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Assessment Tools for Evaluation of Oral Feeding in Infants Less than Six Months Old

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Abstract

Background—Feeding difficulty is common in infants less than six months old. Identification of infants in need of specialized treatment is critical to ensure appropriate nutrition and feeding skill development. Valid and reliable assessment tools help clinicians objectively evaluate feeding.

Purpose—To identify and evaluate assessment tools available for clinical assessment of bottle- and breast-feeding in infants less than six months old.

Methods/Search Strategy—CINAHL, HaPI, PubMed, and Web of Science were searched for "infant feeding" and "assessment tool." The literature (*n*=237) was reviewed for relevant assessment tools. A secondary search was conducted in CINAHL and PubMed for additional literature on identified tools.

Findings/Results—Eighteen assessment tools met inclusion criteria. Of these, seven were excluded because of limited available literature or because they were intended for use with a specific diagnosis or in research only. There are 11 assessment tools available for clinical practice. Only two of these were intended for bottle-feeding. All 11 indicated they were appropriate for use with breast-feeding. None of the available tools have adequate psychometric development and testing.

Implications for Practice—All of the tools should be used with caution. The Early Feeding Skills Assessment and Bristol Breastfeeding Assessment Tool had the most supportive psychometric development and testing.

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Implications for Research—Feeding assessment tools need to be developed and tested to guide optimal clinical care of infants from birth through six months. A tool that assesses both bottle- and breast-feeding would allow for consistent assessment across feeding methods.

Keywords

Infant; Bottle Feeding; Breast Feeding; Feeding Behavior; Feeding Methods; Feeding and Eating Disorders of Childhood; Assessment Tool

Background

Feeding difficulty is common in young infants in the first six months of life.[1] As advancements in health care have allowed for increasing survival of critically ill newborns, the number of infants with oral feeding difficulty has been rising.[2] Infants who are born premature[3] and with congenital heart disease[4] are at particularly high risk for problematic feeding; however some infants who are otherwise apparently healthy also have difficulty with bottle- or breast-feeding.[1]

Difficulty with feeding during infancy is problematic because it often results in suboptimal nutrition during a critical time for brain growth.[5,6] In infants with chronic disease, suboptimal nutrition contributes to morbidity, such as risk for infection and prolonged hospitalization, as well as mortality.[7,8] Feeding difficulties during infancy also impact the developing social dynamics of mealtime[9] and the parent-child relationship.[10]

Early identification of infants with feeding difficulty is critical in order to implement appropriate therapies and optimize the infant's nutrition and oral feeding skill development. However, because infants have limited ability to communicate distress during feeding, problematic feeding behaviors may be subtle and present in heterogeneous ways.[11] All of these factors make differentiation between typical feeding behaviors and problematic feeding difficult.

Clinicians need assessment tools to guide objective evaluation of infant oral feeding that is consistent regardless of who is completing the assessment (e.g., nurse or speech-language pathologist). Psychometric development and testing is critical to ensure that: 1) the tool is valid (i.e., it measures what it is intended to measure) and 2) it is reliable (i.e., the score represents something true about the infant's feeding and it performs in a consistent way).[12] If a tool is not valid, it may, for example, measure parent-infant interaction during feeding rather than the infant's feeding behaviors. If a tool is not reliable, the score may indicate a good feeding when the feeding was problematic, or it may give a different score depending on who completes the assessment.

Psychometric Development and Testing

An extensive review of all types of validity and reliability testing is beyond the scope of this article.[12] Common methods for evaluating assessment tools are presented here.

