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Comparative analysis of different maternal recall methods for assessing exclusive breastfeeding in the Southern Nations Nationalities and People's Region, Ethiopia

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Comparative analysis of different maternal recall methods for assessing exclusive breastfeeding in the Southern Nations Nationalities and People's Region, Ethiopia

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2014

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Abstract

Comparative analysis of different maternal recall methods for assessing exclusive breastfeeding in the Southern Nations Nationalities and People's Region, Ethiopia

By Tsedenia Tewodros

Background: Exclusive breastfeeding (EBF) for the first 6 months of life reduces morbidity, mortality, diarrhea and respiratory tract infections among infants and protects from exposure to suboptimal water and sanitation conditions at an early age. The WHO recommends EBF for 6 months. EBF can be assessed through surveys that rely on maternal recall (such as 24-hour, 7-day and since-birth recall surveys). Point-in-time surveys like the 24-hour and 7-day recalls do not capture EBF for the full 6 months while since-birth recalls are prone to recall bias. This study aims to investigate differences between the three maternal recall methods and to understand whether any sociodemographic factors are associated with discordance between methods.

Methods: Data were collected from SNNPR, Ethiopia. Exclusive breastfeeding was assessed using the 24-hour and 7-day recalls at baseline and the since-birth recall at midline. Overall prevalence of EBF and prevalence by age was calculated and compared. Two-by-two tables were used to compare EBF classification across methods and to determine discordance between the 24-hour and since-birth recalls. Logistic regression was used to examine any associations between sociodemographic characteristics and discordance.

Results: 509 households were included in the analytic sample. EBF prevalence was 80.6%, 79.6%, and 74.7% using the 24-hour, 7-day, and since-birth recalls respectively. The 24-hour and since-birth recalls disagreed on EBF classification of 26% of the sample. The 24-hour and 7-day recalls showed decreasing EBF trends with increasing age. The since-birth recall showed lower rates of EBF in the first month compared to the other two methods. Foods and liquids such as *hamesa*, water, traditional foods and juice were reported at a higher rate using the since-birth recall than the other two methods. Child's age at baseline and district of residence were significantly associated with discordance.

Conclusions: Although overall prevalence was similar across methods, there were differences by age. The point-in-time methods may be missing foods introduced in the early months. Measurement methods should be selected based on the purpose of assessment and include more rigorous assessments of foods given in the first month of life.

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List of Acronyms

ANC	Antenatal care
BFHI	Baby Friendly Hospital Initiative
CI	Confidence interval
CIP	International Potato Center
DHS	Demographic Health Survey
DTM	Dose-to-mother
EBF	Exclusive breastfeeding
HBT	Health baby toolkit
HEW	Health Extension Worker
HLC	Healthy living club
IYCF	Infant and young child feeding
NMOI	Non-milk oral intake
OFSP	Orange fleshed sweet potato
ORS	Oral rehydration therapy
PBF	Predominant breastfeeding
QDBH	Quality Diets for Better Health
SNNPR	Southern Nations, Nationalities and People's Region
UNICEF	United Nations Children's Fund
WHO	World Health Organization

Chapter 1: Literature Review

Propper nutrition in the first two years of a child's life are critical for short- and long-term growth and development. In addition to maternal feeding practices, the World Health Organization (WHO) recommends specific components of infant and young child feeding (IYCF) practices for optimal child growth (Victora et al., 2016). These components, which have been operationalized as measurable indicators, are as follows:

1. *Early initiation of breastfeeding* – breastfeeding a child within the first hour of birth
2. *Exclusive breastfeeding* – feeding the child only breastmilk for the first 6 months of life
3. *Timely and age-appropriate complementary feeding*[1] – initiating solid and semi-solid foods after 6 months and increasing the frequency and variety of these foods according to the age of the child
4. *Continued breastfeeding* – breastfeeding the child until 2 years of age as a supplement to complementary foods

The emphasis on breastfeeding practices in early life is a result of extensive research that shows the benefits of breastfeeding to both mothers and infants. Breastmilk provides infants with nutritional supply and strengthens their immunity. Because colostrum (the first yellow milk after delivery) and breastmilk are laced with maternal immune cells, they act as antibiotics that protect infants against infections (Victora et al., 2016). Breastfeeding has been associated with lower rates of morbidity and mortality among infants and mothers. A 2016 meta-analysis found that increased breastfeeding had strong protective effects against diarrhea and diarrhea related hospitalizations, lower respiratory tract infections and otitis media (ear infections). In the long term, extended periods of breastfeeding can result in a 26% reduction in the odds of overweight or obesity and a 35% decrease in type 2 diabetes incidence. Additionally, increased duration

[1] Complementary feeding is assessed through a combination of indicators that focus on timely introduction of complementary foods, dietary diversity and meal frequency

of breastfeeding has been associated with increased intelligence, as measured through Intelligence Quota tests. This manifests in adulthood as increased income and completed years of schooling. Among mothers, breastfeeding has a protective effect against breast and ovarian cancer and has positive effects on birth spacing. This meta-analysis found that scaling-up breastfeeding to ensure all infants were breastfed would have resulted in 823,000 child and 20,000 maternal deaths prevented (Victora et al., 2016).

Box 1. Definitions of Breastfeeding:

Although breastfeeding is a major public health nutrition research focus globally, there are inconsistencies in definitions of different levels of breastfeeding among publications (M. H. Labbok & Starling, 2012). The most generally accepted definitions, presented below, were developed by the WHO and partners. However, these definitions were determined with a global focus on infant feeding and with minimal consideration for the physiological implications for maternal health research (M. H. Labbok & Starling, 2012). The WHO definitions are as follows (World Health Organization (WHO), 2008a):

Early initiation of breastfeeding: feeding a baby breastmilk within the first hour of birth

Exclusive breastfeeding: feeding a child breastmilk only (including expressed milk or from a wet nurse) with the exception of medicines, vitamin/mineral supplements and oral rehydration therapy (ORT)

Predominant breastfeeding: breastmilk is the main source of nourishment but allows for water and water-based drinks, juice, vitamin/mineral supplements, medicines and ORT

Bottle-feeding: any liquid, including breastmilk, fed through a bottle with a teat

Other terms used in relation to breastfeeding but not included in the WHO indicators include (M. H. Labbok & Starling, 2012):

Full breastfeeding: Exclusive breastfeeding and predominant breastfeeding can sometimes be referred to as full breastfeeding due to breastmilk being the main source of nourishment.

