





Effect of lingual frenotomy on the breastfeeding improvement

Camila Fontanella Possamai¹, Antônio Augusto Schäfer¹ , Micaela Rabelo Quadra^{1*} , Carla Damasio Martins¹ , Fernanda de Oliveira Meller¹ 

¹ Postgraduated Program in Public Health, University of Southern Santa Catarina. Criciúma, Santa Catarina, Brazil.

Corresponding author:

Fernanda de Oliveira Meller
Postgraduated Program in Public Health, University of Southern Santa Catarina.
Avenida Universitária, 1105, CEP 88806-000, Criciúma, Santa Catarina, Brasil
Telefone: +55 48 3431 2609
E-mail: fernandameller@unesoc.net

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Aim: To evaluate breastfeeding in babies up to six months of age before and after frenotomy surgery in a reference hospital in a city from Santa Catarina state. **Methods:** An observational quality improvement study, carried out with babies up to six months of age undergoing frenotomy and their mothers in a reference hospital in southern Santa Catarina state. A questionnaire was applied to the mothers in two moments (before and after the surgery), with information regarding breastfeeding, sociodemographic, anthropometric and behavioral characteristics of them and of the babies. Descriptive analyzes were performed and the association between breastfeeding and the independent variables was assessed through Pearson's chi-square and Fisher's exact tests, using a 5% significance level. **Results:** A total of 74 children were studied, with 48 of them returning after surgery. 83.8% were breastfed before surgery and 64.9% after surgery. Before surgery, 58.1% of children effectively took the breast at once. After surgery, this prevalence was 83.3% ($p=0.015$). Before surgery, 75.9% of the mothers reported not feeling pain, while, after surgery, almost all of them (95.8%) reported this ($p=0.004$). Most mothers reported improvement in grip (83.3%), increase in the duration of breastfeeding (69.0%), improvement of baby's breathing (75.0%), and an increase in the frequency of breastfeeding (51.7%). **Conclusions:** There was a decrease in the prevalence of breastfeeding after frenotomy. However, there was an improvement in the babies' grip and breathing and a reduction in the mothers' pain when breastfeeding. It is emphasized the need to implement multidisciplinary actions in both primary and hospital care to assist mothers in order to prolong the duration of exclusive breastfeeding.

Keywords: Breast feeding. Ankyloglossia. Lingual frenum. Infant.

Introduction

Exclusive breastfeeding, which corresponds to feeding the babies only with breast milk, without the introduction of other liquids or foods such as water, teas, juice, or porridge, is indicated until the age of six months. After this age, complementary feeding should be initiated to provide enough energy, macro and micronutrients. In a complementary way, continuity of breastfeeding is indicated, at least, until the age of two¹⁻³.

However, for breastfeeding to happen effectively, it is necessary that several factors are fully functioning. The child needs to respond to oral stimuli, completely seal the lips and perform the correct mobility of the tongue⁴. In addition, correct jaw movements are essential for successful breastfeeding⁵. The limitation of lingual mobility due congenital malformation - more specifically the attachment of the frenulum at the tongue tip, limiting its function - defines the ankyloglossia. As a result, children with ankyloglossia can present impairments in speech and, mainly, in breastfeeding^{6,7}.

Unfortunately, a unique classification for this condition does not yet exist. The classification of Kotlow (1999)⁸ is based on anatomical parameters, in which is measured the length of free tongue, classifying the ankyloglossia as mild (12-16 mm), moderate (8-11 mm), severe (3-7 mm) and complete (<3 mm). Another classification was proposed by Coryllos et al. (2004)⁹, in which anatomical characteristics are also analyzed, but are correspondent to the frenulum aspect, shape and place where the tongue is anchored. It can be classified into up four types of ankyloglossia. Besides these, the Hazelbaker Assessment Tool for Lingual Frenulum Function can also be used to classified ankyloglossia. In it anatomical and functional characteristics are assessed, and each item evaluated has a score. At the end the score is summed and values >11 indicates impairment in the tongue function¹⁰.

On June 20, 2014, Law No. 13,002, which concerns the test of the tongue, was passed, enforcing and putting into practice the protocol of evaluation of the frenulum in babies' tongue. Since then, all hospitals and maternity hospitals are obliged to implement the assessment of the lingual frenulum in Brazilian territory¹¹. The treatment nonsurgical for ankyloglossia can be realized through speech and physical therapy, as well as with the help of a lactation consultation, in which breastfeeding technics are improved. Besides, craniosacral and myofunctional therapy are also seen as treatment alternatives⁶.