Validity—*Content validity* examines the extent to which a tool comprehensively measures a construct (e.g., feeding). Content validity is determined by the manner in which the tool is

developed and is tested by obtaining feedback from intended users of the tool. Ideally, a tool would be developed using a combination of sources (e.g., input from experts, clinical experience, and a review of the literature)[12] and then formally tested by experts using a content validity index.[13] Other types of validity testing may include *concurrent* or *predictive validity*, which examines how well a tool predicts a score on another measure, either a tool that is considered the "gold standard" or something that is hypothesized to be a related (e.g., nutritional intake).[12]

Reliability—Reliability testing requires a sample of respondents to complete the tool. *Internal consistency reliability* evaluates how related items on the tool are to each other, indicating the items measure the same construct. *Inter-rater reliability* evaluates how consistent two different respondents (e.g., nurses) are to each other when assessing the same event. *Intra-rater reliability* evaluates how consistent the same respondent (e.g., the same nurse) is when assessing the same event at two times (e.g., a video-tape of the same feeding two-weeks apart).[12] A reliability of ≥ 0.7 is considered acceptable and <0.7 is considered unacceptable.[14] Ideally, all of these types of reliability would be tested.

Purpose

The purpose of this review is to identify and evaluate assessment tools available to guide clinical assessment of bottle- and breast-feeding in infants less than six months old. The intended purpose of the tool, user (e.g., nurse, parent, researcher), feeding method (e.g., breast- or bottle-feeding), and the psychometric testing conducted to support the tools' reliability and validity will be presented.

Search Strategy

CINAHL, HaPI (Health and Psychosocial Instruments Database), PubMed, and Web of Science were searched to identify feeding assessment tools for infants less than six months old. The terms used for the search were "infant feeding" and "assessment tool." The search was limited to English language, Human, and Full Text. Both articles and textbooks were included and no limits were placed on publication date. The literature search was conducted in June 2015.

The literature was reviewed by the research team for presentation of new assessment tools, use of existing tools, or reference to existing tools. Assessment tools were excluded if they were intended for infants older than six months, were intended for assessment of solid food feeding (e.g., pureed baby food), or were intended to assess a construct other than the infant's feeding (e.g., parent-infant interaction, breastfeeding self-efficacy, feeding readiness). Once tools were identified, a secondary specific search of tools by name via PubMed and CINAHL was conducted to identify additional literature on that specific tool. Since the intent of this paper is to provide evidence for clinical practice, assessment tools were further excluded if they lacked sufficient published literature to evaluate the tool, if the target population was limited to a specific diagnosis, or if the tool was intended for research only (i.e., not intended for clinical use).

The initial search of databases resulted in 237 articles and texts for review (Figure 1). From this literature, 18 relevant tools were identified that met inclusion criteria. Three of these were excluded because they did not have adequate published literature for evaluation of the tool: B-R-E-A-S-T-Feed Observation Form,[15] Infant Nipple Feeding Assessment and Communication Tool,[16] and Oral Eating Readiness Assessment List.[17] Three additional tools were excluded because their use is limited to specific diagnoses: the Feeding Checklist[18] (infants with non-organic failure to thrive), the Infant Malnutrition and Feeding Checklist for Congenital Heart Disease[19] (infants with congenital heart disease), and the Nutrition and Feeding Risk Identification Tool[20] (infants in early intervention). Finally, the Mother-Infant Feeding Tool[21] was excluded because it assesses mother-infant interaction in the context of feeding, but is not a feeding assessment; it is also an observational coding system intended for research purposes only. The final sample included 11 assessment tools (Table 1).

Summary of Evidence

Bottle-feeding Assessment

Two tools are available to assess bottle- or breast-feeding in infants less than six months old: the Early Feeding Skills Assessment (EFS)[22] and the Neonatal Oral Motor Assessment Scale (NOMAS).[23] However, both of these tools have only been tested in a sample of bottle-feeding infants. The EFS is intended for preterm infants through at least 52 weeks post-menstrual age and takes a holistic approach to the assessment of feeding.[24] It is a 36-item assessment of behavioral state, readiness, muscle tone, energy level, behavioral stress signs, swallowing, physiologic stability, and oral-motor functioning.[24] Subscales of the assessment (e.g., Ability to Maintain Physiologic Stability) are scored and indicate areas of strength, areas of some clinical concern, and areas of major clinical concern. The EFS was developed with neonatal nurses and feeding experts, which supports content validity,[24] but has not had formal content validity testing. It has acceptable intra- and inter-rater reliability (value not reported).[22]

