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## Chapter

# Exclusive Breastfeeding in Infants with Ankyloglossia: Does the Tongue–Tie Interfere with Growth Patterns?

*Christyann Lima Campos Batista  
and Alex Luiz Pozzobon Pereira*

## Abstract

The effect of ankyloglossia on breastfeeding remains unclear. Most studies focus on surgical procedures to correct aspects of breastfeeding, and few studies have focused on follow-up patients through. This chapter aims to analyze the influence of ankyloglossia on exclusive breastfeeding and the growth of infants up to the sixth month of life. A prospective cohort study was carried out with 225 mother–infant dyads who were followed up for the first six months of life. Full-term babies with and without ankyloglossia were followed up at a specialized breastfeeding center. Weight and length were measured and adjustments for age were calculated using the Body Mass Index and Z scores. Statistical analyzes were performed using descriptive statistics, and ANOVA for repeated measures. No significant differences were found in the growth measures of the following babies who remained exclusively breastfed ( $p > 0.05$ ). Thus, compared with infants with the normal lingual frenulum, infants with ankyloglossia had no significant changes were observed in the growth measurements of babies with and without ankyloglossia. Infants should be followed and supported in initial difficulties to avoid unnecessary surgical procedures since the idea that tongue-tied babies could have a different milk flow rate is not supported.

**Keywords:** breastfeeding, ankyloglossia, infants, growth, failure to thrive

## 1. Introduction

The cumulative information about benefits in the current literature is massive [1]. Human milk is the optimal source of nutrition and protection for newborn infants [2]. Well-recognized as the gold standard for nutrition for infants, breastfeeding provides health benefits for infants, their mothers, and society [1, 3, 4].

Worldwide, major medical societies recommend breastfeeding exclusively for approximately the first six months of life and then continuing with the addition of complementary foods for as long as mutually desired by mother and child,

potentially for two years [3]. This is the official recommendation by the World Health Organization [5, 6].

Several factors can hinder the establishment of breastfeeding and its exclusivity until the sixth month [7]. Among them, reports of low production or low perception of milk production by the mother, lack of support or knowledge about early difficulties, and pain when breastfeeding due to etiological changes such as nipple trauma, vasoconstriction, breast engorgement, ducts can be found in the literature. Obstructions, infections, and dermatitis [8, 9].

Thought recent years, a general increase in publications about ankyloglossia, popularly known as tongue-tie, emerged as one of the major factors that could interfere with exclusive breastfeeding [10].

Ankyloglossia is a congenital condition characterized by adhesion of the tongue to the floor of the mouth, resulting from the shortening or abnormality of the fixation of the Lingual Frenulum - a fold of mucous membrane - very close to the tip. of the tongue and/or on the upper surface of the gingiva or the alveolar crest [10–12]. The interest in this subject has increased due to considerable differences in diagnosis and treatment and management options around the world [13].

Recently, a systematic review of the literature, estimated a prevalence of 8% in babies under 1 year of age [14], with a higher prevalence being reported in male babies, in a ratio to a female sex of 1.5:1 to 2.6:1 [15]. Ankyloglossia can be clinically divided into two types: symptomatic when the frenulum directly impacts tongue movement and function; and asymptomatic, when the diagnosis is positive, but this does not result in major problems, especially in the neonatal period [16, 17].

Among the breastfeeding problems caused by ankyloglossia, authors have reported that a poor latch could result in low milk transfer, leading to failure to thrive in the exclusively breastfed infant [18, 19]. Although, most infants with tongue-tie can breastfeed without difficulty [20].

However, in the past years, the number of tongue-tie or ankyloglossia-related articles has increased dramatically, and among this research, few studies with robust methodological data support early surgical intervention [10]. The strength of evidence for the benefits of surgical treatment is limited; thus, other clinical therapies could be more beneficial if well implemented [21]. This treatment could be provided by a lactation specialist consultation and a speech therapist. Still, the optimal timing for surgery is controversial.

Evaluation by a speech pathologist is an essential component of the management of infants with breastfeeding problems and children that could have sound articulation problems [22].

