ ); II-65.6% and 56.2% ( $p = 0.608$ ); III-80.8% and 50% ( $p = 0.0003$ ); and IV-50% and 50% ( $p = 1$ ); respectively. **Conclusion:** HC was the less reported and it may have impaired the longitudinal assessment by health professionals.

<sup>1</sup> Federal University of São Carlos, Adjunct Professor. Medicine course. Child and Adolescent Health Area. - São Carlos - São Paulo - Brazil.

<sup>2</sup> Federal University of São Carlos, Student. Medicine course. Federal University of São Carlos. - San Carlos. - São Paulo. - Brazil.

<sup>3</sup> Faculty of Medicine of Ribeirão Preto, Federal University of São Paulo, Associate Professor. Department of Childcare and Pediatrics. - Ribeirao Preto. - São Paulo. - Brazil.

### Correspondence to:

Ieda Regina Lopes Del-Ciampo.

Universidade Federal de São Carlos. Rod. Washington Luiz, s/n - São Carlos/SP, Brazil. CEP: 13565-905. E-mail: ieda@ufscar.br



## INTRODUCTION

Anthropometry is a simple, non-invasive and low-cost method to assess body size, proportions and composition. The measurement of anthropometric data referring to weight (W), height (H) and perimeter are resources that contribute to detect deviations in the health and nutritional condition of the child, who is in full growth and development. The assessment of head circumference (HC) is important because it has a direct relationship with the speed of brain growth, helping to diagnose developmental changes when associated with anamnesis and physical examination<sup>1,2</sup>.

The Agenda of Commitments to Comprehensive Child Health and Reduction of Infant Mortality of the Ministry of Health proposes, as axes of assistance, 13 lines of care that privilege actions such as prevention of nutritional disorders, attention to prevalent diseases, monitoring of growth and development, encouragement of breastfeeding and healthy eating, oral health, immunization and mental health, prevention of accidents and abuse, in addition to specific actions aimed at women and newborns<sup>3</sup>.

In this context, the Child Health Handbook (CSC) was created with the objective of strengthening public policies on children's health. It is distributed at birth by maternity hospitals and is intended to record important information related to child health, including anthropometric measurements, enabling its interpretation at birth and longitudinally by health professionals during the child's evolution<sup>4</sup>. It is observed, however, that it has been underused<sup>5</sup>.

Measuring the head circumference at birth can help detect congenital infections, malformations, diseases of metabolic and genetic origin, among others. It should be routinely measured for the individual follow-up of children younger than two years of age, the period of greatest speed of brain growth<sup>2,6</sup>.

The hypothesis of this study was that head circumference records would be less frequent than weight and height records during the first two years of life. This study is justified because it can contribute to consolidate the importance of recording the head circumference in the CSC, since it is easy to obtain, serving for the detection of macro or microcephaly by any health professional who works with infants. The aim of this study was to describe the frequency and associations between records of head circumference, weight and height in the Infant Health Card.

## METHODOLOGY

A cross-sectional, descriptive study was carried out, including children up to 2 years of age who attended the 11 Basic Health Units of a medium-sized municipality in the state of São Paulo-SP, between August and November 2016. Data were collected by two previously trained interviewers, during 2 visits to each Basic Health Unit, on randomly selected days and periods. All those responsible for the children present at

the UBS at the time of the visits were invited to participate, and all children up to two years of age who agreed to participate in the study were included. A convenience sample of 77 individuals was obtained.

The instruments for data collection were a questionnaire prepared by the researchers and the Child Health Card requested from the participants. The study variables included the degree of kinship with the child (mother, other), receiving the CSC at the maternity hospital (yes, no), reason for not receiving the CSC (if they had not received it), portability of the CSC at the time of the study (Yes No). The variables obtained through the collection of CSC data included age (months), gender (male and female) and the first five recorded records of head circumference (cm), weight (grams) and height (cm), which were categorized as 0 (birth), I, II, III and IV, respectively. For the descriptive analysis of the qualitative variables, the absolute and percentage indices were calculated, and the mean and their respective standard deviations were calculated for the quantitative variables. To compare the qualitative variables, the Chi-square test was used, or Fisher's Exact Test when relevant, assuming  $p \leq 0.05$  as a significance level. The software used was EPI-INFO 7.