Partial breastfeeding: also referred to as mixed feeding, partial breastfeeding can have different levels – low, medium and high. These levels depend on the proportion of breastmilk that the child consumes compared to other foods/liquids.

Benefits of Exclusive Breastfeeding

Exclusive breastfeeding (EBF) is defined as consumption of only breastmilk for the first 6 months of a child's life (Daelmans, Dewey, & Arimond, 2009). Prior to 2001, this definition only made exceptions for vitamin and mineral supplements or medication given to an infant (Greiner, 2014). The WHO has since revised its definition of EBF to include oral rehydration therapy (ORT).

Exclusive breastfeeding has a strong protective effect against infant mortality; mortality due to infection among exclusively breastfed children 6 months and younger is 0.56 (95% CI: 0.41-0.85) times that of non-exclusively breastfed children of the same age group (Victora et al., 2016). Similar indicators to exclusive breastfeeding include predominant breastfeeding (PBF) and partial breastfeeding [Box 1]. Although predominant breastfeeding refers to children that

receive most of their nourishment from breastmilk, it also includes ORT, supplements, medication, water, water-based drinks and fruit juice (World Health Organization (WHO), 2008b). Studies that compared the effects of EBF for four months with EBF for six months found lower morbidity due to gastrointestinal infection among children exclusively breastfed for 6 months with no significant adverse effects associated with longer duration of EBF (Kramer & Kakuma, 2012). For the first 6 months of life, breastmilk completely fulfils the protein, energy, calcium and vitamin D requirements of an infant, regardless of maternal dietary intake (N. Butte, F., Lopez-Alarcon, M. G., Garza, C., 2002). Whether breastmilk meets infants' requirements of certain nutrients, namely fat-soluble vitamins such as vitamin A, and certain B vitamins (including B6 and B12), is dependent on maternal diet. Conversely, for minerals like iron and zinc, or other water-soluble vitamins such as vitamin C, maternal intake does not affect availability in breastmilk. That said, adequate maternal iron status during pregnancy and at birth only meets the infant's iron requirements for the first three months of life (N. Butte, F., Lopez-Alarcon, M. G., Garza, C., 2002). Therefore, exclusively breastfed infants may require iron supplementation between 3-6 months of age, especially if the mothers' iron stores were inadequate during pregnancy or in cases of preterm and low birth weight children (Perez-Escamilla, Buccini, Segura-Perez, & Piwoz, 2019).

Although the WHO recommends EBF until 6 months, there is some contention about whether breastmilk is nutritionally adequate for children older than four months. One study from the United Kingdom found that breastmilk no longer meets the energy requirements of children older than four months of age (J. J. Reilly, Wells, J. C. K., 2005). This study estimates that breastmilk meets only 90% of a child's energy needs in the 5-6 month period; breastmilk provides 525-574 kilocalories per day of metabolizable energy while a child of that age requires 632-649 kilocalories per day (J. J. Reilly, Ashworth, S., Wells, J. C. K., 2005).

Calls for changing the WHO recommendations to EBF for four months instead of 6 are often predicated on arguments about the nutritional inadequacy of breastmilk. For example, although iron is highly bioavailable in breastmilk, it exists in small amounts. Because maternal diet cannot affect iron levels in breastmilk and because iron supplementation programs for infants require strong health systems, some argue for early introduction of iron rich foods to mitigate risks of iron deficiency (Perez-Escamilla et al., 2019). However, such arguments don't take into account settings where water, sanitation and hygiene facilities are not consistently available. Preparation of complementary foods requires clean and safe drinking water and hygienic environments to protect the infant from infection. In the absence of such environments, early introduction of complementary foods and infant formula could lead to increased morbidity and mortality (Lamberti, Fischer Walker, Noiman, Victora, & Black, 2011). Additionally, introducing complementary foods, infant formula or other fluids can compete with the child's consumption of breastmilk, the more nutritious option (Brown, 1998). Reduced consumption of breastmilk then leads to reduced production by the mother, as breastmilk production is dependent on demand.

Global Trends of Breastfeeding

Globally, rates of breastfeeding are closely associated with wealth and national income. High-income countries have lower rates of any breastfeeding whereas low- and middle-income countries in Africa, Latin America and South Asia have the highest rates of breastfeeding (Victora et al., 2016). Within country analyses show similar trends; populations at the lowest wealth quintile have higher rates of breastfeeding than those in the highest wealth quintile. However, rates of increase in breastfeeding are faster among richer segments of populations and are slowing down in poorer segments. Global trends also show that prevalence of any breastfeeding and breastfeeding among 6 and 12-month-old children were generally higher than prevalence of exclusive breastfeeding and early initiation of breastfeeding.

As of 2016, only 40% of infants 0-6 months old were exclusively breastfed globally (Hawkes, 2017). This is a result of a slow and steady increase over the last two decades. Global prevalence of exclusive breastfeeding in 1993 was 24.9% (Victora et al., 2016). The greatest increase in EBF prevalence within this time period was observed in Western and Central African countries followed by countries Eastern and Southern Africa (Cai, Wardlaw, & Brown, 2012). In these areas, the most prominent reasons for the increase in exclusive breastfeeding prevalence were reduced consumption of water, juice and infant formula prior to 6 months of age.

Changes in policy and extensive advocacy by the nutrition community has contributed to the increase in global exclusive breastfeeding prevalence. In 1989, the WHO and UNICEF sponsored the development of a set of guidelines that outline the steps needed for health facilities to provide adequate support to new mothers to begin and sustain exclusive breastfeeding with their newborns (Naylor, 2001). These steps, called The Ten Steps to Successful Breastfeeding, included statements about training of health care staff and guidelines on providing mothers information on initiation of breastfeeding, breastfeeding on demand and techniques of breastfeeding ("Protecting, promoting and supporting breastfeeding: the special role of maternity services. A joint WHO/UNICEF statement," 1990). They also included restrictions on provision of food or drink other than breastmilk, artificial teats or pacifiers. These Ten Steps were then operationalized as The Baby Friendly Hospital Initiative (BFHI) in 1992, a global initiative that designates health facilities as BFHI based on their implementation and adherence of the Ten Steps. Although there was no statistically significant difference in EBF trends before and after the BFHI, the BFHI has been associated with a significant annual increase of exclusive breastfeeding since its implementation (Abrahams & Labbok, 2009).

