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Evaluation of Neonatal Ankyloglossia

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Doctor of Nursing Practice with an emphasis in Pediatric Nurse Practitioner

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Abstract

Problem Ankyloglossia occurs when the tongue cannot extend past the gums or lips due to frenulum restriction. In breast feeding, proper movement of the tongue around the nipple is hindered causing difficulty for the infant to obtain a proper latch. This may result in slow weight gain (SWG), failure to thrive (FTT), and dehydration due to poor milk production. Evaluating for ankyloglossia is difficult, however, the Hazelbaker Ankyloglossia Tool for Lingual Frenulum Function (HATLFF) may be of benefit.

Method Observational descriptive design utilizing a retrospective medical record review. The HATLFF was utilized in full term neonates suspected of ankyloglossia in a mid-western suburban primary care practice from February 28-April 8, 2022. Birth weights and one-month weights were recorded.

Results Total sample size was nine ($N=9$). Ankyloglossia was not impacted by gender or race ($\chi^2(1) = 0.32, p = .571$). The mean appearance score was 5.44 ($SD=1.59$), mean function score was 3.44 ($SD=1.01$), and mean total score was 8.89 ($SD=2.09$). The mean weight gain for infants who underwent a frenotomy was 4.5 kg ($SD=0.48$ kg) at the one-month visit. The relationship between birth weight and one-month weight was weak ($r=-.06$).

Conclusion The HATLFF assisted providers in determining need for frenotomy. All infants who underwent frenotomy demonstrated adequate weight gain by one-month of age. The HATLFF instrument may be a useful tool for determining the need for frenotomy, however, maternal comfort may also need to be considered.

Keywords ankyloglossia, frenotomy, Hazelbaker Assessment Tool for Lingual Frenulum Function (HATLFF), weight gain

Evaluation of Neonatal Ankyloglossia

The American Academy of Pediatrics (AAP) described the term ankyloglossia, or tongue-tie, as a short or tight lingual frenulum causing a restriction of proper tongue extension and movement past the gums (Thomas, n.d.). This restriction hinders effective breastfeeding abilities in an infant (Korioth, 2021). When the tongue cannot extend past the gums or lips, proper movement of the tongue around the nipple creates difficulty for the infant to obtain a proper latch. However, if the latch does not have a good seal, the infant cannot suckle and express milk. In addition, the ineffective seal can cause pain to the mother, voluntary removal of the infant from the breast, which can contribute to dehydration and poor weight gain in the infant.

The cause of ankyloglossia is unknown but occurs in four to ten percent of infants (Muldoon, 2017). Unfortunately, many pediatricians do not believe ankyloglossia is related to poor breastfeeding. Segal et al. (2017) reported up to 90% of pediatricians, and 70% of otolaryngologists do not think ankyloglossia is related to poor breastfeeding; however, it was also noted by Segal et al. (2017) 69% of lactation specialists believe ankyloglossia is a direct cause of breastfeeding difficulty.

Depending on the severity of the ankyloglossia, a frenotomy has been recommended to improve the infant's ability to latch properly and improve overall feeding abilities and ultimately result in the infant's weight gain. Frenotomy rates have increased from 2004 to 2014, with rates increasing from 3.76 to 14.7 per 1000 live births (Lisonek et al., 2017). A frenotomy is a procedure in which the lingual frenulum is cut with either a laser or sterile scissors (Mayo Foundation for Medical Education and Research, 2018). The procedure is completed and involves holding the tongue toward the

roof of the mouth while cutting through the frenulum which extends from the base of the tongue. Post-procedure bleeding is minimal, and the mother is encouraged to breastfeed immediately (Mayo Foundation for Medical Education and Research, 2018).

Wakhanrittee et al. (2016) discussed the importance of timing for the frenotomy. Day two to day six of life was suggested to produce the most benefit by allowing the infant to develop breastfeeding habits, establish a routine and allow the mother to identify if a problem exists. Because there have been conflicting opinions within the medical community regarding the impact ankyloglossia has on breastfeeding, ankyloglossia may be left untreated, ultimately impacting breastfeeding and weight gain. Incorporating a validated assessment instrument for infants, such as the Hazelbaker Assessment Tool for Lingual Frenulum Function (HATLFF) when ankyloglossia is suspected may assist the provider in diagnosing and treating the condition early. Early intervention may reduce the potential for breastfeeding difficulties, poor milk production, weight loss, and dehydration.

