Residência RP Pediátrica
Publicação Oficial da Sociedade Brasileira de Pediatria
ISSN-Online: 2236-6814

Submitted on: 03/30/2020
Approved on: 07/16/2020

ORIGINAL ARTICLE

Breastfeeding in children with microcephaly due to Congenital Zika Virus Syndrome

Karole Brito Alves Costa[1], Normeide Pedreira dos Santos França[1]

Keywords:
Breast feeding,
Zika virus,
Microcephaly.

Abstract

Introduction: Children with microcephaly are at increased risk for global developmental delay, physical and intellectual disability, and sensorineural changes. Records on growth and development, as well as records on the prevalence of breastfeeding, are still scarce in this population. **Objective:** To identify duration and characterization of breastfeeding in children with microcephaly due to congenital ZIKV syndrome (SCZV) seen at a referral service. **Methodology:** Descriptive, cross-sectional, quantitative study. Data collection was performed on medical records and during interviews, using standardized questionnaires, during the months of September and November 2019. Descriptive statistical analysis was performed using the SPSS 25.0 program. **Results:** Fourteen children met the inclusion criteria and were included in this study. The average age was 43 months (20-50), and the average head circumference corresponded to 29.85 cm (25-34). Most children (92.9%) were breastfed. Eight children (57.2%) received exclusive breastfeeding and five (35.7%) received predominant breastfeeding. Only 21.4% suckled in the first hour of life. The mean time of BF was 14.67 months (04-37). Twelve mothers had already weaned during the data collection period. Three (21.4%) underwent gradual weaning and nine (64.3%) underwent abrupt weaning. All children used artificial teats (pacifiers, n = 14; baby bottles, n = 13), and in 50% of cases, this use occurred while still in the maternity ward. **Conclusion:** This study found a prevalence of 92.9% of breastfed children within the studied group, and an average duration of breastfeeding less than 2 years of age.

[1] Universidade Estadual de Feira de Santana, Departamento de Saúde - Feira de Santana - Bahia - Brasil.

Correspondence to:
Karole Brito Alves Costa.
Universidade Estadual de Feira de Santana. Av. Transnordestina, s/nº, Feira de Santana, Novo Horizonte, BA, Brazil. CEP: 44036-900. E-mail: karolebrito@yahoo.com.br

DOI: 10.25060/residpediatr-2023.v13n2-289

Este trabalho está licenciado sob uma Creative Commons Attribution 4.0 International License.

INTRODUCTION

Microcephaly is a malformation diagnosed when the measurement of the head circumference (HC) of a newborn is less than two standard deviations below the average HC expected for a given gestational age and sex[1]. Children with microcephaly are at increased risk of global developmental delay, physical and intellectual disability, and sensorineural impairment – particularly auditory and visual[2].

From 2000 to 2014, 2,464 children were born with microcephaly in Brazil, averaging 164 cases a year. In 2015 the number went up to 1,608, a nine-fold increase relative to the average observed the year before[3]. Most cases (71%) occurred in the Brazilian Northeast. The scientific community was unaware of the causes behind the increase and studies evinced a correlation between cases of congenital microcephaly and infection by the Zika virus (ZIKV) during pregnancy. The clinical alterations (with or without microcephaly) seen in the children of mothers who had ZIKV infection during pregnancy were named congenital Zika virus syndrome (CZVS).

In the State of Bahia, the proportion of cases involving newborns decreased from 98.1% in 2015 to 83.3% in 2016. In 2017, a marked decrease to 41.7% was observed. In 2018, the proportion was 53.2%. The 2019 year-to-date numbers show that 62.9% of the reported cases involved newborns, 25.7% children, 8.6% fetuses (with alterations and at risk), and 2.9% stillbirths[4].

There is no specific treatment for microcephaly. Care requires the involvement of a multidisciplinary team, including a neuropediatrician and other specialists as needed[5]. Motor physiotherapy for global stimulation, speech therapy, occupational therapy, and other complementary therapies are of paramount importance to mitigate global developmental delay.

ZIKV has been isolated in blood, urine, and semen. Viral particles have been identified in breast milk, but no evidence of virus transmission or replication was found in the latter [6] [7]. This is why breastfeeding is not contraindicated for women with ZIKV infection[2,8].

In CZVS, the pair mother-child might present characteristics that affect breastfeeding, such as psychological issues from the mother and anatomic or functional barriers related to the neurological alterations present in the child[9].

Many studies have discussed CZVS, and most looked into disease transmission, incidence, history of pregnancy, and the delivery and birth of children with microcephaly. Records showing the growth and development of children with microcephaly exposed to ZIKV during pregnancy are still scarce, and little information is available on the prevalence of breastfeeding and its characteristics in this population[10].

This study looked into the breastfeeding data of children with microcephaly associated with CZVS in order to increase the scientific knowledge on the subject and potentially improve the quality of care provided to children with microcephaly.

OBJECTIVE

This study aimed to describe the sociodemographic, biological, and breastfeeding-related characteristics of children with CZVS seen at a referral service.