Aggressive marketing of milk formula as a substitute for breastmilk by corporate companies has also had a negative effect on breastfeeding prevalence. Despite the nutrition community's

efforts, milk formula sales increased from $2 billion to $40 billion between 1987 and 2013, with the largest increase documented in low and middle-income countries in Africa and the Middle East (Piwoz & Huffman, 2015). Marketing of breastmilk substitutes target mothers and their communities, healthcare professionals and policy makers and are often done through mass media, promotion of free samples at health facilities and lobbying efforts targeting decision-makers. This marketing has been associated with decreased exclusive breastfeeding prevalence (Piwoz & Huffman, 2015). The International Code of Marketing of Breast Milk Substitutes, adopted in 1981, provides guidance on policies that restrict the advertising activities of corporate milk substitute companies. However, few countries have adopted The Code, and even fewer have put in tangible steps for implementing, enforcing and monitoring it.

The Global Nutrition Targets developed at the annual World Health Assembly in 2012 determined that the nutrition community should aim to increase the global prevalence of exclusive breastfeeding to 50% by 2025 (World Health Organization (WHO), 2017) . According to the 2017 Global Nutrition Report, the current status of exclusive breastfeeding is classified as "very limited progress" towards achieving the 2025 target (World Health Organization (WHO), 2017). Additionally, because of the association of breastfeeding with morbidity and mortality, EBF prevalence has a direct impact on achieving several of the health and nutrition targets set in the Sustainable Development Goals. Assessing progress towards these targets rely on rigorous measurement and assessment methods that provide accurate estimates of EBF.

Measurement and Assessment of Exclusive Breastfeeding

Exclusive breastfeeding assessment can be done in many different ways. The most accurate "gold standard" method of measurement is the stable isotope method (also called the deuterium dilution dose-to-mother [DTM] method) whereby a breastfeeding mother drinks solution labeled with deuterium isotope (Mulol & Coutsoudis, 2018). This liquid mixes with the

mother's body water and appears in her breast milk. An exclusively breastfed child will have very low levels of unlabeled water (i.e. water from sources other than mother's breast milk). This biochemical method sets a maximum amount of non-milk oral intake (NMOI) as a cut-off to determine exclusive breastfeeding status – infants that have NMOI levels less than the predetermined cut-off are considered exclusively breastfed. Although this method is accurate, it requires seven samples over 14 days and is not representative of breastfeeding patterns over time; therefore, it is expensive and unsuitable for large-scale surveys (Mulol & Coutsoudis, 2018). As the gold standard method of measurement, the DTM method can be used to validate point-in-time recall methods (described below) by comparing mothers' responses to the results of the biochemical assessment. The DTM method itself has been validated against methods that weigh infants before and immediately after breastfeeding (N. F. Butte, Wong, Patterson, Garza, & Klein, 1988) and by measuring the weight of the bottles containing liquids that infants drink before testing (Infante et al., 1991). However, because the method uses the level of non-human liquid an infant consumes, standards to determine cut-offs based on biological significance need to be determined and agreed upon by the nutrition community (Medoua, 2011).

For large-scale surveys, the WHO recommends conducting 24-recall surveys among infants 0-6 months of age (World Health Organization (WHO), 2010). For this method, mothers or caregivers are asked to recall all liquids and food items their child consumed within the past 24 hours before the survey. These 24-hour recall surveys can be closed or open – in closed recalls, the interviewer provides the mother with a list of commonly consumed items and asks whether the child consumed each item whereas open recalls allow the mother to list all consumed items without a providing a predetermined list. This method is conducive to large-scale cross-sectional surveys because it is measured at one point in time and does not require extra equipment (Greiner, 2014). It also minimizes bias in the data caused by maternal recall

by focusing on short-term feeding habits. However, there are some questions about the accuracy of 24-hour recalls. As mentioned, exclusive breastfeeding is recommended up to 6 months of life. Children surveyed in 24-hour recall methods that have not yet reached 6 months may change their EBF status after the time of the survey; therefore, the indicator of EBF calculated by this method can only measure current prevalence of EBF among children 0-6 months of age. However, this indicator is often misrepresented as the proportion of children that exclusively breastfeed up to 6 months and thereby met the WHO recommendation (Greiner, 2014). To mitigate this issue, the WHO modified its recommendation for EBF measurement methods to encourage researchers to also report EBF prevalence disaggregated into smaller age groups of 0-1 months, 2-3 months, 4-5 months and 0-3 months where sample sizes are large enough (World Health Organization (WHO), 2010).

Similar to 24-hour recall, a 7-day recall method is a point-in-time method that relies on maternal recall of the child's diet (Greiner, 2014). As the name suggests, this method requires mothers and caregivers to recall all food and liquid items a child consumed over the 7 days prior to the survey. Although this method can be open or closed, it is often a closed recall where mothers are also asked how many days the child consumed a specific item. Because this method still samples children 0-6 months old, it has similar limitations to the 24-hour recall.

Another common method of EBF assessment in surveys is the "since-birth" recall method. This method can sample infants 0-6 months or those older than 6 months. Again, mothers are provided with a list of food and liquid items and asked when (at what month) their child first consumed each item. Because this method also asks about solid and semi-solid foods among children older than 6 months, it can be used to determine timely initiation of complementary feeding. The difference in prevalence of EBF between since-birth recalls that sample children

older than 6 months and point-in-time recalls that sample children 0-6 months old decreases as the age of the children in the latter sample gets closer to 6 months.

Social Desirability and Recall Bias in Reporting EBF Status

As a pillar of optimal IYCF, and because of the WHO recommendations, exclusive breastfeeding is widely promoted through health efforts in many low-resource settings. Large-scale promotion by health workers and hospitals creates an environment that normalizes exclusive breastfeeding for the first 6 months of a child's life. Therefore, in an attempt to operate within these social norms, mothers can misreport their child's exclusive breastfeeding status. This type of systematic bias, known as social desirability bias, has been shown to affect dietary recall studies (Kristal, Andrilla, Koepsell, Diehr, & Cheadle, 1998). Depending on the variable of investigation, some studies show that social desirability bias is higher among women than men (Herbert, 1995; Kristal et al., 1998) and is especially prevalent in situations where the goal of an intervention or research study is made clear to respondents. Studies exploring this type of bias in substance and alcohol abuse surveys found that older respondents and those with lower socioeconomic status were more likely to misreport (Welte & Russell, 1993).