## RESULTS

Among the 77 participants, 45 (58.4%) were male. The mean age at the time of the study was 7.2 ( $\pm 5.4$ ) months. The CSC had not been made available at the maternity hospital to 27 (35.1%) of them. Of the 50 others who received CS in the maternity ward, 37 (74.0%) had them at the time of the study, which had a mean age ( $\pm$ SD) of 8.6 ( $\pm 4.2$ ) months. There were 40/77 (51.9%) children without CSC at the time of the study.

The frequencies of at least one of the records of head circumference, height and/or weight in the CSC of the 37 children who presented them were equal to 100% at moments 0 (37/37), I (37/37), II (32/32), III (26/26) and IV (20/20), respectively. The percentage distribution of the recording of each anthropometric measurement, according to the different moments and median age, is shown in Table 1.

The associations between the registration of head circumference and weight and height revealed that the first anthropometric parameter was significantly lower at moments I, II, III and IV (Table 2) and at moments 0 and III (Table 3); respectively. In the other moments, the difference was not statistically significant.

## DISCUSSION

The lack of availability of the CSC for children still in the maternity ward was high, preventing them from having access to this important surveillance instrument, created with the aim of facilitating their comprehensive monitoring. The damage also fell on the professionals who care for the child, who would be responsible for the correct and complete record of the child's health conditions, in addition to family guidance on the information found in it<sup>5</sup>.

**Table 1.** Distribution of weight, height and head circumference records, according to with the different moments (birth, I, II, III and IV) and with the median age, in the CSC of children in the UBS of County in Are Carlos-SP, in August The November in 2016.

Time of record	median age (months)	wallets with some record		Record in Weight		Record in Stature		Record in Perimeter Cephalic	
		n	%	n	%	n	%	n	%
0	0	37	100	25	67.5	25	67.5	33	89.2
I	1.4	37	100	37	100	32	86.5	27	72.8
II	2.1	32	100	31	96.9	21	65.6	18	56.2
III	3.5	26	100	25	96.1	21	80.8	13	50.0
IV	4.5	20	100	20	100	10	50.0	10	50.0

**Table 2.** Associations between head circumference and weight records according to the different moments in the Health Cards of the children assisted in basic in Health in the municipality of São Carlos-SP, august to november 201.

Period	wallets with records		Weight		Perimeter Cephalic		P value
	n	%	n	%	n	%	
0	37	100	37	100	33	89.2	0.11 *
I	37	100	37	100	27	72.8	0.001 *
II	32	100	31	96.9	18	56.2	0.0002 *
III	26	100	25	96.1	13	50.0	0.0003 *
IV	20	100	20	100	10	50.0	0.0004 *

\*Test Exactly in Fisher.

**Table 3.** Associations between head circumference and height records according to with you many different moments in the wallets in Health of children in the Units basic in Health from the municipality of Are Carlos-SP, August to November 2016.

Period	wallets with records		Stature		Perimeter Cephalic		P value
	n	%	n	%	n	%	
0	37	100	25	67.6	33	89.2	0.045 *
I	37	100	32	86.5	27	72.8	0.247 **
II	32	100	21	65.6	18	56.2	0.608 *
III	26	100	25	80.8	13	50.0	0.0003 **
IV	20	100	10	50	10	50.0	1 *

\*Test of Chi-square ; \*\*Test Exactly in Fisher.

The frequency of non-portability of the CSC at the time of the visit to the Basic Health Unit was high, either due to non-availability or lack of portability. Studies show that the non-appropriate use of the CSC may include the lack of guidance from parents on the benefits intended for the child in relation to the annotation of important data related to their health<sup>7</sup>.

The possibility of greater accuracy during the care of the child by the health professionals, resulting from the longitudinal visualization of the data duly recorded in the CSC, should also be highlighted. The benefits provided by recording the records in the CSC would justify encouraging their portability and use by family members and health professionals at each appointment<sup>5,8</sup>.