The NOMAS is a 28-item assessment intended for preterm and term infants and focuses primarily on oral-motor skills (i.e., movements of the jaw and tongue) for sucking, with only two items about fatigue or incoordination of the suck, swallow, breathe sequence.[23] Subscales of the assessment (e.g., Nutritive Suck: Jaw) are scored and characterize the oral-motor pattern as normal, disorganized, or dysfunctional.[23] The NOMAS was developed by a Speech-Language Pathologist and was one of the first assessment tools available for evaluation of objective physiologic cues during feeding, but the development process is not described in the literature and there is no evidence of content validation. There is evidence of concurrent validity between the NOMAS and neurobehavioral scores and cerebral diameter,[25] but the NOMAS was not found to be predictive of feeding outcomes in preterm infants.[26] Results for inter-rater (0.50–1.00,[23] 0.43–0.62,[25] and 0.33–0.95[27]) and intra-rater reliability (0.33–1.00[25] and 0.41–0.65[27]) have been inconsistent and/or unacceptable. Further development of the tool and testing has been recommended.[27]

Both the EFS and NOMAS are intended for clinicians and require specialized training. The EFS requires a 2-day training course (www.shaker4swallowingandfeeding.com/course-

brochure/), or is available by request to Dr. Suzanne Thoyre (thoyre@email.unc.edu). The NOMAS requires a 3-day training course (http://www.nomasinternational.org).

Breast-feeding Assessment

Nine tools identified for assessment of infant feeding indicate that they could be used only for the assessment of breast-feeding. Two of these tools were found to be assessment guides that did not have a scoring system and therefore, no psychometric testing: the Breastfeeding Evaluation and Education Tool[28] and Systematic Assessment of the Infant at Breast.[29] The remaining seven tools are the: Bristol Breastfeeding Assessment Tool (BBAT),[30] Infant Breastfeeding Assessment Tool (IBFAT),[31] the LATCH,[32] Mother-Baby Assessment (MBA),[33] Mother Infant Breastfeeding Progress Tool (MIBPT),[34] Potential Early Breastfeeding Problem Tool (PEBT),[35] and the Premature Infant Breastfeeding Behavior Scale (PIBBS).[36]

The BBAT is a four-item assessment intended for healthy, full-term infants and has been tested with 218 breast-feeding sessions of infants up to 10 weeks old.[30] The items assess positioning, attachment, sucking, and swallowing and are scored on a scale of poor, moderate, or good. The BBAT was developed in a manner that supports content validity, but no formal content validity testing was done. The internal consistency reliability of the BBAT was 0.67, which is slightly below acceptable, but inter-rater reliability was acceptable (0.78). The BBAT was tested alongside the LATCH and IBFAT and found to be more responsive to changes over time than the latter two.[30]

The IBFAT is a six-item assessment intended for healthy, full-term infants in the early post-partum period and can be completed by either the mother or a clinician.[31] The IBFAT assesses infant state, readiness, rooting, latching, sucking behaviors, and maternal satisfaction with the breast-feeding experience.[31] Items 2–5 comprise the infant feeding assessment and are scored on a four response option scale with a sum score 10–12 indicating an effective, vigorous feeder, 7–9 indicating a moderately effective feeder, and 0–6 indicating the infant was not able to be roused or did not root and sucked weakly during feeding.[31] The IBFAT was developed using a literature review and observing infant feedings, which supports content validity, but no formal testing was done.[31] Inter-rater reliability between clinicians has been found to be acceptable (0.7–0.78).[37] Inter-rater reliability between clinicians and mothers was acceptable (0.91) in a moderate sample of feeding observations (n=77),[31] but unacceptable (0.27–0.69) in a study on a small sample (n=23).[38] The latter study may not have been of a sufficient sample size for this type of testing. In Schlomer's pilot study[39] of 15 mother-infant dyads, the IBFAT was found to increase with higher maternal satisfaction and lower breastfeeding problem scores, but the findings were not statistically significant. The IBFAT has also been tested with very low birthweight infants (<1.5 kg) and better IBFAT scores were found to be significantly correlated with milk intake volume, intake rate, and percent of time sucking.[40] No process was indicated to ensure validity of this instrument for this different population and no reliability testing was done.