Another potential source of information bias relevant to exclusive breastfeeding assessment is recall bias. Recall bias can refer to misreporting 1) based on *length* of recall period where respondents forget the facts or 2) based on *selective* recall where respondents focus on memorable and impactful events (Fadnes, 2008). The potential for recall bias is higher in dietary recall surveys that try to establish long-term food consumption patterns than shorter point-in-time surveys. However, these longer-term recalls may be more representative of normal dietary patterns and less prone to errors that result from daily variations. For breastfeeding duration, some studies have shown that mothers who had multiple children were less likely to misreport duration of breastfeeding than mothers who had few children

(Promislow, Gladen, & Sandler, 2005). One interesting method to adjust for recall bias in randomized control trials is the Minnesota Multiphasic Personality Inventory (MMPI). This method exposes respondents to "fake" risk factors at the beginning of the study (Fadnes, 2008). Recall of these risk factors is assessed at the end of the study, along with recall of variables of interest. Respondents that overestimate the predetermined risk factor are also assumed to overestimate the variable of interest. Thereby, recall bias can be adjusted for during data analysis.

Systematic bias due to social desirability or recall can affect research study findings and conclusions by attenuating potential associations between exposures and outcomes of interest that rely on maternal self-report. Several studies have assessed the validity and reliability of methods of EBF assessment. The DTM gold standard, by design, is immune to social desirability and recall bias as it is not dependent on maternal recall and self-report. When compared to the gold standard, all types of maternal recall methods are less accurate and overestimate exclusive breastfeeding status (Medoua, 2011). Generally, long-term maternal recalls are more valid and reliable assessment methods of *early initiation* of breastfeeding and duration of *any* breastfeeding (Li, Scanlon, & Serdula, 2005). However, accuracy of these measurements was much lower for *exclusive* breastfeeding. While some studies find that prospective assessment methods are more accurate than retrospective methods (Agampodi, Fernando, Dharmaratne, & Agampodi, 2011), others show that point-in-time methods may overestimate EBF prevalence when compared to retrospective methods (Greiner, 2014) or since-birth methods employed at a similar time point (Engebretsen et al., 2007).

Implications for Policy and Programming

The WHO recommended method is used by many national and large-scale surveys. For example, the Demographic Health Survey (DHS) program, a Unites States Agency for International Development (USAID) funded program that conducts regular national surveys in

many low- and middle-income countries, uses the 24-hour recall method for EBF assessment. Using this method, the DHS can estimate the proportion of children that are exclusively breastfed and the median duration of exclusive breastfeeding in the sample. According to the WHO guidance, median duration of EBF is calculated from a sample of children 0-35 months old (as opposed to the sample of 0-6-month-old children used to estimate EBF prevalence). This indicator, which is slightly more complicated, divides the sample by two-month increment age groups (World Health Organization (WHO), 2010). It then determines the proportion of exclusively breastfed children in each age group. Using these proportions, median age at which fewer than 50% of children were exclusively breastfed within the previous 24 hours is calculated.

The results of the DHS in different countries affects the main public health focus areas in these countries and has implications for nutrition programming by governmental and non-governmental agencies. Additionally, accurate estimations of EBF prevalence are necessary to understand our progress towards the 2025 Global Nutrition Targets as well as the Sustainable Development Goals.

Exclusive Breastfeeding Statistics in Ethiopia

Data for this study were obtained from a parent study conducted in 20 kebeles (districts) in the Sidama and Gedeo zones of the Southern Nations, Nationalities and Peoples Region (SNNPR) of Ethiopia. The parent study was a longitudinal cluster-randomized control trial that aimed to investigate the Quality Diets for Better Health (QDBH) project's effects on vitamin A and energy intake of young children in the region.

As an ethnic federalism, Ethiopia's governance regions are divided into sovereign states based on ethnic groups – the Amhara region consists predominantly of the Amhara people, the Oromia region consists predominantly of Oromo people and so on. SNNPR is located in the

southern part of the country and consists of over forty five smaller ethnic groups that have been combined for governance structures. Like all other regions in Ethiopia, the Health Extension System is the main source of primary healthcare in SNNPR (Yitayal, Berhane, Worku, & Kebede, 2014). The main pillars of this health extension system are the Health Extension Workers (HEWs) stationed at health centers and health posts in every kebele throughout the country. HEWs are in charge of coordination of kebele health activities, provide health promotion and counseling (including nutrition counseling) and perform basic clinical assessments.

According to the 2016 Ethiopian Health Demographic Survey (Central Statistical Agency (CSA) [Ethiopia], 2016) the national prevalence of exclusive breastfeeding among 0-6 month old infants is 57.5% with a median duration of exclusive breastfeeding of 3.1 months. This is an increase from the 2011 EDHS which found that EBF prevalence was 52% with an average EBF duration of 2.3 months (Central Statistical Agency (CSA) [Ethiopia] and ICF International, 2012). Currently, EBF prevalence among 5-6-month old children in Ethiopia is only 36%. Prevalence of EBF in SNNPR is 60% (Alive and Thrive, 2018), the second highest prevalence by region in the country (Alebel, Tesma, Temesgen, Ferede, & Kibret, 2018). The median duration of EBF in SNNPR is 3 months, much lower than the WHO recommendation (Central Statistical Agency (CSA) [Ethiopia], 2016).

Similar to national trends, prevalence of stunting in SNNPR has decreased; between 2010 and 2016, stunting prevalence decreased from 61% to 39% (Alive and Thrive, 2018). Meanwhile, food insecurity seems to be a major challenge in this region where 42% of households are food insecure compared to a national average of 23% (*LSMS - Integrated Surveys on Agriculture: Ethiopia Socioeconomic Survey*, 2017).

Aims and Objectives of the Study

The research presented in this paper aims to contribute to our existing understanding of the differences between exclusive breastfeeding measurement methods by comparing 7-day, 24-hour and "since birth" recall methods. The specific objectives of the study are:

1. To estimate and compare exclusive breastfeeding prevalence using the methods mentioned above.
2. Further investigating discordance between methods by determining whether there are any sociodemographic factors associated with misreporting a child's exlusive breastfeeding status.