However, the surgical procedure (frenotomy) is established as a primary treatment for this condition, where it is observed an improvement in breastfeeding due to the reduction of the mother's discomfort during breastfeeding and to the improvement of the child's sucking process^{6,12-14}. Therefore, the correct and early diagnosis is essential for an adequate treatment and, consequently, better orofacial development of the baby, thus enabling all the benefits resulting from breastfeeding in the first six months of life¹. Nowadays, the Bristol Tongue Assessment Tool (BTAT), can be considered an adequate instrument to diagnosis ankyloglossia, once its consider four aspects of important assessment in tongue of newborns: tip appearance, attachment of frenulum to lower gum ridge, lift of tongue with mouth wide and protrusion of tongue. It has a score that ranges from 0 to 8, in which the most severe tongue impairment is indicated by the presence of only 0 to 3 points¹⁵.

Thus, the objective of this study was to investigate the effects of frenotomy surgery on the factors related to breastfeeding in babies up to six months. Our null hypothesis was that frenotomy had no effect on reducing breastfeeding difficulties in babies up to six months old.

Materials and Method

An observational quality improvement study was carried out between October 2018 and March 2019, with babies up to six months of age who underwent frenotomy and their mothers in a Reference Hospital located in the city of Içara, Santa Catarina, Brazil.

Içara is a city in southern Santa Catarina with a population of approximately 58,000 inhabitants, Human Development Index of 0,741 and Gross Domestic Product *per capita* of BRL 42,042.20¹⁶. The hospital where the research was developed assist children up to 6 months of age, born and evaluated by speech therapist from this and others hospitals from the region of the Association of Municipalities of the Carbon Region, being reference for the performance of lingual frenotomy in the Maxillofacial Surgery and Traumatology service.

The study included children who were with their mothers, who agreed to participated in the study by signing the Informed Consent Form. Children whose mothers were unable to answer the questionnaire and/or had any disease that contraindicated breastfeeding were excluded from the study.

The collection was divided into two parts. First, it was applied a questionnaire to the mothers, who were in the hospital's waiting room, right after the baby was seen by the Buccomaxillofacial Surgery and Traumatology service and had performed the frenotomy. To perform the ankyloglossy diagnosis the lingual frenulum assessment protocol for babies was used^{17,18} and the speech therapists were trained to use that. In the second part, a new questionnaire was applied to the mothers, 15 days after surgery, after the return visit.

The questionnaires were applied by a trained professional and included demographic (age, skin color, schooling, work outside the home, type of childbirth, gestational age), anthropometric, nutritional and behavioral information. Weight and length at birth were collected from the children's monitoring and development card.

To assess breastfeeding, the questions in the questionnaire were based on the Child Breastfeeding Assessment Tool (IBFAT)¹⁹ and on the Pain Scale²⁰, which consists, respectively, of a list of sensory descriptors of pain and corresponding feelings and a scale of pain intensity^{19,20}.

The outcome variables were exclusive breastfeeding (yes, no) and breastfeeding (yes, no) before and after surgery. The exposure variables corresponding to the child's characteristics were: sex (male, female), age (in days), birth weight (in grams), length at birth (in centimeters), use of a pacifier (no, yes), use bottle (no, yes); and characteristics corresponding to the mother: skin color (white, non-white), schooling (evaluated in completed years and categorizes as ≤ 8 , 9-11, ≥ 12), work outside home (no, yes), type of childbirth (normal, cesarean), age (in complete years) and gestational age (in weeks).