Within a large midwestern suburban pediatric primary care practice, there was an opportunity to improve early identification of infants with ankyloglossia by implementing a validated instrument to assess the need for a frenotomy. The purpose of this quality improvement (QI) project was to implement the HATLFF within the first ten days of life when ankyloglossia was suspected. The aim was to initiate the HATLFF on at least 50% of infants suspected of ankyloglossia over a six-week period. The primary outcome measure was the number of infants screened with the HATLFF assessment instrument. Secondary outcome measures included the number of infants who underwent a frenotomy

when indicated, birth weight, and weight measured at 1-month of age. The questions for study were: In breast fed neonates 10-days of age or less,

- 1) what was the impact of using the HATLFF instrument on the rate of frenotomy?
- 2) what was the impact of frenotomy on weight gain by one-month of age?

Review of Literature

The search engines included CINAHL, Cochrane Library, and PubMed. The key search terms used were ankyloglossia, tongue-tie, frenotomy, and frenectomy. Search phrases included "newborn" AND/OR "breastfeeding." Initially 183 publications were retrieved. A refined search was conducted with inclusion criteria of full-text access publications between 2017 and 2021, breastfed infants, ankyloglossia, tongue-tie, and frenotomy; and, exclusion criteria of formula use, prematurity, or those greater than one-month of age. The refined search narrowed resulted in 35 publications to be reviewed. There were 11 publications selected, and seven additional publications utilizing an ancestry approach for a total of 18 publications selected for this literature review. The publications included a variety of studies from case study to randomized control trials.

Ankyloglossia has been studied for some time, however, there has been lost interest over the decades. In recent years, the importance of breastfeeding has become increasingly emphasized with the notion "breast is best" (WHO, 2021). This recommendation has increased research interest in feeding difficulties for infants with ankyloglossia.

Adverse outcomes of ankyloglossia were discussed in several publications and found to be similar in many of them. Campanha et al. (2018) reported pain in the nipples,

cracking, bleeding, deformity of the nipple, mastitis, and thrush of the nipple. Thrush on the mother's nipples can then be transferred to the infant's mouth, which can cause pain, discomfort, and additional difficulties feeding. Additionally, Schlatter et al. (2019) had similar findings but found mothers whose infant had an improper latch, had increased discomfort from breast engorgement or problems with poor milk production. Segal et al. (2017) suggested adverse outcomes led to maternal fatigue and increased rate of discontinued breastfeeding.

In addition to maternal complaints of pain and dissatisfaction with breastfeeding, ankyloglossia may lead to slow weight gain (SWG), failure to thrive (FTT), and dehydration. SWG is defined as an infant less than two-weeks of age who is more than 10% less than birth weight or an infant two-weeks to three-months of age who has gained less than 20 grams per day (Praborini et al., 2018). An infant is considered to have FTT when the bodyweight is under the 3rd percentile; when an infant continues to lose weight after 10-days; has not returned to birth weight by three-weeks of age; or continues to remain below the 10th percentile by the end of the first month (Praborini et al., 2018). Furthermore, if left untreated or undiagnosed, ankyloglossia may result in speech and language problems, dental problems, and gum disease in an older child (Visconti et al., 2021).

While the diagnosis of ankyloglossia has increased over the past several years, no standardized assessment instrument is consistently used in practice to assess for ankyloglossia (Lisonek et al. 2017). Ankyloglossia assessment instruments published to date include:

- Neonatal Tongue Screening Tool (NTST, Brandão et. al., 2018)

- Latch, Audible swallow, nipple Type, Comfort, Hold scale (LATCH, Muldoon et. al., 2017)
- Bristol Tongue Assessment Tool (BTAT Brandão et. al., 2018)
- Hazelbaker Assessment Tool for Lingual Frenulum Function (HATLFF, Ferrés-Amat et. al., 2017)

The NTST consists of six categories assessing the anatomical and functional characteristics of the lingual frenulum. Total score for each category may range from 0 to 12 (Brandão et. al., 2018). The LATCH scale instrument can assess both maternal and infant variables and identify areas of intervention where needed. The LATCH scale is used as a screening instrument in which a numerical score of 0-2 is assigned to the five key components of breastfeeding, latch, audible swallow, type of nipple, comfort, and hold. The BTAT examines two appearance items which were tongue tip appearance and then also examines two functional items which were lift of tongue with mouth wide while the infant was crying, and tongue protrusion.