Chapter 2: Manuscript

Contribution of the student

Data for this study were obtained from the Quality Diets for Better Health project funded by the European Union, led by the International Potato Center (CIP) and implemented in partnership with Emory University and People in Need. The team at Emory University led the baseline and midline evaluations. As a graduate research assistant, I became involved in the project after the collection of the midline data and supported with translating and validating data entry. I conducted analysis of the data for this study and developed the tables and figures with constant discussion and guidance from my thesis chair, Dr. Amy Webb Girard, and Emily Faerber, a PhD candidate that led the design, data collection and analysis efforts of the evaluation.

Comparative analysis of different maternal recall methods for assessing exclusive breastfeeding in the Southern Nations Nationalities and People's Region, Ethiopia

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ABSTRACT

Background: Exclusive breastfeeding (EBF) for the first 6 months of life reduces morbidity, mortality, diarrhea and respiratory tract infections among infants and protects from exposure to suboptimal water and sanitation conditions at an early age. The WHO recommends EBF for 6 months. EBF can be assessed through surveys that rely on maternal recall (such as 24-hour, 7-day and since-birth recall surveys). Point-in-time surveys like the 24-hour and 7-day recalls do not capture EBF for the full 6 months while since-birth recalls are prone to recall bias. This study aims to investigate differences between the three maternal recall methods and to understand whether any sociodemographic factors are associated with discordance between methods.

Methods: Data were collected from SNNPR, Ethiopia. Exclusive breastfeeding was assessed using the 24-hour and 7-day recalls at baseline and the since-birth recall at midline. Overall prevalence of EBF and prevalence by age was calculated and compared. Two-by-two tables were used to compare EBF classification across methods and to determine discordance between the 24-hour and since-birth recalls. Logistic regression was used to examine any associations between sociodemographic characteristics and discordance.

Results: 509 households were included in the analytic sample. EBF prevalence was 80.6%, 79.6%, and 74.7% using the 24-hour, 7-day, and since-birth recalls respectively. The 24-hour and since-birth recalls disagreed on EBF classification of 26% of the sample. The 24-hour and 7-day recalls showed decreasing EBF trends with increasing age. The since-birth recall showed lower rates of EBF in the first month compared to the other two methods. Foods and liquids such as *hamesa*, water, traditional foods and juice were reported at a higher rate using the since-birth recall than the other two methods. Child's age at baseline and district of residence were significantly associated with discordance.

Conclusions: Although overall prevalence was similar across methods, there were differences by age. The point-in-time methods may be missing foods introduced in the early months. Measurement methods should be selected based on the purpose of assessment and include more rigorous assessments of foods given in the first month of life.

BACKGROUND

Proper nutrition in the first two years of a child's life are critical for short- and long-term growth and development. In addition to maternal feeding practices, the World Health Organization (WHO) recommends specific components of infant and young child feeding (IYCF) practices for optimal child growth (Victora et al., 2016). These components, which have been operationalized as measurable indicators, are: early initiation of breastfeeding, exclusive breastfeeding for 6 months, timely and age-appropriate complementary feeding[2], and continued breastfeeding until age 2.

Benefits of Exclusive Breastfeeding

Breastmilk provides infants with nutritional supply and strengthens their immunity. Exclusive breastfeeding (EBF) is defined as consumption of only breastmilk, with the exception of medicines, vitamin and mineral supplements and oral rehydration therapy (Daelmans et al., 2009). EBF for 6 months has a strong protective effect against infant mortality; mortality due to infection among exclusively breastfed children 6 months and younger is 0.56 (95% CI: 0.41-0.85) times that of non-exclusively breastfed children of the same age group (Victora et al., 2016). For the first 6 months of life, breastmilk completely fulfils the protein, energy, calcium and vitamin D requirements of an infant, regardless of maternal dietary intake (N. Butte, F., Lopez-Alarcon, M. G., Garza, C., 2002). For other nutrients, such as vitamin A, B6 and B12, availability in breastmilk is dependent on maternal diet. Introduction of non-breastmilk fluids and foods requires clean and safe drinking water and hygienic environments. In the absence of such environments, early introduction of complementary foods could lead to increased morbidity and mortality due to infection (Lamberti et al., 2011). Therefore, EBF reduces opportunities of infection that result from suboptimal water and sanitation conditions.

[2] Complementary feeding is assessed through a combination of indicators that focus on timely introduction of complementary foods, dietary diversity and meal frequency

As of 2016, only 40% of infants 0-6 months old were exclusively breastfed globally (Hawkes, 2017), a significant increase from 24.9% in 1993 (Victora et al., 2016). The Global Nutrition Targets aim to increase global EBF prevalence to 50% by 2025 (World Health Organization (WHO), 2017). Assessing progress towards this target relies on rigorous measurement and methods that provide accurate estimates of EBF.

Measurement and Assessment of Exclusive Breastfeeding

Stable Isotope Method: The most accurate "gold standard" method of assessing EBF is the stable isotope method (also called the deuterium dilution dose-to-mother [DTM] method) whereby a breastfeeding mother drinks solution labeled with deuterium isotope (Mulol & Coutsoudis, 2018) that labels her breastmilk. An exclusively breastfed child will have very low levels of unlabeled water (i.e. water from sources other than mother's breast milk). Although this biochemical method is accurate, it is expensive and unsuitable for large-scale surveys (Mulol & Coutsoudis, 2018).

Point-in-time Methods: For large-scale surveys, the WHO recommends conducting 24-hour recall surveys among infants 0-6 months of age (World Health Organization (WHO), 2010). Mothers or caregivers are asked to recall all liquids and food items their child consumed within the 24 hours before the survey. Similarly, the 7-day recall method relies on maternal recall of the child's diet over the 7 days preceding the survey (Greiner, 2014). Both methods are inexpensive and can be measured at one point in time. Therefore, they are conducive to large-scale cross-sectional surveys (5). However, both methods sample children who have not yet reached 6 months and may change their EBF status between the time of the survey and their 6th month. Therefore, these point-in-time methods cannot calculate the proportion of children that were exclusively breastfed for the full 6 months.

Since-birth recall method: this method can sample infants 0-6 months or those older than 6 months. Again, mothers are provided with a list of food and liquid items and asked when (at what month) their child first consumed each item.