The higher frequency of weight recording (100%) in relation to head circumference (89.2%), although without significant difference ( $p = 0.11$ ), evidences the importance given by professionals in carrying out the weighing of NBs. However, the highest record of notes ( $p = 0.045$ ) referring

to head circumference (89.2%) in relation to height (67.6%) is worrying, as both should have been recorded in the Child Health Card of all NBs still in maternity. The frequency of head circumference records was compatible with a study carried out in Minas Gerais that observed the availability of this information in 85.6% on the first pages of the CSC, which also detected a frequency of birth weight equal to 94.1%<sup>5</sup>.

Recognition of the nutritional status of newborns is important because they may have low birth weight (LBW), which must be differentiated between prematurity or intrauterine growth restriction (IUGR), both with different outcomes and pediatric follow-up needs. For the classification of the IUGR, knowing birth weight and gestational age are necessary and fundamental, since these newborns have higher mortality and difficulty in neonatal adaptation in the short and long term, requiring greater surveillance<sup>9,10</sup>.

Weight, information that is simple to obtain as it does not require special equipment, is an anthropometric measure

closely related to birth and growth and may vary according to gestational age and the total amount of body water. On the other hand, the lean body mass is reflected by the length, measured determined by the genetic potential, suffering less intrauterine influence. Obtaining this anthropometric parameter depends on two individuals and an appropriate technique for its measurement, making it more difficult to obtain, but necessary, and should always be performed in the delivery room<sup>11</sup>.

Head circumference, directly related to the size of the brain mass, is the least sensitive measure to assess malnutrition. (Falcão MC, Cardoso LE; 20010)<sup>11</sup>. The causes of higher registration of head circumference in relation to height cannot be detected through this study, but they stimulate the elaboration of questions to be answered with the elaboration of new researches. Would the measuring tape be the instrument with greater accessibility, next to the scale, in relation to the horizontal anthropometer, thus facilitating the measurement and subsequent recording of this anthropometric measurement? Would it have been considered difficult to measure height, due to the NB's particularity of maintaining a flexor attitude? Would it have been considered more important to record head circumference than height records due to the Zika virus outbreak that occurred during the study period?

A progressive decrease in the frequency of head circumference records was observed in relation to weight records at moments I 100% and 72.8% ( $p = 0.001$ ); II 96.9% and 56.2% ( $p = 0.0002$ ); III 96.1% and 50% ( $p = 0.003$ ) and IV 100% and 50% ( $p = 0.004$ ); respectively. The same occurred for the registration of head circumference in relation to height at moments I - 86.5% and 72.8% ( $p = 0.247$ ); II - 65.6% and 56.2% ( $p = 0.608$ ); III 80.8% and 50% ( $p = 0.0003$ ) and IV 50% and 50% ( $p = 1$ ); respectively. Only the records of weight measurements remained high, those of height gradually decreased and those of head circumference even more, evidencing their devaluation with the advancement of the child's age. Would these measurements have been carried out in routine consultations, but not recorded in the CSC or were they gradually being neglected? Further studies would be needed to answer these questions. The fact is that they should have always been measured and recorded in the CSC. It is important to note that, at the time of the study, there were descriptions of the increase in cases of microcephaly resulting from the outbreak of infection by the ZIKA virus (ZIKV), which should require even greater attention on the anthropometric assessment of the head circumference<sup>12,13</sup>. The spread of the disease throughout Brazil and the world, associated with the confirmation of ZIKV by laboratory tests, started to be classified as a Public Health Emergency of International Concern (PHEIC) by the World Health Organization<sup>14,15</sup>.

This study showed that the CSC was not valued, either due to the lack of access to it at birth or the lack of portability during the search for the Basic Health Unit.

There were more records of head circumference than height at birth. The weight record was always the most recorded in the Child Health Card. However, the head circumference record was soon surpassed by the weight and height records from the first moment of care at the Basic Health Unit, demonstrating its undervaluation in relation to the records of other anthropometric measurements.

## CONCLUSION

The results point to the need for constant training aimed at health professionals and the development of educational measures for family members, so that there is a greater understanding of the importance of the CSC, which, if properly completed, could provide better outcomes for children's health, in addition to optimizing the Union's financial resources invested in the preparation and distribution of an underused document.