METHOD

This descriptive cross-sectional quantitative study was conducted at the microcephaly ward of the Epidemiological Surveillance Department (VIEP) of the Secretary of Health of Feira de Santana (SMSFS). The ward was opened in 2015 to provide care to children with suspected or confirmed exposure to ZIKV during pregnancy.

In Feira de Santana, Bahia, 58 cases of children with microcephaly with suspected or confirmed exposure to ZIKV during pregnancy were reported from 2015 and 2019[4]. In September of 2019, 32 patients exposed to ZIKV during pregnancy were registered with the VIEP at SMSFS for investigation and follow-up. These children are seen at a specialized ward opened in 2015 by the VIEP at SMSFS. The population included in the study comprises all children with microcephaly seen at the aforementioned ward.

Inclusion criteria: children with microcephaly, with a confirmed or likely etiology described as vertical ZIKV transmission, i.e., history of exanthematous disease during pregnancy and negative serology for STORCH, with or without positive serology for ZIKV; mothers aged 18 years and older at the time of the interviews.

Exclusion criteria: children with microcephaly of a different etiology; mothers aged less than 18 years at the time of data collection; children who had not attended sessions at the referral center for at least two years.

Fourteen patients met the inclusion criteria and were selected for interviews and chart reviews. None of the children included in the study population died during the course of the study.

Data were collected from September to November of 2019. Data from the charts were extracted based on a form designed to inform the study's variables of interest (Appendix A) and a structured questionnaire was used in the interviews with the mothers of the included children (Appendix B).

The variables of interest captured from the patients' medical charts were divided into the following categories: sociodemographic, biological, clinical, and breastfeeding-related. Variables belonging to the breastfeeding-related category were extracted from patient medical charts and interviews with the mothers.

Software program *Statistical Package for Social Sciences* (SPSS) version 25.0 for Windows 10 was used in statistical analysis and in the production of graphs and tables. Collected data were expressed as measures of central tendency (mean, median, proportions) and scatter (standard deviation – SD).

The study design was approved by the Research Ethics Committee of the State University of Feira de Santana (UEFS) and granted certificate no. 3.578.404. VIEP/SMSFS granted the authors access to medical charts, patients, and mothers for the interviews. The informed consent form was read and explained to the patients and they were given the option not to join the study if they so preferred. The identity of the individuals involved in the study (patients, mothers, and medical staff that made entries to patient charts) was treated as confidential.

RESULTS

The study included 14 children born between August 6, 2015 and January 26, 2018. The mean age of the mothers at the time of the interviews was 31 years (median: 30 years; mode: 29 years; range: 18-41 years). The mean age of the children included in the study at the time of data collection was 43 months (20-50). Eight children (57.1%) were males and six (42.9%) were females. All children were born in Feira de Santana, a condition to be seen at the SMSFS clinics; none of the children came from rural areas.

The mother was the only person present in the medical appointments of 71.4% (n=10) of the children included in the study; both parents accompanied the other children (n=4). Declared household income ranged between two and three minimum wages in 35.7% of the families and between one and two minimum wages in 28.6% of the families. One family (7.15%) had a household income lower than one minimum wage and one family (7.15%) had a household income greater than three minimum wages. Other sociodemographic data are shown in Table 1.

Prenatal diagnosis of microcephaly was noted in only four (28.6%) of the fourteen children: one (7.2%) in the first trimester and three (21.4%) in the last trimester. The diagnostic method, in all four cases, was obstetric non-morphology ultrasound scan.

In order to rule out other etiologies of microcephaly, data from maternal prenatal serology tests looking at vertically transmitted infections, namely syphilis, toxoplasmosis, rubella, cytomegalovirus, and herpes (STORCH) and non-infectious teratogenic factors (drinking and smoking) were analyzed. Only one mother had reactive IgM for cytomegalovirus, but her child's serology tests were negative. None of the other 13 mothers had positive IgM or other positive tests for STORCH. Only two mothers (14.3%) had positive serology for ZIKV: one had reactive IgM and IgG, and another had IgM and IgG of undetermined significance. In terms of non-infectious factors, all mothers claimed that they did not drink or smoke during pregnancy.

Table 2 describes the biological variables. In the study population, most children (n=8; 57.1%) were born from vaginal deliveries and six (42.9%) from Cesarean sections. The indications reported for performing a Cesarean section were microcephaly (n=3), ventriculomegaly (n=1), anhydramnios (n=1), and failure to induce vaginal delivery (n=1).

On average, the newborns weighed 2874g at birth (median 2664.5g; SD 627g) and their mean length was 48.14cm (median 47.5cm; SD 3.9cm). HC at birth ranged from 25 to 34cm (mean: 29.85cm; median: 29.00cm; SD: 2.41cm). Differently from what is currently proposed by the Ministry of Health, only one of the children had their HC measured within 24 to 48 hours of birth. Anthropometric data at birth are shown in Table 3.

Diagnosis of CZVS was based on clinical criteria (maternal history of febrile or non-febrile exanthematous disease during pregnancy), since only one child had reactive IgM and IgG for ZIKV. All children in the study population had negative tests for STORCH.