The HATLFF instrument measures both appearance and function. The appearance score assesses five criteria including, appearance of the tongue when lifted, elasticity of the frenulum, length of the lingual frenulum when the tongue is lifted, attachment of the lingual frenulum to the tongue, and attachment of the lingual frenulum to the inferior alveolar ridge. The maximum score for appearance is 10. The function score was modified from the original HATLFF tool to include the five most beneficial criteria which included lateralization, lift of the tongue, extension of the tongue, spread of the anterior tongue, and the tongues cupping ability. Each category has a score of 2-0. The maximum score for function is 10. If the appearance score was less than or equal to eight

or the total score was less than or equal to 11, it was recommended the infant undergo immediate frenotomy.

The most frequently mentioned and utilized assessment instrument was the HATLFF tool. Overall, ankyloglossia assessment instruments were used either alone or combined with another instrument to aid in determining the accuracy of each. The HATLFF was reported to be the only researched-based ankyloglossia screening instrument for infants under six-months (Hazelbaker Lactation Institute, n.d.).

In determining whether a frenotomy was beneficial to breastfeeding, Ramoser et al. (2019) completed a study with short-term and long-term outcomes after a frenotomy. The short-term outcomes revealed 86% (of 141) patients had improved maternal comfort with breast feeding between weeks 1-18. The long-term outcomes, assessed up to 15-months after frenotomy, revealed 82% of mothers continued to report improvement in maternal comfort with breast feeding; latch had improved; better milk production; and tongue mobility had improved. These improvements resulted in improved weight gain in 12% of the infants in the study. Similar results by Ghaheri et. al. (2017) and Muldoon et al. (2017), found infants with ankyloglossia who had a frenotomy had significant improvements in maternal pain scores, improved latch, and increased maternal confidence in breast feeding.

The publications in this literature review provided consistent evidence of a frenotomy being beneficial in improving weight gain, breastfeeding outcomes, and maternal satisfaction. The publications utilized various ankyloglossia assessment instruments; however, each resulted in similar findings. The strength of these studies was consistent maternal self-reports of breastfeeding satisfaction post-frenotomy when

compared to pre-frenotomy. A weakness of these studies was the limited numbers in each study. Weaknesses also included the inconsistent use of multiple assessment instruments, incomplete data collection due to loss of follow-up, mothers discontinuing breastfeeding and changing to bottle feeding, and providers having difficulty identifying ankyloglossia (Brandão, et. al., 2018). In addition, one publication discussed infants being excluded due to an ankyloglossia diagnosis being made after discharge from the hospital. Hence, a gap in the literature includes those infants who were born at home who did not undergo an ankyloglossia assessment and infants who were discharged prior to ankyloglossia assessment being performed (Lisonek et. al., 2017).

While limited, this literature review demonstrated relatively safe, efficacious, and positive outcomes of pediatric patients who underwent frenotomy. More study is needed to determine a valid, reliable ankyloglossia assessment instrument to guide decision making for frenotomy. In contrast, there were no published studies found comparing infants with ankyloglossia who underwent frenotomy compared to those with ankyloglossia who did not. Further studies regarding frenotomy for ankyloglossia are needed.

For guidance on this project, the Johns Hopkins Nursing Evidence-Based Practice Model (JHNEBP) was selected. When evaluating current practice, frenotomies were performed based on provider experience. However, validated ankyloglossia assessment instruments have been available but not utilized in practice. The providers of a pediatric primary care practice, who routinely perform frenotomy for ankyloglossia decided to implement evidence into practice by utilizing the HATLFF assessment instrument into practice and evaluate its outcomes.

Methods

Design

An observational descriptive design using a retrospective medical record review. This was a quality improvement initiative to implement a validated instrument for assessing ankyloglossia over a six-week period from February 28, 2022, to April 9, 2022. A modified HATLFF assessment instrument was selected for use (Appendix A).

Setting

A pediatric primary care practice located in a suburb of a large midwestern community. The community has over 3 million residents, and the practice services over 5,000 children. There are two pediatricians, one nurse practitioner, one registered nurse, three medical assistants, and an office manager within the practice. In addition to seeing patients in the office, the providers perform daily nursery rounds, including ankyloglossia assessments and treatment. Neonates are often referred to the practice for ankyloglossia evaluation and treatment by other providers within the community.

Sample

A purposive sample included newborns through 1 month of age. Inclusion criteria for assessment included full-term neonates initially assessed at 0 to 10 days of age for suspected ankyloglossia. Exclusion criteria include prematurity, older than ten days of age at time of initial assessment, and formula use.