Bias in exclusive breastfeeding measurement

Maternal recall methods are prone to social desirability and recall bias. As a pillar of optimal IYCF, EBF is widely promoted through health efforts in many low-resource settings as a desired behavior in the community. In an attempt to operate within these social norms, mothers can misreport their child's EBF status. This type of systematic bias, known as social desirability bias, has been shown to affect dietary recall studies (Kristal et al., 1998). On the other hand, recall bias can refer to misreporting 1) based on length of recall period where respondents forget the facts or 2) based on selective recall where respondents focus on memorable and impactful events (Fadnes, 2008).

Exclusive breastfeeding in Ethiopia

In 2016 the national prevalence of EBF among children 0-6 months in Ethiopia was 57.5% (Central Statistical Agency (CSA) [Ethiopia], 2016). Prevalence of EBF in the Southern Nations Nationalities and Peoples Region (SNNPR) of Ethiopia is 60% (Alive and Thrive, 2018), the second highest prevalence by region in the country (Alebel et al., 2018). The median duration of EBF in SNNPR is 3 months, much lower than the WHO recommendation (Central Statistical Agency (CSA) [Ethiopia], 2016).

Aims and Objectives of the Study

The research presented in this paper aims to understand the differences between 7-day, 24-hour and since-birth maternal recall methods. The specific objectives of the study are:

1. To estimate and compare EBF prevalence using the methods mentioned above.
2. Further investigating discordance between methods by determining whether there are any sociodemographic factors associated with misreporting a child's EBF status.

METHODS

Study Design:

Data for this research were obtained from a one-year cluster-randomized controlled trial conducted in the SNNPR of Ethiopia. The longitudinal study is one component of a multipronged evaluation of the Quality Diets for Better Health (QDBH) project funded by the European Union, led by the International Potato Center (CIP) and implemented in partnership with Emory University and People in Need. The QDBH project focused on improving diet quality, with an emphasis on vitamin A intake, of women and children in SNNPR through nutrition education and orange-fleshed sweet potato (OFSP) agriculture. The research presented in this paper utilizes data from the QDBH project to compare different methods of measuring exclusive breastfeeding and their outcomes.

Study Setting and Participants:

The QDBH project selected 41 target kebeles (smallest administrative units in Ethiopia) in SNNPR based on high population density and agricultural conditions that support growth of orange-fleshed sweet potatoes. These kebeles are located within three woredas (districts) – Aleta Chuko woreda in Sidama zone, and Wonago and Dila Zuria woredas in Gedeo zone (figure 1). Twenty-six of the kebeles were classified as eligible for project implementation in year one due to their moderate or high potential for growing OFSP and the absence of other nutrition projects in the area (figure 2). Of these kebeles, 6 were randomly selected to receive partial intervention (described below) while 7 were randomly selected to receive the full

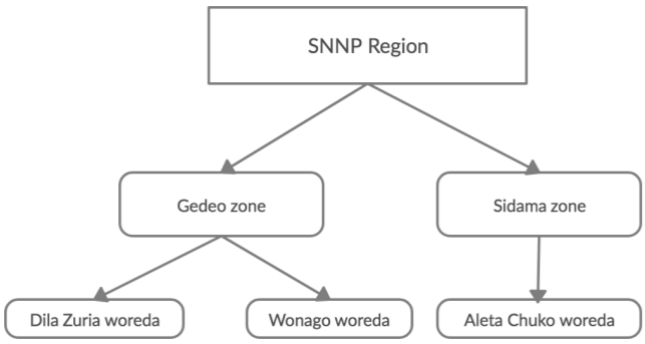

Figure 1. Levels of administrative government units

intervention. An additional 7 kebeles were randomly selected as control kebeles with no intervention activities[3].

Households were identified for participation in the QDBH project by collecting data (age of children younger than 6 months, gestational age of pregnant women) on all households within the 13 kebeles and categorizing these households into priority levels. Households with women in their third trimester of pregnancy and those with children younger than 6 months of age were prioritized. Households with children younger than 2 years were also considered eligible for the project. A sample size of 600 households – 200 each for the full, partial and control kebeles – was calculated for the longitudinal study. All prioritized households that met the eligibility criteria were invited to participate in the study in order to reach this sample size.

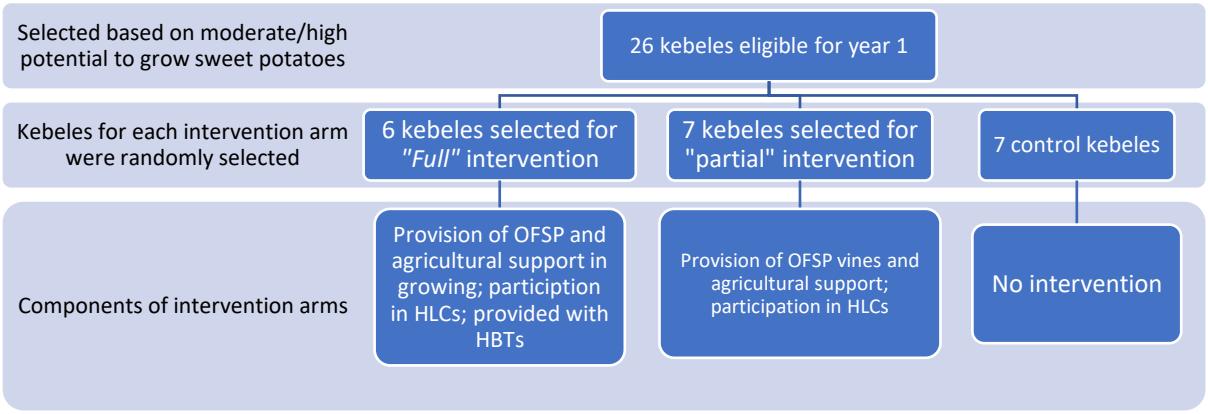

Figure 2. Process of selecting intervention and control kebeles and description of components of each intervention arm

To take part in the study, participants had to meet the following set of eligibility criteria at the time of baseline data collection:

1. The child should be younger than 6 months
2. Informed consent must be provided by the primary caregiver and, if possible, by the head of the household

[3] Control kebeles were part of the 41 target kebeles for the project. Although they were not included in year one, the project planned to expand to these kebeles in subsequent years of programming.

3. In the case of the full and partial interventions, caregivers must participate in healthy living clubs.

Children with serious health problems were excluded from the study.