Thirteen of 14 children had the following imaging scans done within the first year of birth: transfontanellar ultrasound (n=9), skull CT (n=3), and skull X-ray (n=1). The main findings were: microcalcifications (n= 11), ventriculomegaly (n=9), and enlarged posterior fossa (n=2). No records of cerebellar hypoplasia, hydrocephalus, or lissencephaly were found. Clinical and radiological alterations associated with microcephaly were found in most of the children; they are described in Table 4.

Table 1. Sociodemographic variables.

Variables	N (%)
Sex	
Male	8 (57.1%)
Female	6 (42.9%)
Residence	
Urban area	14 (100%)
Rural area	0 (0%)
Guardian	
Mother	10 (71.4%)
Both parents	4 (28.6%)
Household income	
<1 minimum wage	1 (7.15%)
1 to 2 minimum wages	4 (28.6%)
2 to 3 minimum wages	5 (35.70%)
> 3 minimum wages	1 (7.15%)
Not reported	3 (21.4%)
Schooling - Mother	
Incomplete Elementary Education	1 (7.15%)
Incomplete High School	1 (7.15%)
Complete High School	4 (28.56%)
Incomplete Vocational School	1 (7.15%)
Complete Vocational School	1 (7.15%)
Not reported	6 (42.84%)

Only one (7.1%) of the 14 children included in the study was not breastfed. The declared reason was a prolonged stay at the Neonatal Intensive Care Unit (NICU) and absence

of skin-to-skin contact within the first days after birth. Three (21.4%) newborns were breastfed within one hour of birth; nine (64.3%) within one and 24 hours of birth; and one (7.1%) after 24 hours of birth.

Eight were only breastfed, and four of them were nursed for six months. Five were predominantly breastfed, and four of them were nursed for six months. Four (28.6%) of the 13 children were breastfed ad libitum.

Ten children (71.4%) were given only breast milk and three (21.4%) of them were also fed with donor human milk from a milk bank. None of the mothers engaged in cross feeding. Breast milk was given via breastfeeding (n=13), bottles (n=4), transition cups (n=2), spoons (n=1), or syringes (n=1). Thirteen children were given formulas, four before six months of age and seven only after six months of age. Eight mothers reported use of thickeners, with three introducing thickeners to infants aged less than six months.

Mean time of breastfeeding was 14.67 months (04-37). Among the factors cited as obstacles to nursing, two mothers (14.2%) said that their infants could not suck much milk from their breasts. Eleven infants could not swallow saliva well and ten choked when they were fed. One infant (7.1%) was allergic to cow's milk protein, an element described as an obstacle to breastfeeding given the impossibility of changing the mother's diet. Two participants (14.2%) reported experiencing complications during nursing; one described having trouble producing enough milk (n=1; 7.1%) and the other suffered with breast engorgement and mastitis (n=1; 7.1%).

The introduction of complementary foods to the study population took place in two stages, first with non-milk liquids and then pureed foods. All mothers said that they attempted to introduce solid foods, but all infants rejected it. Complementary foods are served after they are processed in a blender or mashed to a puree with a fork.

Twelve mothers had weaned their infants at the time of data collection. Three (21.4%) weaned their infants gradually and nine (64.3%) weaned them abruptly. The reasons given for weaning were "my breasts went dry" (n=2), "the child refused to take my breast" (n=1), "the child was biting my breasts" (n=2), the mother wanted to stop breastfeeding (n=6), and allergy to cow's milk protein (n=1). Considering the factors

Table 2. Biological variables.

Variable	N (%)
Parity	
One child	4 (28.6%)
Two children	5 (35.7%)
Three or more children	5 (35.7%)
Planned Pregnancy	
Yes	4 (28.6%)
No	10 (71.4%)
Desired Pregnancy	
Yes	14 (100%)
No	0 (0%)
Attendance to prenatal appointments	
Yes	14 (100%)
No	0 (0%)
Number of attended prenatal appointments	
2	3 (21.4%)
5	3 (21.4%)
7	3 (21.4%)
8 or more	3 (21.4%)
Not reported	2 (14.3%)
Start of prenatal care	
1st trimester	7 (50%)
2nd trimester	2 (14.3%)
3rd trimester	3 (21.4%)
Not reported	2 (14.3%)
Gestational age at delivery	
Preterm	3 (21.4%)
Full term	11 (78.6%)
Type of delivery	
Vaginal	8 (57.1%)
Cesarean section	6 (42.9%)
Condition at birth	
Vigorous	9 (64.3%)
Depressed	5 (35.7%)

Table 3. Anthropometric measures at birth per patient.