Approval Processes

A team of key stakeholders, including the two pediatricians, the nurse practitioner, and the primary investigator (PI), identified a need to improve the assessment of ankyloglossia, initiate a standardized ankyloglossia assessment instrument, and measure

the outcome it would have on the weight gain of infants after ankyloglossia treatment.

The HATLFF instrument was selected for use to standardize screenings between the three providers. The PI obtained approval for the project from the medical center's institutional review board (IRB), the Doctor of Nursing practice committee, and the university's institutional review board.

Data Collection/Analysis

All data were de-identified and numerically coded. Demographic information such as age, gender, and race were recorded. In addition, the HATLFF scores were recorded, birth weight, and one-month weights were obtained and documented. All data was stored on a password-protected computer. Descriptive statistics, Fisher exact test, and a Pearson Correlation were performed.

Results

A total of nine infants ($N=9$) were evaluated and suspected of having ankyloglossia. The ages ranged from one to five days. The mean age for the initial assessment was 3.6 days of age. Of the infants, eight were male ($n=8$, 88%) and one was female ($n=1$, 12%). Seven of the nine were Caucasian ($n=7$, 78%), while the remaining two were African American ($n=2$, 22%). Finally, eight ($n=8$, 88%) of the infants were found to be eligible for immediate frenotomy, but one was not ($n=1$, 12%) (Appendix B).

A Fisher exact test was conducted to compare gender and race with the sample size consisting mostly of males ($n=8$) and one female ($n=1$). The relationship between gender and race was not statistically significant at the .05 level ($\chi^2(1) = 0.32$, $p = .571$). Neither gender nor race were related to ankyloglossia.

There were three scores recorded: appearance (maximum=10), function (maximum=10), and total score. The range of the appearance score was 3.0-8.0 with a mean score of 5.44 ($SD=1.59$). The range of the function score was 2.0-5.0 with a mean score of 3.44 ($SD=1.01$). The range of the total score was 6.0-12.0 with a mean score of 8.89 ($SD=2.09$) (Appendix C). For those infants with an appearance score of less than or equal to eight an immediate frenotomy was performed. There was one infant with an appearance score of eight ($n=1$, 11%), there were two infants with an appearance score of seven ($n=7$, 12.8%), there were four infants with an appearance score of five ($n=4$, 55.5%), one infant with an appearance score of four ($n=1$, 11%), and one infant with an appearance score of three ($n=1$, 11%). One infant did not undergo an immediate frenotomy due to a total score of 12. However, at the one-month appointment, the infant was reassessed by the physician after the mother raised concerns regarding the upper lip tucking under during feeding and complaints of nipple discomfort. Ankyloglossia was determined on reassessment using the HATLFF instrument and a lingual frenotomy, along with a maxillary frenotomy, was performed.

The mean weight gain for infants who underwent a frenotomy was 4.5 kg ($SD=0.48$ kg) at the one-month visit; hence, all infants who underwent a frenotomy had adequate weight gain. A Pearson r was performed to determine the strength and direction of the relationship between birth weight and one-month weight. The relationship between birth weight and one-month weight was weak ($r=-.06$) (Appendix D).

Discussion

The impact of implementing a standardized assessment instrument such as the HATLFF assessment instrument, resulted in a 100% use rate in infants suspected of

having ankyloglossia. In the case of the infant who did not undergo frenotomy until day 30 of life, it was determined the assessment collection form was not used during the initial assessment but completed after the patient had left the office. The total score however was above the recommendation score for a frenotomy.

All infants who underwent frenotomy demonstrated adequate weight gain by the one-month visit. The infant who did not have a frenotomy performed initially, also demonstrated some weight gain, but mother's nipple soreness resolved after the frenotomy was performed 30 days later. Hence, assessment for appearance and function of the infant's latch and suck is important, but soreness of nipples may also be of consideration. Perhaps the inclusion of an assessment for maternal comfort would be beneficial since the HATLFF instrument only assesses for appearance and function of an infant's latch.

A positive impact resulting from this project was the creation of a "Smart Phrase" within the electronic medical record system. This allowed for each office provider to have immediate access to the assessment instrument for documentation purposes. All infants now assessed for ankyloglossia have documentation of the assessment utilizing a validated instrument. Furthermore, providers have an objective assessment for frenotomy indication.