Data were collected on the same cohort of study participants at baseline, midline and endline. Therefore, the study followed infants that were 0-5 months old at baseline, 6-11 months old at midline and 12-17 months at endline. This research paper uses data from the baseline and midline surveys only. Baseline data collection was conducted in December, 2017 – January, 2018 while midline data collection took place in August, 2018.

Intervention Components

The project included three tiers of intervention (figure 2):

a. The "full" intervention where participants took part in Healthy Living Clubs (HLCs), were provided with the Healthy Baby Toolkits (HBTs) and were provided with vines and support to grow orange-fleshed sweet potatoes

b. The "partial" intervention which included all components of the full *except* the Healthy Baby Toolkits

c. The control group which did not receive any component of the intervention

Healthy Living Clubs provide participants with nutrition education and technical support in planting, maintaining and harvesting OFSP vines. These clubs are facilitated by Health Extension Workers and Agriculture Development Agents, part of the government's health and agriculture workforce at the kebele level. Each HLC consists of 30 households and meets once a month for 8 months.

The Healthy Baby Toolkit is used to encourage age-appropriate complementary feeding for children 6-23 months old. It consists of a feeding bowl, a slotted spoon and a counseling card. The feeding bowl has lines demarcating the amount of food a child should consume based on

his/her age. The slots in the spoon discourage mothers from feeding their child thin porridge while the counseling card reinforces these messages through pictorial reminders.

Survey Instruments:

The baseline and midline surveys were designed to collect similar information but differ in the methodology employed to collect information about exclusive breastfeeding.

Baseline

The baseline survey determined whether a child was exclusively breastfed using two different methods – a 24-hour recall and a 7-day recall. In both cases, mothers and caregivers were provided with a list all of foods and liquids that are commonly given to an infant in that area. The former asked whether the child consumed each item in the 24 hours before the survey while the latter asked how many days in the past 7 days the child consumed each item. Caregivers were also asked whether their child consumed any liquids or solids not included in the list. Both methods aimed to collect short term data with minimal chances for recall errors. Because the sample at baseline included children 0-6 months old, these methods can estimate prevalence of exclusive breastfeeding among that sample.

Midline

During the midline survey, the questionnaire retrospectively assessed exclusive breastfeeding using the EBF since birth method whereby participants were provided with a list of foods and liquids commonly consumed by infants and asked how old, in months, the child was when he/she consumed each item for the first time. Caregivers were also asked whether their child consumed any liquids or solids not included in the list. This method requires longer term recall. Because all children in the sample are older than 6 months at midline, this method can determine age of initiation of complementary foods and age of cessation of exclusive breastfeeding.

In addition to data on exclusive breastfeeding, the survey instrument collected data on household demographics, food security, infant and young child feeding practices, 24-hour dietary recall, nutrition knowledge and anthropometric measurements.

Outcome of Interest and Determinants

The main outcomes for this research are prevalence of exclusive breastfeeding and discordance. Exclusive breastfeeding was defined in this study as feeding an infant only breast milk, with no other liquids (including water), with the exception of oral rehydration therapy, vitamin and mineral supplements and medication, per the WHO definition. Discordance was defined based on a discrepancy in EBF classification by assessment method – those classified as non-EBF (not exclusively breastfed) using the 24-hour recall method at baseline but classified as EBF at midline using the since-birth recall method were labeled as discordant. By definition, these respondents have misreported the EBF status of the child at midline. Although the inverse, that is, children classified as EBF at baseline and non-EBF at midline, can also be defined as discordant, they were not included in any exploratory analysis of this paper because we cannot ascertain misreporting among this group. This is because the sample at baseline included children younger than 6 months, who could have changed their EBF status after the time of the survey.

Discordance was further investigated by assessing whether any socioeconomic, maternal or child characteristics were associated with this type of misreporting. Variables assessed included child's age, mother's/caregiver's age and education level, household wealth, place where the child was born, number of antenatal care visits that the mother attended and district of residence.

Data Analysis

Statistical analysis was done on SAS version 9.4. Analysis was conducted on the 509 households in which data was collected for both the baseline and midline surveys. Respondents

that were lost to follow-up at midline or were missing data on one of the variables required to determine EBF status were removed from the analytic sample.

For descriptive analyses, discrete variables were presented as frequency and percent while continuous variables were described as means and standard errors. Overall prevalence of exclusive breastfeeding and prevalence by age group was assessed for the 24-hour and 7-day recall methods. Age of cessation of exclusive breastfeeding was assessed using the since-birth recall method by determining the age at which the first solid/liquid was consumed by the child. The number of children that ceased breastfeeding at each age group was then subtracted from the total number of children in that age group at baseline to calculate prevalence of EBF by age group using the since-birth recall.

Bivariate analysis of associations between discordance and sociodemographic variables was done to determine whether there were any significant predictors of discordance. Age- and woreda-adjusted logistic regression was done for all other variables. Finally, a fully adjusted logistic regression analysis was conducted to determine any meaningful changes in the association between each variable and the outcome. A difference of 10% or higher from the crude model was determined meaningful. A $p<0.05$ was considered statistically significant. Finally, logistic regression analysis using the stepwise selection method was done to determine what variables make it into the model.

Chi-square tests for discrete variables and two-sample independent t-tests for continuous variables were done to determine whether there were significant differences between the analytic sample and those that were dropped due to loss to follow-up and missing outcomes.

Ethical Considerations

This study was approved by Emory University's Institutional Review Board in the United States. The Southern Nations Nationalities and People's Regional State Health Bureau also

approved the study. Interviews were conducted only after receiving verbal consent from both the study participant and the head of the household.

Limitations

Due to the stark differences in nutritional status, sociodemographic make-up and geopolitical factors in different parts of Ethiopia, this study is only generalizable to SNNP region of the country. Additionally, there is no gold standard measurement for exclusive breastfeeding built into the study. Although comparisons can be made between the three different methods, the study cannot validate the accuracy of any method against another.