	Birth weight (g)	Z-score / Percentile	Birth length (cm)	Z-score / Percentile	HC within 24h of birth *(cm)*	Z-score / Percentile
01	2554	-0.9 / 17.65	43	-2.8 / 0.20	29.00	-3 / 0.03
02	1890	-2.7 / 0.26	42	-3.2 / 0.06	30.00	-2.7 / 0.28
03	2225	-2.0 / 1.79	47	-0.9 / 17.65	29.00	-3.4 / 0.03
04	2775	-0.7 / 22.27	49	+0.2 / 59.49	25.00	-5.4 / 0.00
05	3108	+1.4 / 92.66	46	0.0 / 49.46	29.00	-2.2 / 1.14
06	2550	-1.3 / 9.14	47	-0.9 / 17.65	32.00	-1.24 / 10.71
07	3700	+1.4 / 92.93	52	+1.8 / 97.02	34.00	+0.4 / 67.03
08	2875	-0.5 / 30.63	48	-0.3 / 36.35	29.00	-3.4 / 0.03
09	3870	+2.8 / 99.78	58	+4.4 / 100.00	34.00	+1.4 / 93.02
10	3150	+0.4 / 67.14	46	-1.2 / 11.30	29.00	-3.2 / 0.06
11	2504	-1.44 / 7.42	49	+0.2 / 59.49	29.00	-3.4 / 0.03
12	2486	-1.3 / 9.16	48	0.0 / 49.78	28.00	-3.8 / 0.01
13	2544	+0.4 / 67.05	47	+0.8 / 80.02	29.00	-2.0 / 1.84
14	4018	+2.0 / 98.07	52	+1.8 / 97.02	32.00	-1.2 / 10.71

Table 4. Clinical and radiological alterations associated with microcephaly.

Clinical/radiological alterations	N (%)
Microcalcifications	
Yes	11 (78.6%)
No	2 (14.3%)
Not reported	1 (7.1%)
Enlarged posterior fossa	
Yes	2 (14.3%)
No	6 (42.9%)
Not reported	6 (42.9%)
Arthrogryposis	
Yes	10 (71.4%)
No	4 (28.6%)
Cardiac malformations	
Yes	2 (14.3%)
Membrane aneurysm	1 (7.15%)
Patent foramen ovale	1 (7.15%)
No	12 (85.7%)
Respiratory alterations	
Yes	3 (21.35%)
Recurrent respiratory infection	2 (14.3%)
Turbinate and adenoid hypertrophy	1 (7.15%)
No	11 (78.65%)
Seizures	
Yes	7 (50.0%)
No	7 (50.0%)
GERD	
Yes	4 (28.6%)
No	10 (71.4%)
Visual disorders	
Yes	7 (50.0%)
No	7 (50.0%)
Auditory disorders (confirmed by BAEP)	
Yes	7 (50.0%)
No	7 (50.0%)

related to weaning, artificial nipples (pacifiers, n=14; bottle nipples, n=13) had been introduced to all included children; in half of the cases, infants were introduced to artificial nipples while in the maternity hospital.

The weight charts (z-scores) of the children before and after weaning were compared (Table 5). The weight z-scores decreased after weaning in 58% of the infants (n=7); four kept their weight within the same z-score range; and two infants increased their z-scores after weaning.

DISCUSSION

This study included children aged one to four years, born between August 6, 2015 and January 26, 2018, a period that comprehends epidemiological weeks 31/2015 to 04/2018. Starting on epidemiological week 12/2015, an increase was observed in the number of live births with microcephaly and/or other congenital disorders[2]. The Ministry of Health stipulated that a noticeable increase in cases of CZVS started occurring on epidemiological week 01/2015, which supports the consideration of congenital ZIKV infection as the cause of microcephaly in the study population.

All included mothers were literate. Spending more years in school and having an income between one and three minimum wages, as found in another study, correlate with longer breastfeeding time[11].

Prenatal care is a key factor in the identification of risk factors for the mother-infant duo and a fundamental element to successful breastfeeding. Although some mothers claimed they were not given advice on breastfeeding, all attended prenatal care appointments.

Newborn serology test results were analyzed the same way as the serology of the mothers. Another study[12] included children (n=5) tested positive for syphilis, cytomegalovirus, and herpes virus, claiming that one cannot link these infections to microcephaly, since they might have been transmitted during delivery or breastfeeding. In our study, however, in order to rule out other potential etiologies, we decided to exclude infants with reactive IgM or positive test results for STORCH.

HC measurement is inversely correlated with severity of microcephaly. The mean HC at birth was 29.85 (+-2.41) cm, a number that corresponds to a z-score of -3 (severe microcephaly) for a newborn of 38 weeks of gestational age. A higher prevalence of severe microcephaly (mean values) in children with CZVS was also reported in other studies[12-14].

In our study, 13 of 14 children (92.9%) were breastfed. The only child that was not nursed had a craniofacial malformation (a small lower jaw) and a history of staying at the NICU. There is a described association between staying at a NICU and not breastfeeding[15], and the occurrence of craniofacial malformations associated with microcephaly may affect breastfeeding[16].

The median time until weaning and the time feeding breast milk alone were greater than the numbers reported by other authors[17]. Introduction of other foods has been associated with lower frequency of nursing[18]. Since all children with microcephaly included in the study had trouble accepting other foods, this may have been a factor in the increased prevalence of breastfeeding seen in the group.

Two mothers (14.2%) reported difficulty nursing, with one citing low breast milk production. This proportion is low when compared to the results described by Santos et.

Table 5. Weight scores before and after weaning.