Understanding that the general strategies for the infant should focus on supporting initiation and maintenance of breastfeeding and the remained controversies about the milk transfer rate and the possibility of failure to thrive of infants with ankyloglossia, this chapter is presented the result of a longitudinal study that assesses the growth of exclusive breastfeeding infants with and without ankyloglossia. The objective of this study was to analyze the influence of ankyloglossia on the growth evolution of infants up to the sixth month of life.

## **2. Methodology**

A prospective cohort study was carried out at the University Hospital of the Federal University of Maranhao (Maternal-Infant Unit) - HUUFMA in the sectors of Rooming-in and Pediatric Follow-up Clinic at the Human Milk Bank (HMB), a center

specializing in breastfeeding difficulties. HUUFMA is in the city of São Luís, the capital of a state in northeastern Brazil.

It is a high-complexity referral hospital for high-risk and habitual pregnancies. The estimated population of São Luís is 1.101,884 and an average income of 3.2 minimum wages. The data collection period was from January 2019 to December 2021.

To calculate the sample size, the level of alteration of the lingual frenulum reported in a previous prevalence study (8%) [14] was considered. In 2018, 15.959 live births were computed in the city, and the minimum number of participants calculated was 113 participants for a confidence level of 95% (population study with 80% power, 5% error). A total of 329 mother–infant dyads met the inclusion criteria at baseline. However, 225 remained followed up in the study, following the inclusion and exclusion criteria.

Mothers who expressed a desire to breastfeed, without medical contraindications for breastfeeding, and infants without health problems that could interfere with the growth or continuity of breastfeeding were included in the study. Babies with heart disease, pneumopathies, neuropathies, or those with genetic syndromes such as Pierre–Robin or Down syndrome, as well as twins, preterm newborns, and those with birth weight less than 2 kg were excluded.

Participants were recruited in two stages: initially in the rooming-in sector, through the “Tongue–tie Test Universal Screening (*Teste da Linguinha*)” performed by a qualified speech therapist. After a detailed assessment and completion of a positive diagnosis for ankyloglossia by a qualified speech therapist, those responsible were instructed to remain under follow-up in that sector and invited to participate in this research; for the group without ankyloglossia, they had to return to the outpatient clinic after 30 days of life to monitor growth and development until 6 months of age, and at that moment, those responsible were invited to participate in the study. The diagnosis was performed using the Bristol Tongue Assessment Tool [23].

Babies who for some reason met the criteria for surgical indication of ankyloglossia correction were removed from the study and referred for the procedure. All participants had the assistance of the multi-professional team to overcome the difficulties in breastfeeding and were properly instructed on the management of the nutritional aspect by a pediatrician and nutritionist.

Social and demographic data, as well as information regarding the type of diet declared by the mothers, were collected from the medical records. The birth-related variables were collected in the live birth declaration. Growth indicators were collected monthly as the dyads attended the follow-up appointment.

The measurements collected were weight in grams (with baby weighed in the morning, before feeding, without clothes and a diaper on a Balmak ELP25BB digital scale); length in centimeters (calm baby, lying on a rigid and fixed horizontal stadiometer model “Seca Mod. 416”). From these, the body mass index (BMI) ( $\text{kg}/\text{m}^2$ ) was calculated. Adjustments regarding the Z score for age were calculated using the WHO Anthro software (v 3.2.2). All growth measurements were collected according to World Health Organization recommendations [24].

To analyze the evolution of the infants’ growth, ANOVA for repeated measures was used in a general linear model, considering the Greenhouse–Geisser corrections to analyze the effects of time, the interaction time x ankyloglossia and ankyloglossia on the outcome variables, since the sphericity hypothesis in the Mauchly test was violated. In this analysis, only data from infants who remained on exclusive breastfeeding in all months were used.

The significance level adopted for all tests was 5% ( $p < 0.05$ ). The analyzes were carried out using the IBM SPSS Statistics program (version 26).

This study was approved by the Ethics Committee for Research with Human Beings (local Institutional Review Board) under protocol no 3,052,208. The mothers and/or guardians of the newborns were informed about the objectives, risks, benefits, and procedures of the research and were invited to sign the Free and Informed Consent Form to participate in the study.

### 3. Results

A total of 225 dyads contained information on the outcome variable (weaning) in the study database and were entered into the final analysis. The median maternal age was 28 years (IQ 22–34).

It was observed that 27% of the sample presented early weaning and that, among infants with ankyloglossia, which represented 24% of the sample, the proportion of weaning rose to 51.9%. The general characteristics of the sample at the baseline are presented in **Table 1**.