The LATCH (target population not specified) is a five-item assessment of latch, audible swallowing, type of nipple, comfort of breast/nipple, and hold (positioning) scored on a

scale from 0 to 2, with higher scores indicating more ideal breast-feeding (e.g., successful latch and frequent audible swallowing).[32] The LATCH was developed with experts, but no formal content validity testing is reported.[32] The LATCH can be completed by clinicians or mothers. Inter-rater reliability between clinicians has been inconsistent. In a study of 35 feedings, reliability was acceptable (0.85–1.0)[41] and in another study of 46 feedings, reliability was mostly acceptable (0.65–0.91).[37] In a third small sample of only 23 feedings, reliability was unacceptable (0.11–0.48).[38] The only study of inter-rater reliability between clinicians and mothers (n=35) found unacceptable reliability (0.18–0.67).[41]

The MBA (target population not specified) is a five-item assessment completed by a clinician that evaluates signaling, positioning, fixing, milk transfer, and ending, with each item scored as either 1 (behavior present) or 0 (behavior absent).[33] The mother and baby each receive a score on each of the 5 items, with a higher score indicating a more effective breastfeeding encounter.[33] The process of development of the MBA is not discussed and there is no evidence of content validity. Inter-rater reliability results of the MBA have also been variable, with one small study of 23 feedings finding unacceptable reliability (0.33–0.66),[38] but another study of 46 feedings finding acceptable reliability (0.81–0.88).[37]

The MIBPT is an eight-item checklist intended for healthy, late preterm and term infants and completed by clinicians.[34] The eight items evaluate maternal response to feeding cues, length between feedings, latch, nutritive sucking bursts, independence in positioning and latching infant, nipple trauma, and negative comments made about breastfeeding.[34] Items are checked as either yes or no and the purpose of the MIBPT is to assess maternal and infant behaviors in order to facilitate teaching and support by the clinician.[34] The MIBPT was tested with 81 breast-feeding sessions of infants 35–42 weeks post-menstrual age during the post-partum hospitalization (2–5 days old).[34] The tool development supports content validity and content validity was assessed informally by two experts. Inter-rater reliability for each item was acceptable (0.79 – 0.95).[34] No other testing is reported.

The PEBPT is a 23-item list of possible breast-feeding events (e.g., baby falls asleep, sore nipples breast infection), rated as either 0 (not experienced), 1 (manageable, no real problem), 2 (usually manageable, sometimes a problem) or 3 (very difficult to manage, makes me consider weaning).[35] The PEBPT was developed in a manner that supports content validity, but has no formal content validity testing. Lower breastfeeding satisfaction and bottle use were predictive of worse PEBPT score (R^2=0.15, p<0.01).[35] Schlomer[39] found the internal consistency reliability for the PEBPT to be acceptable (0.81), but no further development or testing has been done.

The PIBBS is a 12-item checklist intended for hospitalized, preterm infants and can be completed by a clinician or mother.[36] Items evaluate rooting, latching, sucking, swallowing, general behavior, letdown, problems with the breast and nipple, and influence of the environment. Each item is scored differently.[36] The PIBBS was developed in a manner that supports content validity, but has not had formal content validity testing. Inter-rater reliability of the current tool has only been tested with 10 feedings and has found unacceptable reliability between clinicians (0.44) and between mothers and clinicians (0.5–0.75).[36]

Recommendations for Practice

None of the assessment tools currently available have formal content validity testing and none have comprehensive reliability testing. Further development and testing is needed before any of the tools can be recommended as valid and reliable measures of infant feeding. Given these limitations, recommendations are made for the assessment tools with the most supportive psychometric development and testing. Figure 2 provides a flow chart to guide the selection of an assessment tool for evaluating bottle- or breast-feeding in the infant less than six months old.