Patient	Weight score before weaning	Weight score after weaning
01	Not breastfed	Not breastfed
02	Mostly equal to or below a z-score of -3	Mostly between a z-score of -3 and -2
03	Mostly between a z-score of -2 and -1	Mostly between a z-score of -3 and -2
04	Mostly between a z-score of -2 and -1	Mostly between a z-score of -2 and -1
05	Mostly between a z-score of -1 and 0	Mostly between a z-score of 0 and +1
06	Mostly between a z-score of -2 and -3	Mostly equal to or below a z-score of -3
07	Mostly between a z-score of -1 and 0	Mostly between a z-score of -3 and -2
08	Mostly between a z-score of -2 and -1	Mostly between a z-score of -2 and -1
09	Not weaned	Not weaned
10	Mostly between a z-score of -2 and -1	Mostly between a z-score of -2 and -1
11	Mostly between a z-score of -1 and 0	Mostly between a z-score of -2 and -1
12	Mostly equal to or below a z-score of -3	Mostly equal to or below a z-score of -3
13	Mostly between a z-score of -2 and -1	Mostly equal to or below a z-score of -3
14	Mostly between a z-score of 0 and +1	Mostly between a z-score -1 and 0

Al. (2019), in which more than half of the mothers (53.6%) reported difficulty nursing children with microcephaly, with low breast milk production coming up as the predominant complaint. Regular visits to a pediatrician and multidisciplinary follow-up, both elements in the care provided to the children included in our study, may explain the fewer cases of mothers experiencing difficulty breastfeeding seen in our population (children not followed by a pediatrician were excluded from the study).

CONCLUSION

This study described the sociodemographic profiles and the breastfeeding characteristics of 14 children with microcephaly by CZVS seen at a referral center in the city of Feira de Santana, Bahia, Brazil. The children were diagnosed based on clinical and radiological criteria, and half of the study population was born with severe microcephaly.

Prevalence of breastfeeding among children with CZVS has not been widely reported. Our study found a prevalence of 92.9% and a mean time of breastfeeding of less than two years. Some factors may be tied to the high prevalence of breastfeeding seen in our group: number of years the mothers spent in school, access to prenatal care, having a vaginal delivery, having a full term birth, and infants having trouble eating other foods. Nevertheless, most of the children had been introduced to artificial nipples (pacifiers, bottle nipples) and were not nursed within one hour of birth, contrary to the recommendations of the World Health Organization, the Brazilian Ministry of Health, and the Brazilian Society of Pediatrics.

LIMITATIONS

The limitations of the present study include the low number of participants and the lack of serology tests for congenital ZIKV infection. Although all included mothers were diagnosed with ZIKV infection and despite the alterations seen in the imaging scans of the children, other infectious diseases such as measles, rubella, parvovirus, dengue, exanthem subitum are known for causing exanthems; of these, dengue and ZIKV were epidemic conditions in the region at the time of the study.

The absence of a control group against which to compare results was another limiting factor that allowed us to deliver solely a descriptive analysis of the observed events. Further studies are needed to support the results described herein and enhance the knowledge about this subject in similar populations.

REFERENCES

1. Ministério da Saúde (BR), Secretaria de Atenção à Saúde, Política Nacional de Humanização da Atenção e Gestão do SUS. Orientações integradas de vigilância e atenção à saúde no âmbito da Emergência de Saúde Pública de Importância Nacional. Brasília: Ministério da Saúde; 2017.
2. Ministério da Saúde (BR), Secretaria de Atenção à Saúde, Política Nacional de Humanização da Atenção e Gestão do SUS. Protocolo de atenção à saúde e resposta à ocorrência de microcefalia relacionada à infecção pelo vírus zika. Brasília: Ministério da Saúde; 2016.
3. Marinho F, Araújo VEM, Porto DL, Ferreira HL, Coelho MRS, Lecca RCR, et al. Microcefalia no Brasil: prevalência e caracterização dos casos a partir do Sistema de Informações sobre Nascidos Vivos (Sinasc), 2000-2015. Epidemiol Serv Saúde. 2016;25(4):701-12.
4. Governo do Estado da Bahia (BR), Secretaria da Saúde. Síndrome congênita associada à infecção pelo Zika vírus e outras etiologias infecciosas, Boletim Epidemiológico, Bahia. 2019 Ago;(2).
5. Ministério da Saúde (BR), Secretaria de Atenção à Saúde. Guia sobre a estimulação precoce na Atenção Básica: contribuições para abordagem do desenvolvimento neuropsicomotor pelas equipes de Atenção Básica, Saúde da Família e Núcleo de Apoio à Saúde da Família (Nasf), no contexto da microcefalia. Brasília: Ministério da Saúde; 2016.
6. Blohm GM, Lednicky JA, Márquez M, White SK, Loeb JC, Pacheco CA, et al. Evidence for Mother-to-Child Transmission of Zika Virus Through Breast Milk. Clin Infect Dis. 2018 Mar;66(7):1120-1.