Variables related to breastfeeding were also evaluated: stimulus for the baby to breastfeed (does not need to be stimulated - takes the breast alone -, there is a need for stimulation - touch the baby's face against the breast -, there is a need to use a light stimulation such as pats, the baby is placed on the chest without the need for effort), the handle on the breast (it does not handle well even with stimulation, it is necessary to stimulate it, it takes effectively all at once), mother feels breast pain (no, mild, moderate, severe), mother feels throbbing pain when breastfeeding (no, mild, moderate, severe), mother feels pain as if she had a blow to the breast (no, mild, moderate, severe), mother feels sharp pain in the breast (no, mild, moderate, severe), mother feels colic (no, mild, moderate), mother feels pain as if the baby chews the breast (no, mild, moderate, severe), mother feels pain as if the breast is burning (no, mild, moderate, severe), mother feels heavy breast (no, slightly, moderately, a lot), mother feels breast cracking (no, slightly, a little, a lot), breastfeeding is tiring or exhausting (no, slightly, a little, a lot), mother feels sick (no, a little, a lot), mother feels scared (no, a little, a lot), mother feels chastised (no, a little, a lot). In addition, variables on the mother's perception of breastfeeding after surgery were also assessed: improvement in attachment (no/yes), duration of breastfeeding (changed, remained the same), change in duration of breastfeeding (increased, decreased), pain reduction for the mother (no/yes), improvement in the baby's breathing (no/yes), breastfeeding frequency (changed, remained the same), there was a change in breastfeeding frequency (increased, decreased), and breastfeeding became easier (no/ yes).

Descriptive analysis of the studied variables was performed, presenting absolute (n) and relative (%) frequencies for categorical variables, and measures of central tendency and dispersion (median and interquartile range or mean and standard deviation) for numerical variables. The associations between breastfeeding and exposure variables were performed using Pearson's Chi-square and Fisher's Exact tests, using a significance level of 5%. SPSS software version 23.0 was used for statistical analysis.

The project was approved by the research ethics committee of the University of Southern Santa Catarina under protocol number 2,923,840, and all mothers signed the informed consent form agreeing to participate in the research.

Results

The study had the participation of 74 children and their mothers, with only 48 of them returning after surgery (64.9%). Table 1 shows the demographic, anthropometric and behavioral characteristics of the children studied. The median age of them was 44.5 days, and most of them were male (60.8%). The average birth weight was 3,412.8 (\pm 451.8) grams and more than a half of them were exclusively breastfed (58.1%), used a bottle (54.1%) and a pacifier (66,2%).

In the same table, the sociodemographic and gestational characteristics of the children's mothers are shown. Most mothers were white (85.1%), more than half studied between 9 and 11 years (56.7%) and did not work outside home (55.4%). It is also observed that more than half of childbirth were cesarean (56.8%) and that 83.8% of children were breastfed before surgery. After the surgery this prevalence reduced to 64.9%.

Table 1. Sociodemographic, anthropometric and behavior characteristics of children and mother studied in Içara-SC and breastfeeding prevalence before and after surgery. (n=74).

Variable	n	%
Children variables		
Sex		
Male	45	60.8
Female	29	39.2
Age (in days)		
Median	44,5	
Interquartile range	33-56	
Birth weight (in grams)		
Mean	3412.8	
Standard deviation	451.8	
Birth height (in centimeters)		
Mean	49.6	
Standard deviation	2.3	
Exclusive breastfeeding *		
No	26	41.9
Yes	36	58.1
Pacifier use		
No	25	33.8
Yes	49	66.2
Bottle use		
No	34	45.9
Yes	40	54.1
Mothers variables		
Skin color		
White	63	85.1
Non-white	11	14.9
Schooling (in years)		
≤8	21	28.4
9-11	42	56.7
≥12	11	14.9
Work outside home		
No	41	55.4
Yes	33	44.6
Childbirth		
Normal	32	43.2
Cesarean	42	56.8

Continue

Continuation		
Mother age (in years)		
Mean	27.8	
Standard deviation	6.7	
Gestational age (in weeks)		
Mean	39.2	
Standard deviation	1.3	
Breastfeeding before surgery		
No	12	16.2
Yes	62	83.8
Breastfeeding after surgery		
No	26	35.1
Yes	48	64.9

*The variable has 12 observations, because the question was applied only to those women who were breastfeeding.

Table 2 shows the influence of the surgery in the variables related to breastfeeding. Before surgery, 58.1% of children effectively took the breast at once, whereas, after surgery, this prevalence was 83.3% ($p=0.015$). Regarding the mother feeling pain as if she was hit in the breast, before the surgery, 75.9% of them answered no, and after the surgery, almost all of them (95.8%) reported not feeling this pain ($p=0.004$). A similar result was found with stabbing pain in the breast, in which 67.8% of the mothers previously said they did not feel such pain and, after surgery, this prevalence increased to 89.6% ($p=0.001$). About feeling pain as if the baby chews the breast, 71.0% reported not feeling it before surgery, while after surgery, this frequency increased to 91.7% ($p=0.019$). In addition, before surgery, 82.2% of mothers reported feeling the breast crack, a frequency that increased to 97.9% after surgery ($p=0.044$).