For the bottle-feeding preterm or full-term infant up to 52 weeks post-menstrual age, the EFS is a more comprehensive assessment of feeding and it has more supportive psychometric development and testing than the NOMAS. Specifically, the development of the EFS supports content validity of this tool while the development process is not described for the NOMAS. Additionally, the EFS has acceptable inter-rater and intra-rater reliability, while the NOMAS has inconsistent and/or unacceptable inter-rater and intra-rater reliability. For the assessment of the breast-feeding preterm infant less than 35 weeks post-menstrual age, the EFS has more supportive psychometric development and testing than either the NOMAS or the PIBBS. While the PIBBS also has evidence of content validity, the very limited testing of the current tool with 10 feedings has found unacceptable inter-rater reliability.

For the breast-feeding full-term infant, Figure 2 indicates the assessment tools available that are intended for use in the early post-partum period (< 5 days old) and those intended for use with infants beyond the first 5 days of life. The EFS and BBAT are the two assessment tools with the most supportive psychometric development and testing of the tools available for the breast-feeding full-term infant, regardless of age. The BBAT has evidence of content validity, acceptable inter-rater reliability, and internal consistency reliability was nearing acceptable (0.67).[30] The EFS has not reported testing of internal consistency reliability, but also has evidence of content validity and has acceptable inter-rater and intra-rater reliability. The significant difference between these two tools is the comprehensiveness of the assessment. The BBAT only has 4 items while the EFS has 36 items. The BBAT does not require specialized training and is a faster, more concise assessment, which may be appropriate for assessing the healthy, full-term infant experiencing minimal difficulties. For the infant experiencing more complex feeding difficulties in need of a more comprehensive assessment, the EFS may be more appropriate. There are currently no tools that have been tested with medically-fragile infants other than those born preterm and there are no tools available for assessment of the bottle-feeding infant older than 52 weeks post-menstrual age.

Recommendations for Research

Valid and reliable assessment tools for the evaluation of bottle- and breast-feeding are needed for infants from birth through six months of age. These tools need to be developed and tested for use with infants who are at highest risk for feeding difficulty, particularly those who are medically fragile, as well as with infants who are otherwise healthy. Assessment tools that require specialized training provide an opportunity for continuing

education about feeding, however the requirement for training limits the use of the tool. The development of a tool that is valid and reliable without specialized training would allow for more widespread use. While breast-feeding at breast may be ideal, many medically fragile infants require some bottle-feedings and clinicians need tools to objectively assess the infant's ability to safely and effectively feed. Many of the tools reviewed in this article are promising, but they have not yet been developed and tested comprehensively. Even the EFS, which was identified as the most comprehensive assessment with the most supportive development and testing, needs formal content validity testing, testing of internal consistency reliability, and reported values for inter-rater and intra-rater reliability.

Future research should focus on the psychometric development and testing of tools that can be used for both bottle- and breast-feeding. A tool that can be used for assessment of both feeding methods will allow clinicians to learn one assessment and consistently evaluate feeding regardless of feeding method. For infants who remain hospitalized or are continuing to develop feeding skills, an assessment tool that is intended for clinicians would guide clinical assessment, documentation of feeding, and tailoring of feeding interventions.

For infants who have been discharged from the hospital, but are experiencing feeding difficulty, a parent-report tool would be best. Parents are in the best position to report on typical feeding behavior, which may be different from behaviors seen by clinicians observing a feeding in an environment that is unusual for the infant. A tool that could be used from the time of discharge up through the introduction of solid foods would allow clinicians to follow the progress of feeding development and/or response to feeding treatment over time using the same tool. In some circumstances, the combination of a clinician-report and parent-report tool may provide a comprehensive assessment and help guide discussions between clinicians and parents about feeding concerns. Development and testing of assessment tools is a lengthy, but necessary process to provide clinicians with the tools they need to support best clinical practice and provide optimal care to patients.

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Summary of Recommendations for Practice and Research

What we know

- Feeding difficulty in infants is common and challenging to differentiate from typical feeding.
- Feeding assessment tools allow for objective measurement of bottle- and breast-feeding.
- None of the currently available tools have adequate psychometric testing to ensure validity and reliability.