A strength of this project was use of a validated assessment instrument for assessing infant ankyloglossia. A limitation was the lack of assessment for maternal comfort. In addition, a small sample size may not be representative of instrument usefulness. Recommendations for future study would be the inclusion of an assessment instrument for maternal comfort when breastfeeding and a larger sample size.

Conclusion

In conclusion, the HATLFF assessment instrument was successfully implemented in a pediatric primary care practice. Frenotomies were performed based on the objective assessment from instrument utilization versus the subjective assessment from provider experiences. In addition, all infants had adequate weight gain and were still breastfeeding after frenotomy was performed. An ineffective latch can cause pain to the mother, voluntary removal of the infant from the breast, contributing to dehydration and poor weight gain in the infant. Assessing for ankyloglossia and its treatment (if needed), may be beneficial for infant growth and the promotion of breastfeeding.

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Appendix A

HATLFF assessment instrument

Hazelbaker Assessment Tool for Lingual Frenulum Function (HATLFF)			
Appearance Items	Score	Function Items	Score
1. Appearance of tongue when lifted		1. Lateralization	
<input type="checkbox"/> Round OR square	2	<input type="checkbox"/> Complete	2
<input type="checkbox"/> Slight cleft in tip apparent	1	<input type="checkbox"/> Body of tongue but not tongue tip	1
<input type="checkbox"/> Heart-shaped	0	<input type="checkbox"/> None	0
2. Elasticity of frenulum		2. Lift of tongue	
<input type="checkbox"/> Very elastic (excellent)	2	<input type="checkbox"/> Tip to mid-mouth	2
<input type="checkbox"/> Moderately elastic	1	<input type="checkbox"/> Only edges to mid-mouth	1
<input type="checkbox"/> Little OR no elasticity	0	<input type="checkbox"/> Tip stays at alveolar ridge or rises to mid-mouth only with jaw closure	0
3. Length of lingual frenulum when tongue lifted		3. Extension of tongue	
<input type="checkbox"/> More than 1 cm OR embedded in tongue	2	<input type="checkbox"/> Tip over lower lip	2
<input type="checkbox"/> 1 cm	1	<input type="checkbox"/> Tip over lower gum only	1
<input type="checkbox"/> Less than 1 cm	0	<input type="checkbox"/> Neither of above, OR anterior or midtongue humps	0
4. Attachment of lingual frenulum to tongue		4. Spread of anterior tongue	
<input type="checkbox"/> Posterior to tip	2	<input type="checkbox"/> Complete	2
<input type="checkbox"/> At tip	1	<input type="checkbox"/> Moderate OR partial	1
<input type="checkbox"/> Notched tip	0	<input type="checkbox"/> Little OR none	0
5. Attachment of lingual frenulum to inferior alveolar ridge		5. Cupping	
<input type="checkbox"/> Attached to floor of mouth OR well below ridge	2	<input type="checkbox"/> Entire edge, firm cup	2
<input type="checkbox"/> Attached just below ridge	1	<input type="checkbox"/> Side edges only, moderate cup	1
<input type="checkbox"/> Attached at ridge	0	<input type="checkbox"/> Poor OR no cup	0
TOTAL APPEARANCE SCORE		6. Peristalsis	
FUNCTION ITEMS SCORE 14 Perfect score (regardless of Appearance Item score) 11 Acceptable, if Appearance Item score is 10 <11 Function impaired • Frenotomy should be considered if management fails. • Frenotomy necessary if Appearance Item score is <8.		<input type="checkbox"/> Complete, anterior to posterior (originates at the tip)	2
		<input type="checkbox"/> Partial: originating posterior to tip	1
		<input type="checkbox"/> None OR reverse peristalsis	0
		7. Snapback	
		<input type="checkbox"/> None	2
		<input type="checkbox"/> Periodic	1
		<input type="checkbox"/> Frequent OR with each suck	0
TOTAL FUNCTION SCORE			

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[https://media.starship.org.nz/hazelbaker-assessment-tool-for-lingual-frenulum-function-\(hatlff\)/hazelbaker.pdf](https://media.starship.org.nz/hazelbaker-assessment-tool-for-lingual-frenulum-function-(hatlff)/hazelbaker.pdf)