The number of follow-up infants exclusively breastfed was presented in **Table 2**. The analysis showed no significant differences between the interaction of time x ankyloglossia

Variables	N (%)
Newborn sex	
Male	130 (57,8)
Female	95 (42,2)
Breastfed in the first hour	
Yes	138 (65,4)
No	73 (34,6)
Missing (14)	
Mother's age	
18 years old or less	18 (8,1)
Above 18 till 30 years	117 (52,7)
31 years old or more	87 (39,2)
Missing (3)	
Marital status	
Husband, live together	179 (79,6)
Single, widow	46 (20,4)
Mother's maximum educational level	
Elementary or less	31 (13,8)
High school	142 (63,1)
Graduate or more	52 (23,1)
Mother's occupation	
Jobless	104 (47,1)
Work	100 (45,2)
Just student	17 (7,7)

Variables	N (%)
Missing (4)	
Family income	
1 minimum wage (MW) or less	94 (42,2)
Above 1 till 3 MW	80 (35,9)
Above 3 till 5 MW	43 (19,3)
5 SM or more	6 (2,7)
Missing (2)	
Is the mother's first infant	
Yes	111 (49,3)
No	114 (50,7)
Delivery type	
Natural	103 (46)
C-section	121 (54)
Missing (1)	
Ankyloglossia	
Yes	54 (24)
No	171 (76)
Apgar Score	
1° minute, median - M, interquartile interval IQ	9 (8-9)
5° minute, M (IQ)	9 (9-9)
Birth weight, mean - m (standard deviation SD)	3212,9 (27)
Cephalic perimeter, M (IQ)	34,5 (33,5-35,3)
Thoracic perimeter, m (SD)	32,8 (0,3)
Length, M (IQ)	49 (47-50)

**Table 1.** Social and demographic characteristics of mothers and infants in the baseline of the study, São Luís, Brazil, 2019–2021.

or isolated ankyloglossia on the reported measures ( $p > 0.05$ ). For a better description of growth, only infants who were on exclusive breastfeeding were included in this analysis.

We observed that for the crude values in the intra-subjects (ANOVA) was a significant association that was not repeated for Z scores. This indicates that the infants followed in this study did grow positively and the adjustment for age was considered normal. In the other words, the infants did grow in the normal velocity and rhythm, ankyloglossia does not affect these measures.

When we observed the values for ankyloglossia isolated, none of the variables has an association with the grown measures, that is, the presence of tongue-tie does not affect the growth when we compare the groups ( $p > 0,05$ ).

**Figure 1** (A-F) visually shows the growth curves between the groups analyzed, reporting no differences between the curves. All growth measurements were considered within the normal range according to the WHO growth curves.