What needs to be studied

- Feeding assessment tools need to be developed and tested for validity and reliability.
- An ideal tool would measure both bottle- and breast-feeding to allow consistent assessment of both feeding methods.
- A clinician-report tool needs to be developed to guide assessment, tailoring of interventions, and documentation of feeding.
- A parent-report tool needs to be developed for use after hospital discharge to identify infants in need of specialized assessment and treatment.

What we can do today

- The Early Feeding Skills Assessment (EFS) has the most supportive psychometric development and testing for assessment of bottle- and breast-feeding in the preterm infant through 52 weeks post-menstrual age and the full-term infant experiencing complex feeding difficulties.
- The Bristol Breastfeeding Assessment Tool (BBAT) has the most psychometric support for assessment of breast-feeding in healthy, full-term infants experiencing minimal feeding difficulties.

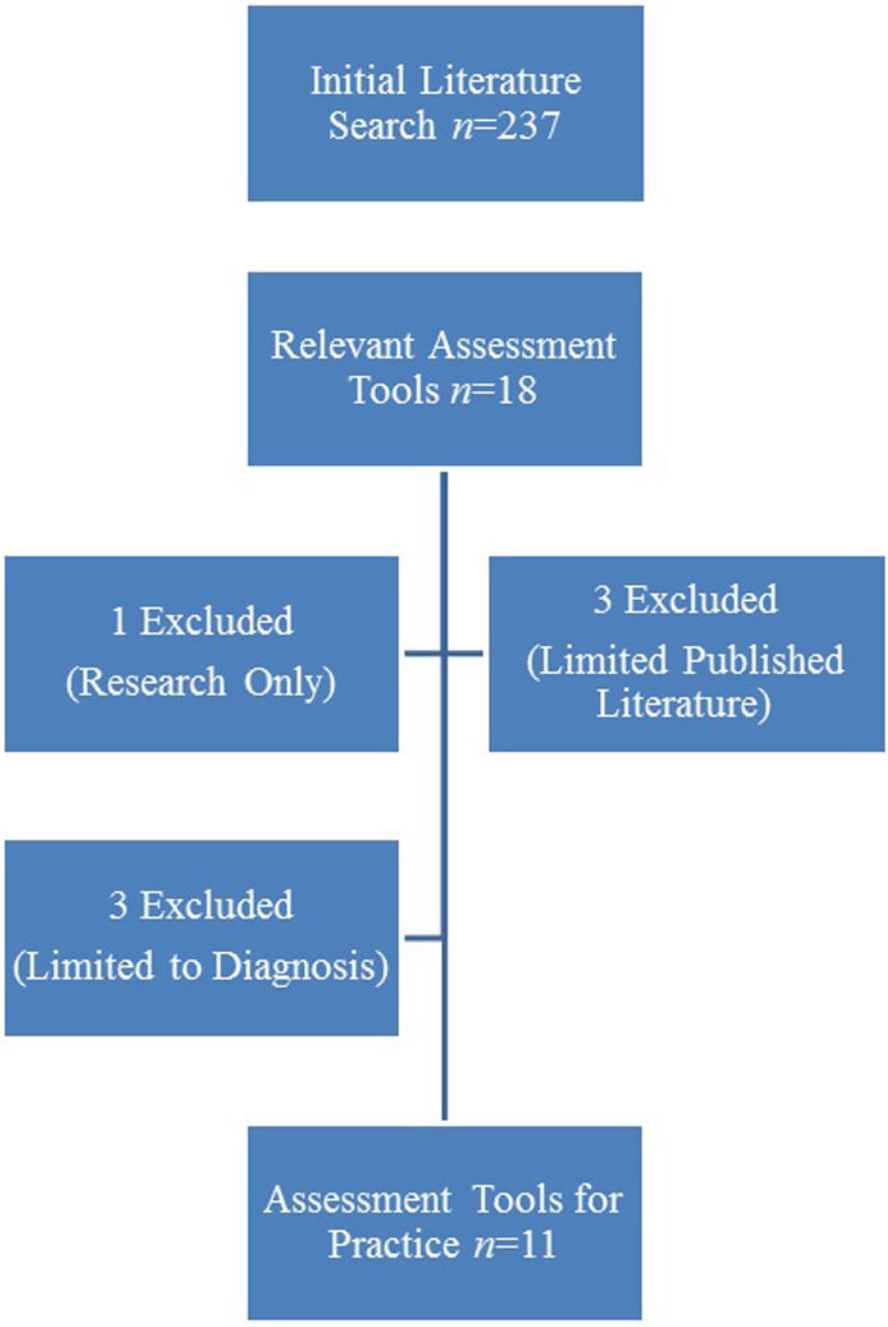

Figure 1.