Table 2. Influence of the frenotomy on the variables related to breastfeeding in the studied children (n=74).

Variáveis	Before surgery		After surgery		p-value*
	n	%	n	%	
Stimulus for the baby to breastfeed					0.068
Does not need to be stimulated (takes the breast alone)	14	22.6	19	39.5	
There is a need for stimulation (touch the baby's face against the breast)	24	38.7	9	18.8	
There is a need to use a light stimulation such as pats	1	1.6	1	2.1	
The baby is placed on the chest without the need for effort	23	37.1	19	39.6	
The handle on the breast					0.015
It does not handle well even with stimulation	6	9.7	1	2.1	
It is necessary to stimulate it	20	32.3	7	14.6	
It takes effectively all at once	36	58.1	40	83.3	

Continue

Continuation				
Mother feels breast pain				0.479
No	39	62.9	36	75
Mild	9	14.5	6	12.5
Moderate	12	19.4	6	12.5
Severe	2	3.2	0	0
Mother feels throbbing pain when breastfeeding				0.058
No	32	51.7	35	72.9
Mild	19	30.6	7	14.6
Moderate	8	12.9	6	12.5
Severe	3	4.8	0	0
Mother feels pain as if she had a blow to the breast				0.004
No	47	75.9	46	95.8
Mild	10	16.1	0	0
Moderate	3	4.8	2	4.2
Severe	2	3.2	0	0
Mother feels sharp pain in the breast				0.001
No	42	67.8	43	89.6
Mild	8	12.9	4	8.3
Moderate	9	14.5	0	0
Severe	3	4.8	1	2.1
Mother feels colic				0.914
No	52	83.9	42	87.5
Mild	7	11.3	4	8.3
Moderate	3	4.8	2	4.2
Mother feels pain as if the baby chews the breast				0.019
No	44	71	44	91.7
Mild	9	14.5	4	8.3
Moderate	6	9.7	0	0
Severe	3	4.8	0	0
Mother feels pain as if the breast is burning				0.512
No	46	74.2	40	83.3
Mild	8	12.9	6	12.5
Moderate	7	11.3	2	4.2
Severe	1	1.6	0	0
Mother feels heavy breast				0.645
No	41	66.1	36	75
Slightly	12	19.4	8	16.7
Moderately	7	11.3	4	8.3
A lot	2	3.2	0	0

Continue

Continuation				
Mother feels breast cracking				0.044
No	51	82.2	47	97.9
Slightly	5	8.1	1	2.1
A little	5	8.1	0	0
A lot	1	1.6	0	0
Breastfeeding is tiring or exhausting				0.001
No	27	43.5	31	64.6
Slightly	14	22.6	5	10.4
A little	14	22.6	10	20.8
A lot	7	11.3	2	4.2
Mother feels sick				1
No	59	95.2	46	95.8
A little	2	3.2	2	4.2
A lot	1	1.6	0	0
Mother feels scared				0.450
No	55	88.7	46	95.8
A little	5	8.1	2	4.2
A lot	2	3.2	0	0
Mother feels chastised				0.328
No	60	96.8	47	97.9
A little	2	3.2	0	0
A lot	0	0	1	2.1

* Fisher's Exact test

The mother's perception of breastfeeding after surgery is demonstrated in Table 3. Most mothers reported improvement in the grip (83.3%), increase in the duration of breastfeeding (69.0%) and improvement in the baby's breathing (75.0%). They also reported that breastfeeding has become easier (85.4%). In addition, more than half of them (51.7%) reported an increase in the frequency of breastfeeding (51.7%).

Table 3. Mother's perception of breastfeeding after surgery (n=74).

Variáveis	n	%
Improvement in attachment		
No	8	16.7
Yes	40	83.3
Duration of breastfeeding		
Changed	29	60.4
Remained the same	19	39.6

Continue

Continuation		
Change in duration *		
Increase	20	69.0
Decreased	9	31.0
Pain reduction for the mother		
No	30	62.5
Yes	18	37.5
Improvement in the baby's breathing		
No	12	25.0
Yes	36	75.0
Breastfeeding frequency		
Changed	29	60.4
Remained the same	19	39.6
If there was a change in breastfeeding frequency *		
Increase	15	51.7
Decreased	14	48.3
Breastfeeding became easier		
No	7	14.6
Yes	41	85.4

* Question applied only to women who reported changes in duration and frequency of breastfeeding.