7. Colt S, Garcia-Casal MN, Peña-Rosas JP, et. al. Transmission of Zika virus through breast milk and other breastfeeding-related bodily fluids: A systematic review. PLoS Negl Trop Dis. 2017 Apr;11(4):e0005528.
8. World Health Organization. Guideline: infant feeding in areas of Zika virus transmission. Geneva: WHO; 2016 [access in 2019 Mar 20]:42. Available from: https://apps.who.int/iris/bitstream/handle/10665/208875/9789241549660_eng.pdf;jsessionid=B4E249CA6113DCA6867F58EFA94531F2?sequence=1.
9. Carvalho CMS, Pereira AAM, Abreu GF, Paz LJM, Pires LC, Almeida CAPL, et. al. Sentimentos de mães de lactentes com microcefalia: um estudo qualitativo. Biosci J. 2018 Set/Out;34(5);1422-31.
10. Prata-Barbosa A, Martins MM, Guastavino AB, Cunha AJLA. Repercussões da infecção por Zika sobre o crescimento. J Pediatr (Rio J). 2019;95(1);S30-S41.
11. Almeida IMLM, Ramos CV, Rodrigues DC, Sousa AC, Nascimento MLCAPC, Silva MVB, et al. Clinical and epidemiological aspects of microcephaly in the state of Piauí, northeastern Brazil, 2015-2016. J Pediatr (Rio J). 2019 Aug;95(4):466-74.
12. Vargas A, Saad E, Dimech GS, Santos RH, Sivini MAVC, Albuquerque LC, et al. Características dos primeiros casos de microcefalia possivelmente relacionados ao vírus Zika notificados na Região Metropolitana de Recife, Pernambuco. Epidemiol Serv Saúde. 2016 Dez; 25(4):691-700.
13. Avelino MOA, Ferraz PCS. Análise do desenvolvimento neuropsicomotor em crianças com síndrome pós-zika vírus: um estudo transversal. Rev Pesq Fisio. 2018;8(2):147-54.
14. Abreu TT, Novais MCM, Guimarães ICB. Crianças com microcefalia associada à infecção congênita pelo vírus zika: características clínicas e epidemiológicas num hospital terciário. Rev Ciênc Méd Biol. 2016 Dez;15(3):426-33.
15. Frota FDS, Gavião MBD, Aguiar SMHCA. Fatores associados à amamentação em crianças com deficiência e fenotipicamente normais. Rev CEFAC [Internet]. 2015 Fev [access in 2019 Mar 20];17(1):201-8. Available from: https://www.scielo.br/j/rcefac/a/nGvBFqRc8tDgpscL6ybv33y/?lang=pt.
16. Gusmão TPL. Prevalência das alterações orais e craniofaciais em crianças portadoras da síndrome congênita do zika vírus. [Tese]. Recife: Universidade Federal de Pernambuco: 2017.
17. Santos SFM, Soares FVM, Abranches AD, Costa ACC, Moreira MEL, Fonseca VM. Infants with microcephaly due to ZIKA virus exposure: nutritional status and food practices. Nutr J. 2019;18(1):4.
18. Ministério da Saúde (BR), Secretaria de Atenção à Saúde, Política Nacional de Humanização da Atenção e Gestão do SUS. Guia alimentar para crianças brasileiras menores de 2 anos. Brasília: Ministério da Saúde; 2017.