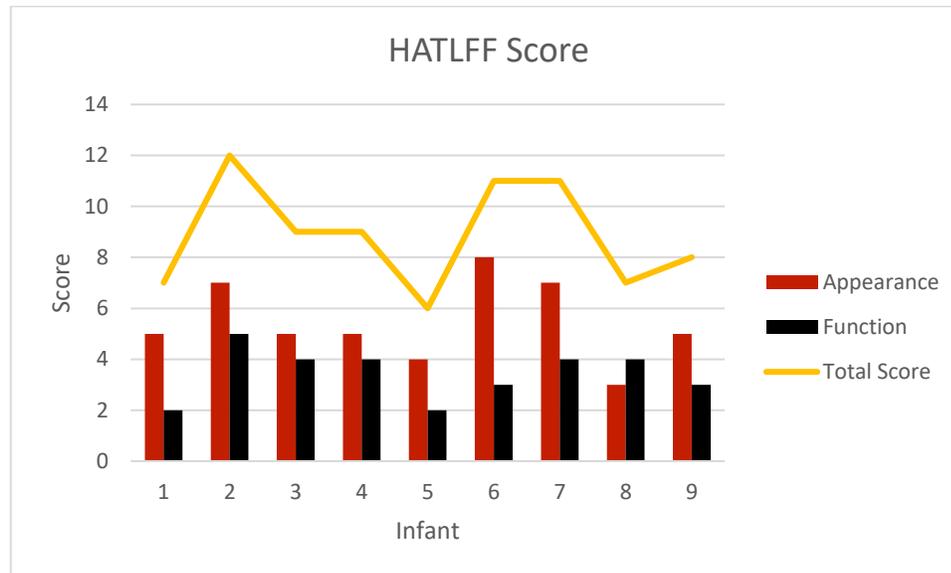
Note: the original HATLFF instrument was modified for this project. The peristalsis and snapback assessments were removed.

Appendix B*Demographic Information*

Variable	n	%
Gender		
M	8	88.89
F	1	11.11
Missing	0	0.00
Race		
Caucasian	7	77.78
African American	2	22.22
Missing	0	0.00
Age at Release		
3 days	2	22.22
30 days	1	11.11
10 days	1	11.11
1 day	3	33.33
5 days	2	22.22
Missing	0	0.00

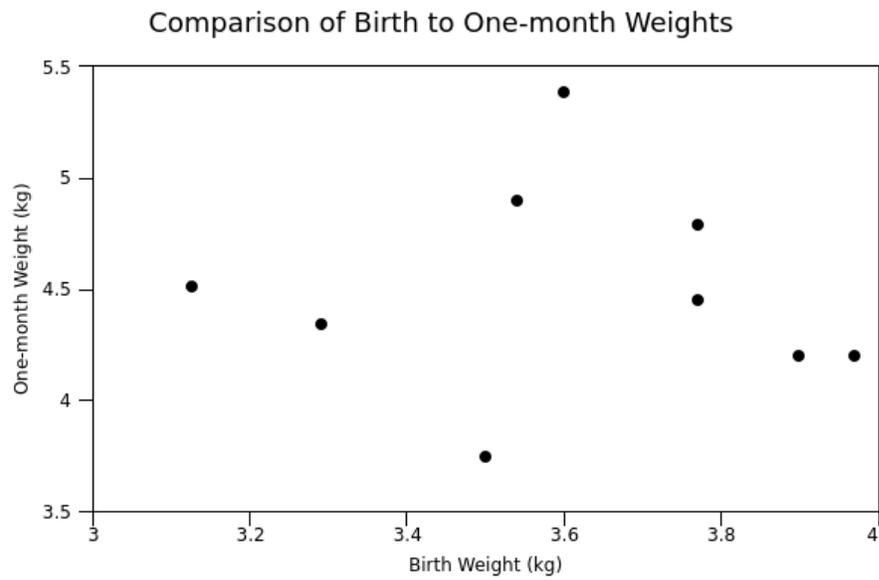
Appendix C

HATLFF Scores: Appearance, Function, and Total



Note: Summary Statistics

Variable	<i>M</i>	<i>SD</i>	<i>n</i>	<i>SE_M</i>	Min	Max	Skewness	Kurtosis
Total Score	8.89	2.09	9	0.70	6.00	12.00	0.15	-1.31
Function Score	3.44	1.01	9	0.34	2.00	5.00	-0.22	-1.00
Appearance Score	5.44	1.59	9	0.53	3.00	8.00	0.21	-0.9

Appendix D*Comparison of Birth to One-month Weights*

Note: The relationship between birth weight and one-month weight is weak (Pearson $r=-.06$).