The association between exclusive breastfeeding and the characteristics of children and their mothers is found in Table 4. There was evidence of an association between breastfeeding and the use of pacifiers and bottles, in which children who did not use a pacifier ($p=0.019$) and bottles ($p<0.001$) had higher prevalence of exclusive breastfeeding when compared to children who were using it. In addition, white mothers had higher prevalence of exclusive breastfeeding than non-white mothers ($p=0.050$).

Table 4. Associated factors to exclusive breastfeeding in the studied children (n=74).

Children variable	Exclusive breastfeeding		p-value
	Yes n (%)	No n (%)	
Sex			0.231**
Male	21 (52.5%)	19 (47.5%)	
Female	15 (68.2%)	7 (31.8%)	
Birth weight (in grams)			0.867**
< 3500	20 (57.1%)	15 (42.9%)	
≥ 3500	16 (59.3%)	11 (40.7%)	

Continue

Continuation		
Birth height (em centimeters)		0.894**
< 50	16 (57.1%)	12 (42.9%)
≥ 50	20 (58.8%)	14 (41.2%)
Pacifier use		0.019**
No	19 (76.0%)	6 (24.0%)
Yes	17 (45.9%)	20 (54.1%)
Bottle use		<0.001*
No	34 (100.0%)	0 (0.0%)
Yes	2 (7.1%)	26 (92.9%)
Mother variables		
Skin color		0.050*
White	34 (63.0%)	20 (37.0%)
Non-white	2 (25.0%)	6 (75.0%)
Schooling (in years)		0.194*
≤8	11 (64.7%)	6 (35.3%)
9-11	17 (48.6%)	18 (51.4%)
≥12	8 (80.0%)	2 (20.0%)
Work outside home		0.934**
No	19 (57.6%)	14 (42.4%)
Yes	17 (58.6%)	12 (41.4%)
Childbirth		0.894**
Normal	16 (57.1%)	12 (42.9%)
Cesarean	20 (58.8%)	14 (41.2%)
Age (in years)		0.736**
< 30	25 (59.5%)	17 (40.5%)
≥ 30	11 (55.0%)	9 (45.0%)
Gestational age (in week)		0.280**
≤ 38	8 (47.1%)	9 (52.9%)
> 38	28 (62.2%)	17 (37.8%)

* Fisher's Exact test

** Pearson's Chi-square test

Discussion

The present study showed a reduction in the prevalence of exclusive breastfeeding after frenotomy surgery. Despite this, there were also important improvements in breastfeeding after surgery, such as improved latching and a breastfeeding without pain for the mother's. In addition, a higher prevalence of exclusive breastfeeding was associated with not using pacifiers and bottles.

Other studies present similar results. In London, a study carried out with children under three months of age found that after frenotomy, almost half of mothers were exclusively breastfeeding their babies (49%), however, the study did not present data prior to surgery²¹. Improvements in breastfeeding after surgery, reducing the occurrence of incorrect grip, of baby's fatigue when performing the sucking movement and of maternal tear at the time of breastfeeding, are also reported²²⁻²⁴.

Dixon et al.²² (2018) identified a subjective improvement in breastfeeding in 85% of cases, an increase in the breastfeeding rate, and an increase in breastfeeding rate after frenotomy. Berry et al.²⁵ (2012) observed that 78% of mothers reported instantaneous progress in breastfeeding after the procedure was performed. One day after the surgery, 90% of them declared an evolution in breastfeeding and, after three months, 92% still declared benefits in breastfeeding, with 51% of them continuing with breastfeeding. Another study also showed that the lack of procedure can affect the production of breast milk, compromising the practice of breastfeeding and resulting in the loss of child weight, impairing the child's development²⁶.

Despite the improvement in breastfeeding reported by mothers after frenotomy, approximately half of them stopped exclusive breastfeeding. There are numerous reasons, social and cultural, for the mother to breastfeed or not her child^{21,27}. According to Billington et al.²¹ (2018), the mother's option to stop breastfeeding and convenience are the two most common reasons, while problems with feeding are the least frequent reason for weaning.