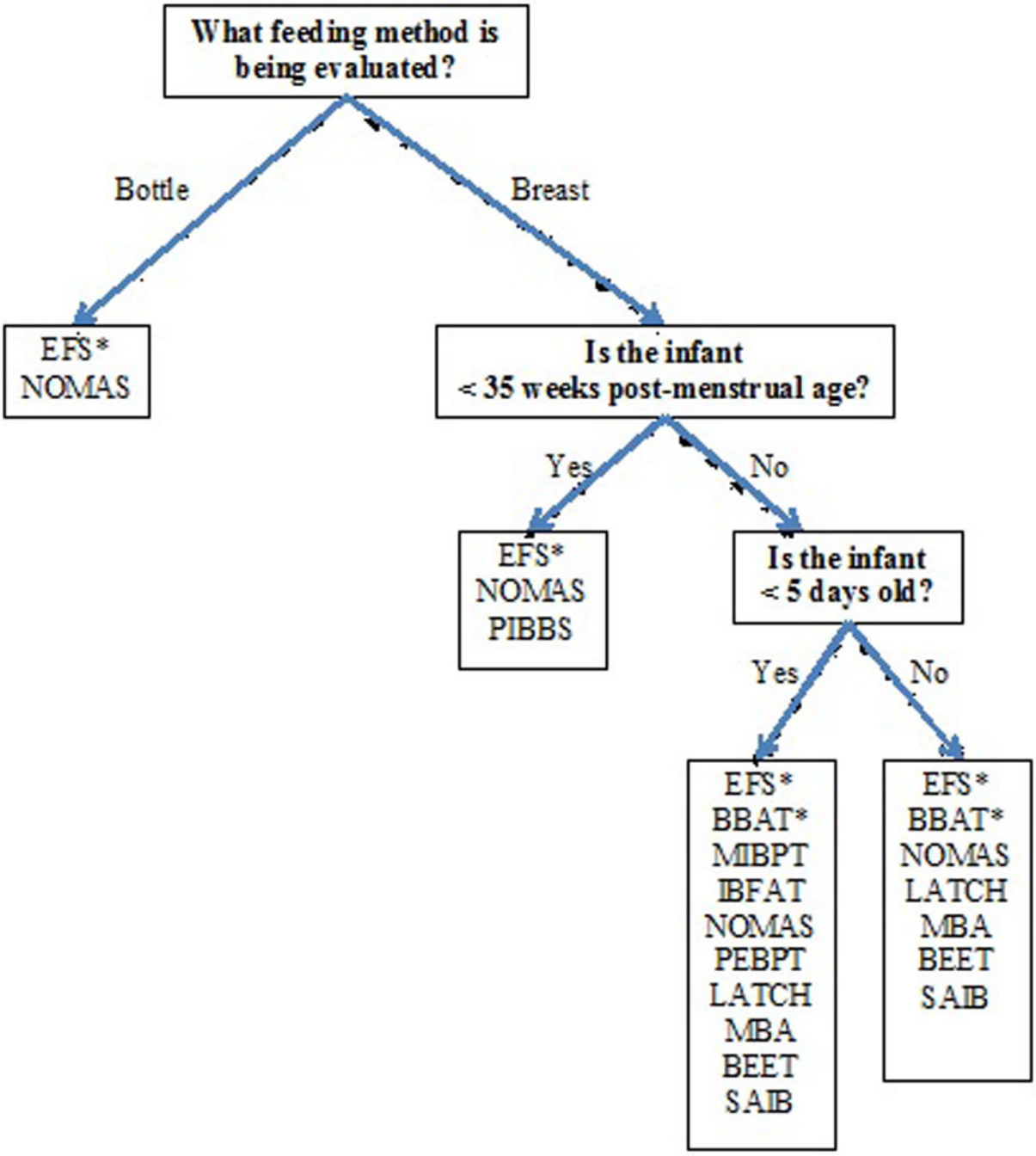

Figure 2.
Flow chart to guide selection of a feeding assessment tool. * Indicates recommended.

Table 1

Feeding Assessment Tools for Infants Less than 6 months old

Tool (Author)	Purpose	Target Population & Age	Feeding Method	Intended User	Psychometric Testing
Breastfeeding Evaluation and Education Tool (BEET)[28]	To guide assessment of breastfeeding, identify problems, and facilitate seeking assistance.	Healthy, full-term young infants (age not specified)	Breast	Motheror Clinician	None. This is a list of questions/ interview and assessment guide. No scoring system.
Bristol Breastfeeding Assessment Tool (BBAT)[30]	To facilitate accurate, rapid breast feeding assessment and targeted advice to mothers acquiring skills or experiencing problems.	Tested with healthy, full-term infants up to 10 weeks old.	Breast	Clinician	Evidence of content validity, but no testing done. Internal reliability slightly below acceptable, but inter-rater reliability acceptable.
Early Feeding Skills Assessment (EFS)[22]	To standardize assessment of feeding skills and individualize interventions.	Preterm infants through 52 weeks post-menstrual age.	Breast or Bottle	Clinician *Specialized training required	Evidence of content validity, but no testing. Acceptable inter- and intra-rater reliability.
Infant Breastfeeding Assessment Tool (IBFAT)[31]	To measure infant breastfeeding competence.	Healthy, full-term infants < 5 days old.	Breast	Mother or Clinician	Evidence of content validity, but no testing. Inconsistent inter-rater reliability.
LATCH[32]	To standardize assessment and teaching of breastfeeding.	Not specified	Breast	Mother or Clinician	Evidence of content validity but no testing. Inconsistent inter-rater reliability.