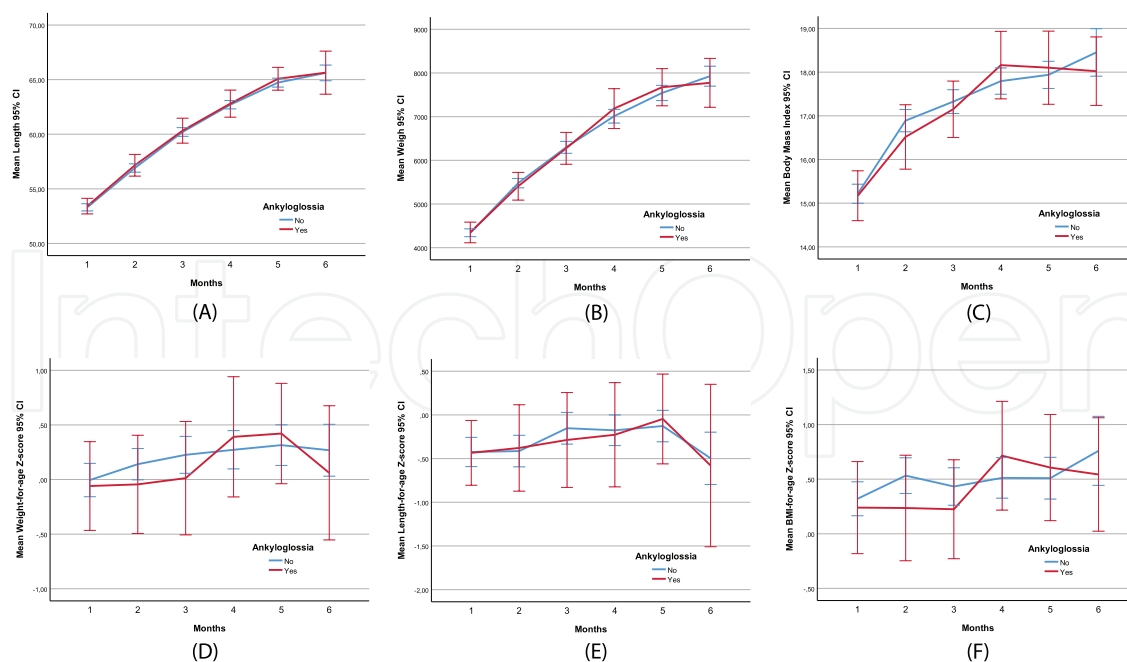
Month	First		Second		Third		Fourth		Fifth		Sixth		ANOVA for repeated measures (p-value)			
	Report Ankyloglossia	Yes (36)	No (198)	Yes (21)	No (169)	Yes (27)	No (155)	Yes (20)	No (152)	Yes (18)	No (137)	Yes (18)	No (136)	Intra-subjects	Between subjects	Ankyloglossia isolated x time
Weight (g; mean, SD)		4349,1 (116,7)	4341,7 (45,6)	5407,0 (151,8)	5477,2 (54,5)	6274,8 (177,5)	6297,7 (69,3)	7184,2 (217,8)	7010,1 (78,9)	7673,1 (201,8)	7542,2 (87,9)	7984,1 (181,4)	8000,8 (95,7)	<0,001	0,817	0,597
Length (cm; mean, SD)		53,41 (2,11)	53,30 (2,37)	57,16 (2,18)	56,90 (2,49)	60,32 (2,88)	60,20 (2,49)	62,80 (2,64)	62,70 (2,40)	65,07 (2,09)	64,72 (2,39)	66,27 (2,29)	65,95 (3,09)	<0,001	0,396	0,771
BMI (Mean, SD)		15,17 (1,68)	15,21 (1,56)	16,51 (1,61)	16,88 (1,67)	17,15 (1,63)	17,32 (1,71)	18,16 (1,65)	17,79 (1,86)	18,10 (1,68)	17,93 (1,83)	18,15 (1,76)	18,39 (2,35)	<0,001	0,778	0,624
Z scores for age																
Weight (Mean, SD)		-0,05 (1,20)	-0,00 (1,08)	-0,04 (0,98)	0,14 (0,94)	0,01 (1,31)	0,22 (1,06)	0,39 (1,17)	0,27 (1,09)	0,42 (0,92)	0,31 (1,10)	0,29 (1,00)	0,33 (1,13)	0,054	0,832	0,539
Length (Mean, SD)		-0,43 (1,09)	-0,42 (1,19)	-0,37 (1,08)	-0,41 (1,18)	-0,28 (1,37)	-0,15 (1,14)	-0,22 (1,27)	-0,17 (1,08)	-0,04 (1,03)	-0,12 (1,06)	-0,26 (1,02)	-0,35 (1,30)	0,112	0,406	0,718
BMI (Mean, SD)		0,23 (1,24)	0,32 (1,10)	0,23 (1,06)	0,53 (1,07)	0,22 (1,14)	0,43 (1,07)	0,71 (1,06)	0,51 (1,15)	0,60 (0,97)	0,50 (1,12)	0,59 (1,08)	0,73 (1,37)	0,559	0,819	0,628

BMI: body mass index; SD: standard deviation

Linear generalized model, ANOVA for repeated measures. The Mauchly test indicates that the sphericity hypothesis was always violated, therefore, the degrees of freedom were corrected using the estimation of sphericity of Greenhouse–Geisser ( $p > 0,05$ ).

**Table 2.**

Analysis of variance of variables related to the growth of infants evaluated according to the month of follow-up and ankyloglossia, São Luís, Brazil, 2019–2021.