One of the strengths of this study was the observation of the underutilization of the CSC, especially with regard to recording the head circumference. Its replication in uni- or multi-center studies would make it possible to compare the results obtained with those from other places in Brazil. The questions generated by this research allow the elaboration of other studies so that the answers can be obtained and, thus, strategies are developed in order to increase the effectiveness of the records. The lack of access to the CSC by some children and the non-portability of the same during the visit to the UBS may have generated difficulties for the study, but they were opportune to highlight the need for constant actions that can modify these results. Although there was underreporting of all anthropometric measurements, head circumference was the least reported, which may have hampered the longitudinal assessment by health professionals and even prevented the early detection of possible cases of micro or macrocephaly.

## REFERENCES

1. World Health Organization (WHO). An evaluation of infant growth: the use and interpretation of anthropometry in infants. *Bull World Health Organ.* 1995;73(2):165-74.
2. Macchiaverni LML, Barros Filho AA. Perímetro cefálico: porque medir sempre. *Medicina (Ribeirão Preto).* 1998 Out/Dez;31:595-609.
3. Ministério da Saúde (BR). Secretaria de Atenção à Saúde. Departamento de Ações Programáticas Estratégicas. Agenda de compromissos para a saúde integral da criança e redução da mortalidade infantil. Brasília (DF): Ministério da Saúde; 2004.
4. Ministério da Saúde (BR). Secretaria de Atenção à Saúde. Departamento de Ações Programáticas Estratégicas. Manual para utilização da caderneta de saúde da criança. Brasília (DF): Ministério da Saúde; 2005.
5. Alves CRL, Lasmar FLMLBF, Goulart LMHF, Alvim CG, Maciel GVR, Viana MRA, et al. Qualidade do preenchimento da caderneta de saúde da criança e fatores associados. *Cad Saúde Pública.* 2009 Mar;25(3):583-95.
6. DeMyer W. Small, large, or abnormally shaped head. In: Maria BL, editor. *Current management in child neurology.* 3<sup>th</sup> ed. London: BC Decker; 2005. p. 338-41.

7. Vieira GO, Bastos MC, Reis MR, Moreira ISS, Martins CC, Gomes DR, et al. Fatores associados ao uso da caderneta de saúde da criança em uma cidade de grande porte do nordeste brasileiro, 2009. *Ciênc Saúde Coletiva*. 2017;22(6):1943-54.
8. Silva FB, Gaiva MAM, Mello DF. Utilização da caderneta de saúde da criança pela família: percepção dos profissionais. *Texto Contexto Enferm*. 2015 Abr/Jun;24(2):407-14.
9. Lee PA, Chernausek SD, Hokken-Koelega AC, Czernichow P, International Small for Gestational Age Advisory Board. International small for gestational age advisory board consensus development conference statement: management of short children born small for gestational age, April 24-October 1, 2001. *Pediatrics*. 2003 Jun;111(6 Pt 1):1253-61.
10. Lubchenco LO, Searls DT, Brazie JV. Neonatal mortality rate: relationship to birth weight and gestational age. *J Pediatr* 1972 Oct;81(4):814-22.
11. Falcão MC, Cardoso LE. Avaliação nutricional do recém-nascido pré-termo. *Rev Bras Nutr Clin* 2001;16:144-7.
12. Calvet G, Aquiar RS, Melo ASO, Sampaio SA, Filippis I, Fabri A, et al. Detection and sequencing of Zika virus from amniotic fluid of fetuses with microcephaly in Brazil: a case study. *Lancet Infect Dis*. 2016 Jun;16(6):653-60.
13. Mlakar J, Korva M, Tul N, Popovic M, Poljsak-Prijatelj M, Mraz J, et al. Zika virus associated with microcephaly. *N Engl J Med*. 2016 Mar;374(10):951-8.
14. World Health Organization (WHO). WHO statement on the first meeting of the International Health Regulations (2005) (IHR 2005) Emergency Committee on Zika virus and observed increase in neurological disorders and neonatal malformations. Geneva: WHO; 2016.
15. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Departamento de Vigilância das Doenças Transmissíveis. Protocolo de vigilância e resposta à ocorrência de microcefalia relacionada à infecção pelo vírus Zika. Brasília (DF): Ministério da Saúde; 2015.