Mother-Baby Assessment (MBA)[33]	To assist clinicians in documenting their observations of breastfeeding.	Not specified	Breast	Clinician	No content validation. Inconsistent inter-rater reliability.
Mother Infant Breastfeeding Progress Tool (MIBPT)[34]	To assess maternal and infant behaviors and skills for breastfeeding and guide support and education.	Healthy, late preterm and term infants (35–42 weeks post-menstrual age) during post-partum hospital stay (2-5 days old).	Breast	Clinician	Evidence of content validity & informal assessment. Acceptable inter-rater reliability.
Neonatal Oral Motor Assessment Scale (NOMAS)[23]	To qualify and describe patterns of disorganized and dysfunctional sucking.	Preterm, medically fragile, and chronically ill infants.	Breast or Bottle	Clinician *Specialized training required	No evidence of content validation. Results of reliability testing inconsistent and/or unacceptable.
Potential Early Breastfeeding Problem Tool (PEBPT)[35]	To elicit early breastfeeding events that may be indicative of breast-feeding problems.	Healthy, full-term infants during post-partum hospitalization.	Breast	Clinician	Evidence of content validity, but no testing. Acceptable internal consistency reliability.
Premature Infant Breastfeeding Behavior Scale (PIBBS)[36]	To facilitate clinical observation of preterm infant breastfeeding behavior.	Hospitalized preterm infants.	Breast	Mother or Clinician	Evidence of content validity, but no testing. Inter-rater reliability of revised tool unacceptable.
Systematic Assessment of the Infant at Breast (SAIB)[29]	To evaluate the effectiveness of the infant's contribution to breastfeeding.	Healthy, full-term infants (age not specified).	Breast	Clinician	None. This is an assessment/ teaching guide. No scoring system.