**Figure 1.** (A–F) Graphics showing the monthly evolution of infant growth indicators, according to ankyloglossia. Curves: Mean (95% CI) of weight in kg for age (A); length in cm for age (B); body mass index for age (C); weight-for-age Z score (D); length for age (E) and body mass index for age (F).

## 4. Discussion

The main findings of this study, which analyzed the influence of ankyloglossia on aspects of growth, suggest that tongue–tie did not interfere with the growth of healthy full-term infants diagnosed when compared to infants without the normal tongue when they were exclusively breastfed until the sixth month of life. This finding corroborates the hypothesis that ankyloglossia does not interfere with the milk flow transmitted during sucking and that babies with and without ankyloglossia can breastfeed exclusively and have the same growth rate and speed.

To this date, this is the first long-term follow-up study in early life to report the influence of ankyloglossia on growth indicators. Other studies [25–27], below, were similar in pointing out how ankyloglossia can act on the sucking and swallowing mechanisms, thus being able to affect the ingestion of human milk from the mother’s breast.

In a retrospective study carried out in Austria, low weight gain was observed, for example, among effects on breastfeeding of infants aged 0–12 months such as breast pain, irritability, cracked nipples, reduced milk production, and poor attachment. However, this effect was not measured, being only reported by parents in the presentation of symptoms for frenotomy/frenectomy [26]. A systematic review of the literature by Manipon [25] states that weight loss is a common problem, but the isolated relationship of ankyloglossia with this outcome, or the age of presentation of these indicators, was not evidenced. A study by Livingstone et al. [27] reported cases of dehydration after massive weight loss caused by breastfeeding problems, citing ankyloglossia among adjacent disorders, but without mentioning its direct effect on the outcome.

The concern with the adequate growth of the baby is constant for families that seek medical help for breastfeeding problems in the first months of life and adequate multidisciplinary follow-up can be requested [28, 29].



The growth velocity seems to be more linked to the feeding method, and the effects of weaning can be corrected by the use of formulas, generally more caloric in advance in babies with this alteration [30]. Thus, this study analyzed only infants who remained on exclusive breastfeeding until the 6th month. A longer duration of exclusive breastfeeding can impact overall growth [31].

It is observed that breastfeeding problems should be the criteria to be taken into account when deciding on the frenotomy/frenectomy correction procedure, and in the current scientific literature, concerns about growth indicators are not mentioned. It is theorized that problematic breastfeeding resulting from ankyloglossia can generate low weight gain and consequent hypodevelopment.

Among the benefits reported after surgical intervention are the reduction of pain when breastfeeding and the improvement in the quality of breastfeeding [29, 32, 33]. Attention must be given to a precise clinical indication, as complications, although rare, can be found in the literature. A study carried out in New Zealand found an incidence of 13.9 problems per 100,000 procedures, such as feeding difficulties, respiratory events, pain, bleeding, and weight loss [34].

Therefore, it is evident that a reduction in frenotomy/frenectomy rates may result from the establishment of a multi-professional consensus with continued education and improvement of diagnostic methods for tongue-tie [35]. For this, the determination of comorbidities associated with ankyloglossia, such as alterations in growth indicators, can prove efficient to avoid unnecessary procedures.

This research was conducted in a center specializing in breastfeeding, which may lead to selection bias or bias in the reported rates, as mothers were continually instructed to continue with exclusive breastfeeding and were helped when they reported problems. However, this situation can be seen as a strong point since, even for the group with the alteration, the total breastfeeding time was longer than the national average, demonstrating that adequate monitoring and guidance can be decisive for reducing the chance of weaning, thus highlighting clinical and non-surgical measures as a protective effect of breastfeeding.

## **5. Conclusions**

In EBF infants, no differences were observed in the measures of growth assessed up to the sixth month of age, demonstrating that, for all groups, the studied indicators were equivalent.

Adequate follow-up by a specialized team can help in the early diagnosis and treatment of ankyloglossia, which may result in a decrease in weaning rates and improve children's health indicators. Thus, in this way, early surgery could be unnecessary if the mother-infant dyad has the correct support and guidance on breastfeeding.

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## Conflict of interest

The author declares no conflict of interest.

## Acronyms and abbreviations

HUUFMA	University Hospital of the Federal University of Maranhao
HMB	Human Milk Bank
EBF	Exclusive Breastfeeding
BF	Breastfeeding
BMI	Body Mass Index

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