APPENDIX A - DATA COLLECTION INSTRUMENT IN RECORDS

1. Name _____
2. Date of birth _____
3. Mother's name _____
4. Companion to appointments: (0)W/ I; (1) Mother; (2)Father; (3) Mother and Father; (4)Other family member; (5)No relation.
5. Gender: (1)Female (2)Male
6. Origin : (0)S/I; (1)Urban area; (2) Rural area;
7. Family Income : (0)S/I; (1) < 1 minimum wage (2) 1 to 2 minimum wages (3) 2 to 3 minimum wages (4) > 3 minimum wages
8. Maternal education level: (0)S/I; (1)Illiteracy; (2) Incomplete elementary school; (3)Complete elementary school; (4) Incomplete high school; (5)Complete high school; (6) Incomplete higher education; (7) Complete superior; (8) Incomplete Technical Education; (9) Complete Technical Education.
9. Offspring: (0)S/ I; (1)One son; (2)Two children; (3)3 or more children.
10. Attended prenatal care : (0)S/I; (1)Yes; (2)No.
11. Beginning of prenatal care : (0)S/I; (1) 1st trimester; (2)2nd quarter; (3)3rd trimester.
12. Number of prenatal appointments : (0)S/I; (1)1; (2)2; (3)3; (4)4; (5)5; (6)6; (7)7; (8)8 or more.
13. Diagnosis of intrauterine microcephaly: (0)S/ I; (1)Yes; (2)No.
14. GI at diagnosis: (0)Y/I or not applicable; (1) 1st trimester; (2)2nd trimester; (3)3rd trimester.
15. Diagnostic method: (0)W/I or not applicable; (1) Obstetric USG ; (2) morphological USG; (3) Amnio / cordocentesis ; (4)Other
16. Gestational age at delivery: (0)S/A; (1) Pre term; (2)Forward; (3)Post term.
17. Type of delivery: (0)W/ I; (1) Vaginal; (2) Cesarean section.
18. If cesarean, Indication: _____
19. Vitality at birth: (0)W/ I; (1)Vigorous; (2)Depressed.
20. Birth weight: _____ g
21. Length at birth: _____ cm
22. Head circumference (first 24 hours): ____ cm
23. PC cm (with 48 hours): _____ cm
24. Zika IgM (0)S/I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
25. Zika IgG (0)S/I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
26. Toxoplasmosis IgM 0)S/I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
27. Toxo IgG (0)S/I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
28. Cytomegalovirus IgM : (0)S/I; (1)Reagent ; (2)N/Reagent; (3)Undetermined.
29. CMV IgG(0)S/I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
30. Rubella IgM (0)S/I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
31. Rubella IgG (0)S/I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
32. VDRL (0)S/I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
33. FTA HBS : (0)S/I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
34. Herpes Virus 1 and 2 IgM : (0)S/I; (1)Reagent ; (2)N/Reagent; (3)Undetermined.
35. Herpes Virus 1 and 2 IgG: (0)S/I; (1)Reagent ; (2)N/Reagent; (3)Undetermined.
36. Did the child undergo imaging exams in the first year of life? (0)W/ I; (1)Yes; (2)No.
37. Which exam: (0)W/ I; (1)USG Transfontanela ; (2)cranial CT; (3) skull X-ray; (4)RM; (5) Other.
38. Microcephaly (0)S/I; (1)Yes; (2)No.
39. Microcalcifications (0)S/I; (1)Yes; (2)No.
40. Ventricular Dilation (0)S/I; (1)Yes; (2)No.
41. Cerebellar hypoplasia (0)S/I; (1)Yes; (2)No.
42. Hypoplasia of the Cerebellar Vermis (0)S/I; (1)Yes; (2)No.
43. Posterior Fossa Enlargement > 10 : (0)S/I; (1)Yes; (2)No.
44. Agenesis/Hypoplasia of the corpus callosum : (0)S/I; (1)Yes; (2)No.
45. Lissencephaly : (0)S/I; (1)Yes; (2) No
46. PCR for Zika Virus: (0)S/ I; (1)Detectable; (2)Not detectable.
47. Zika Virus IgM : (0)S/ I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
48. Zika IgG : (0)S/I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
49. Toxoplasmosis IgM : (0)S/I; (1)Reagent ; (2)N/Reagent; (3) Undetermined
50. Toxo IgG : (0)S/I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
51. Cytomegalovirus IgM : (0)S/I; (1)Reagent ; (2)N/Reagent; (3)Undetermined.
52. Cytomegalovirus IgG: (0)S/I; (1)Reagent ; (2)N/Reagent; (3)Undetermined.

53. Rubella IgM : (0)S/ I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
54. Rubella IgG : (0)S/I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
55. VDRL: (0)S/ I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
56. FTA HBS: (0)S/ I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
57. Herpes Virus 1 and 2 IgM : (0)S/ I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
58. Herpes Virus 1 and 2 IgG: (0)S/ I; (1) Reagent; (2)N/Reagent; (3)Undetermined.
59. Diagnosis of Microcephaly: (0)S/ I; (1)Intrauterine; (2)Post natal.
60. Malformations associated with Microcephaly : (0)S/I; (1)Yes; (2)No.
61. Artogripose : (0)W/ I; (1)Yes; (2)No.
62. Cardiac : (0)S/I; (1)Yes; (2)No.