A systematic review and an integrative review evaluating the benefits of surgical treatment for babies who were born with ankyloglossia and who experienced breastfeeding difficulties, suggests that frenotomy may be associated with improvements in breastfeeding and with reduction of nipple pain. However, the authors emphasize that the studies contained in the review are small, carried out in short periods of time and with dubious methodology, which makes the scientific evidence to conclude these findings scarce^{12,28}.

Another result found in the present study was the improvement in babies' breathing after surgery and the increase in the exclusive breastfeeding between the babies who did not use bottle or pacifier. The movement that the baby makes at the time of breastfeeding is indispensable for the harmonious growth of its oral cavity, enabling a better development of the hard palate, which is essential for the proper positioning of the teeth and a perfect dental occlusion. On the other hand, pacifiers and baby bottles put pressure on the hard palate and thus reduce the space for air to pass, disfavoring nasal breathing²⁹. Furthermore, when a bottle is used at some point during feeding, there is a possibility of "nipple confusion" (when the baby starts to confuse the nipples due to the difference in sucking in the breast and in the bottle). In these situations, the baby starts breastfeeding at the breast and soon abandons it because the milk comes out of the bottle faster, more easily and in greater quantities, while the milk flow from the breast can take a while⁴.

When mother stops breastfeeding early, it impairs the expected growth of the baby's oral cavity, which may interfere with chewing, swallowing, breathing and phonation, resulting in dental malocclusion, mouth breathing and motor-oral alteration³. Even in

groups of mothers educated and encouraged to breastfeed, the option to stop breastfeeding in the near future occurs and it is usually associated with family and psychosocial issues, factors related to the puerperium, the return to work and pain^{21,27,29}. Therefore, knowledge about breastfeeding by parents is of paramount importance for the practice breastfeeding³⁰. Besides, the importance of promoting public policies, both local and national, to encourage breastfeeding is highlighted, boosting the increase in breastfeeding rates²¹.

It is important to highlight the limitations of this study. Until now, there has been no agreement between researchers regarding the efficiency of frenotomy in babies with ankyloglossia, in addition to the scarcity of studies that prove such association^{28,31}. Thus, there is no possibility of stating the prevalence of babies diagnosed with ankyloglossia and who will have problems with breastfeeding and will need surgical intervention²⁸. Besides, approximately one third of mothers did not attend the return visit after surgery, resulting in a loss of 35.1% of the studied sample. This fact was responsible for impairing the outcome assessment and because of this, the comparison of the breastfeeding variables before and after the frenotomy is subject to bias, requiring caution in the results interpretation. However, it is likely that the benefits of frenotomy have been achieved, since, possibly, if there were any problems, mothers would return the babies to the hospital.

As strengths, it is noteworthy that the study was carried out in a medium-sized hospital that is a reference for maxillofacial surgery and speech therapy, and that serves for the evaluation and performance of the frenotomy procedure of newborns from all Southern region of Santa Catarina.

Conclusion

In conclusion, it was possible to observe a decrease in the prevalence of breastfeeding after frenotomy. Despite this, there was an improvement in the babies' grip and breathing and a reduction in the mothers' pain when breastfeeding. In addition, the non-use of pacifiers and bottles was associated with a higher prevalence of exclusive breastfeeding.

Surgery provides improvements in swallow, breathing, in the grip on the breast, and in the emotional and affective bond with the mother, for the babies who need it. In addition, it also avoids possible future speech problems. However, it is proposed that more studies, with better levels of scientific evidence, regarding frenotomy and its effects in long-term breastfeeding need to be carried out. Thus, encouraging the promotion and rise of exclusively breastfeeding in the first months of life.

It is also noted that it is of fundamental importance to rethink and implement multidisciplinary actions in primary and hospital care environments to monitor, support and assist mothers, as well as, to identify possible reasons for interruption of exclusive breastfeeding. In addition, it is necessary to develop actions and/or interventions in The Family Health Strategies, with this population group, to prolong the time of exclusive breastfeeding.

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Authors contribution

Possamai CF, Schäfer AA and Meller FO participated in the conception and design of the study, acquisition, analysis and interpretation of data, draft and revised it critically for important intellectual content. Quadra MR and Martins CD participated in the analysis and interpretation of the data, draft and revised it critically for important intellectual content. All author revised and approved the final version to be published and are responsible for all aspects of the work.

Conflicts of interest

None.

Data availability

Datasets related to this article will be available upon request to the corresponding author.

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