62.1. If so, which one(s): _____

63. Respiratory : (0)S/I; (1)Yes; (2)No.

63.1 If yes, which one(s): _____

64. Hydrocephalus: (0)W/ I; (1)Yes; (2)No.
65. Visual Changes : (0)S/I; (1)Yes; (2)No.
66. Hearing disorders (confirmed with BERA) : (0)S/I; (1)Yes; (2)No.
67. Convulsions: (0)S/I; (1)Yes; (2)No.
68. GERD: (0)W/ I; (1)Yes; (2)No.
69. Other: _____
70. Sucks well: (0)W/ I; (1)Yes; (2)No.
71. Swallow saliva? (0)W/ I; (1)Yes; (2)No.
72. Do you choke when eating? (0)W/ I; (1)Yes; (2)No.
73. When did the baby breastfeed for the first time? (0) W/ I; (1) First hour of life (2) First 24 hours (3) After first 24 hours (4) Never breastfed
74. Did you receive an artificial teat in the maternity ward? (0)W/ I; (1)Yes; (2)No.
75. Exclusively breastfed (0)W/I; (1)Yes; (2) Predominant Breastfeeding; (3) No.
76. Duration AME/AMP _____
77. Supply of breast milk (0)S/I; (1) Yes, breast milk; (2) Yes, milk from the Milk Bank; (3) Yes, cross-breastfeeding; (4)No.
78. Mother's breast: (0)W/ I; (1)Yes; (2)No.
79. Bottle: (0)W/ I; (1)Yes; (2)No.
80. Transition Cup: (0)W/ I; (1)Yes; (2)No.
81. Spoon : (0)S/I; (1)Yes; (2)No.
82. Syringe: (0)W/ I; (1)Yes; (2)No.
83. Beginning of food introduction: _____ months
84. Use of formulas before 6 months (0)W/I; (1)Yes; (2)No.
85. Use of formulas after 6 months (0)S/I; (1)Yes; (2)No.
86. Use of flours/ thickeners before 6 months (0)S/I; (1)Yes; (2)No.
87. Use of flours/ thickeners after 6 months (0)W/I; (1)Yes; (2)No.
88. Use of animal milk before 6 months (0)W/I; (1)Yes; (2)No.
89. Use of animal milk after 6 months (0)W/I; (1)Yes; (2)No.
90. Weaning: (0)W/ I; (1) Before 6 months; (2) Between 6 months and 1 year; (3) between 1year and 1year6m; (4)between 2 and 3 years; (5) after 3 years; (6) Not applicable.
91. Weaning mode: (0)W/ I; (1) Abrupt; (2)Gradual; (3) Not applicable.
92. Use of pacifiers: (0)Y/ I; (1)Yes; (2)No.
93. Use of bottle: (0)W/ I; (1)Yes; (2)No.
94. Low milk production (0)S/I; (1)Yes; (2)No.
95. Hyperlactation (0)S/I; (1)Yes; (2)No.
96. Mastitis (0)S/I; (1)Yes; (2)No.
97. Use of medication incompatible with breastfeeding (0)S/I; (1)Yes; (2)No.
98. Maternal desire to wean (0)S/I; (1)Yes; (2)No.
99. Weight curve during breastfeeding: (0) No information (1) Most below -3z score ; (2) Majority between -3z and -2z scores ; (3) Majority between -2z and -z scores ; (4) Majority between scores -z and 0; (5) Most between scores 0 and +z; (6) Majority between scores +z and +2z; (7) Majority between +2z and +3z scores ; (8) Majority above +3z score ; (9) Not applicable.
100. Weight Curve after weaning: 0) No information (1) Majority below score -3z; (2) Majority between -3z and -2z scores ; (3) Majority between -2z and -z scores ; (4) Majority between scores -z and 0; (5) Most between scores 0 and +z; (6) Majority between scores +z and +2z; (7) Majority between +2z and +3z scores ; (8) Majority above +3z score ; (9) Not applicable.

APPENDIX B - DATA COLLECTION INSTRUMENT IN INTERVIEW

Block 1 - Identification

1. Name
2. Date of birth
3. Mother's name
4. Mother's age
5. Gender of the child

Block 2 - Pregnancy, Delivery and Birth

6. G _ _ P ___ A ___
7. Planned Pregnancy? ( ) Yes ( ) No
8. Desired Pregnancy? ( ) Yes ( ) No
9. Diagnosis of microcephaly during prenatal care ? ( ) Yes ( ) No
10. Did you drink alcohol during pregnancy? ( ) Yes ( ) No
11. Smoking during pregnancy? ( ) Yes ( ) No
12. Type of Delivery ( ) Natural ( ) Cesarean

12.1 If cesarean section, indication: _____

13. How long after giving birth did you breastfeed for the first time? ( ) ____ ( ) Did not breastfeed
14. Were you advised to breastfeed during prenatal care ? ( ) Yes ( ) No/Not applicable
15. Were you advised to breastfeed in the maternity ward? ( ) Yes ( ) No/Not applicable

Block 3 – Breastfeeding

16. Did you breastfeed? If not, for what reason?
17. How long did you breastfeed the child?

17.1 Made free demand: (1)Yes ; (2)No.

17.2 How long exclusively?

17.3 How long with water, teas?

17.4 How long with other types of milk?

18. Which ways to offer breast milk?

( ) Mother's breast ( ) Baby bottle ( ) Transition cup ( ) Measuring spoon
( ) Syringe ( ) Other: _____

19. Did the child receive milk from another mother? ( ) Yes ( ) No
20. If yes, in what way? ( ) Milk bank ( ) Home milking and pasteurization ( ) Cross-breastfeeding
21. Did the child receive another type of milk? ( ) Yes ( ) No
22. If yes, which one? ( ) Formula ( ) Pure cow's milk ( ) Cow's milk in preparation ( ) Vegetable milk ( ) Other:
23. Did you use artificial teats (pacifier, bottle)? ( ) Y ( ) N ( ) No information
24. Did the baby have difficulty sucking at the breast?
25. The mother had any of the following conditions:

( ) Puerperal mastitis ( ) Breast engorgement ( ) Galactocele ( ) Hyperlactation
( ) Low milk production ( ) Nipple trauma ( ) Breast candidiasis

26. During the breastfeeding period, was the baby's weight gain satisfactory?
27. Was weaning carried out?

27.1 In what way? ( ) Gradual ( ) Abrupt ( ) S/I

27.2 Reason: _____

27.3 Period: _____

28. When was food introduced?

28.1 Liquids:

28.2 Pasty:

28.3 Solids:

29. After introducing food, was the weight gain satisfactory?

Block 3 – Clinical Variables

30. Do you do multidisciplinary follow-up? ( ) Yes ( ) No ( ) Y/I

30.1 If yes: ( ) Pediatrician ( ) Pediatric Neurologist ( ) Physiotherapist ( ) Speech therapist ( ) Psychologist ( ) Other specialist. Which: ____