RESULTS

Of the 605 households that were surveyed at baseline, 548 were also surveyed at midline. Thirty-nine respondents had missing data for variables required to determine exclusive breastfeeding using at least one of the methods (Figure 1) and were excluded from analysis. The final analytic sample included 509 children that were 0-6 months old at baseline. The mean child's age was 2.6 months at baseline and 10.0 months at midline (table 1). The majority of the children at midline were between 9-12 months old while the child sex was split almost evenly (49.7% male and 50.3% female). The average age of female caregivers/mothers at baseline was 26.1 years, 87.9% of whom had eight years of schooling (primary school level) or less. For 24% of these caregivers/mothers, the child in the study was their first child (primiparous) while 75.8% had other children.

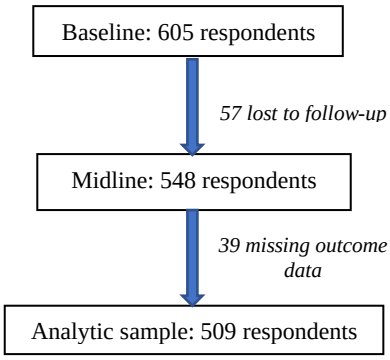

Figure 3. Steps to reach final analytic sample of n=509. Any missing values for variables required to calculate EBF through methods 1, 2, or 3 were not included in the analytic sample.

The parent study classified kebeles as control, partial intervention (healthy living clubs) and full intervention (healthy living clubs + healthy baby toolkits). Because the nutrition education provided at the healthy living clubs is the most relevant in exclusive breastfeeding behavior,

for this study, the full and partial intervention kebeles were combined into one category and compared with the control kebeles. Forty-three percent of the children were in the control kebeles while 56.6% were in the intervention kebeles. Respondents resided in the Aleta Chuko (40.9%), Dila Zuria (39.9%) and Wonago (19.3%) woredas (districts).

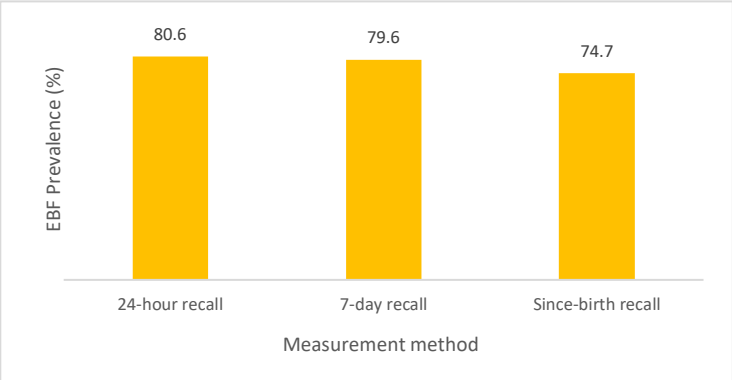

Figure 4. Total prevalence of exclusive breastfeeding in analytic sample using three different measurement methods (24-hour, 7-day and since-birth recalls). The 24-hour and 7-day recalls show proportion of exclusively breastfed children 0-6 months old at baseline. The since-birth recall shows proportion of children at midline that were exclusively breastfed for 6 months. n=509.

Comparative analysis between the analytic sample and those removed from the analytic sample showed no statistically significant differences between the two groups for all sociodemographic variables except place of delivery (supplemental table 1). Health facility delivery was much higher among the analytic sample than the removed sample (p=0.05).

Exclusive breastfeeding was calculated at baseline using the 24-hour and the 7-day recall method and at midline using the since-birth recall method. The first two methods resulted in similar estimates of EBF prevalence; the proportion of children exclusively breastfeeding at baseline was 79.6% using the 7-day recall and 80.6% using the 24-hour recall (figure 2). The since-birth recall showed that 74.7% of the children were exclusively breastfed for 6 months. With the first two methods, the prevalence of EBF decreased with age; 95.1% of children younger than one month were exclusively breastfed while 59.1% of children 5-6 months old were classified as exclusively breastfed using the 24-hour recall method (figure 3). The since-birth method did not show a similar trend by age. A smaller proportion (73.8%) of children were exclusively breastfed at 0-1 months compared to around 95% using the 24-hour and 7-day recall methods.

Table 1. *Sociodemographic characteristics of respondents included in analytic sample (n=509). Respondents were children 0-6 months old at baseline. Data for this table is from the baseline survey unless indicated otherwise.*

Respondent Characteristics	**Overall**
Child's age at baseline (mean, SD)	2.6 (0.016)
Child's age at midline (mean, SD)*****	10.0 (0.031)
Child's age category at baseline [n, (%)]	
0-2.9 months	224 (44.0)
3-4.9 months	219 (43.0)
5-6 months	66 (13.0)
Child's age category at midline [n, (%)]*	
6-8.9 months	115 (22.6)
9-11.9 months	288 (56.6)
12-13.9 months	106 (20.8)
Child's sex [n, (%)]	
Male	253 (49.7)
Female	256 (50.3)
Caregiver's age [mean, (SD)]	26.1 (0.065)
Caregiver's highest education level [n, (%)]	
No education	149 (29.3)
Early primary (Grade 1-4)	143 (28.2)
Late primary (Grade 5-8)	154 (30.4)
Secondary (Grade 9-12)	55 (10.8)
Technical/vocational training	6 (1.2)
Wealth quintiles [n, (%)]	
Lowest	96 (18.9)
Second	104 (20.4)
Middle	100 (19.6)
Fourth	102 (20.0)
Highest	107 (21.0)
Place of delivery [n, (%)]	
In home	191 (37.7)
Health facility	310 (61.1)
Other	6 (1.2)
Number of ANC visits [n, (%)]	
0	74 (14.5)
1-3	228 (44.8)
4 or more	207 (40.7)
Parity [n, (%)]	
Primiparous (1 birth)	123 (24.2)
Multiparous (more than one birth)	386 (75.8)
Intervention group:	
Control	221 (43.4)
Intervention (full and partial combined)	288 (56.6)
Woreda [n, (%)]	
Aleta Chuko	208 (40.9)
Dila Zuria	203 (39.9)
Wonago	98 (19.3)

**Data were obtained from midline survey.*

Data were obtained from a longitudinal study of the Quality Diets for Better Health project in the Wonago, Dila Zuria and Aleta Chuko woredas of the SNNPR, Ethiopia. Baseline data collection was done December 2017-January 2018 and midline data was collected in August 2018.

Table 2. 2x2 tables of a) 24-hour vs 7-day recall b) Since-birth recall vs 24-hour recall c) since-birth recall vs 7-day recall (n=509).

a. 24-hour vs 7-day recall

		24-Hour Recall		
		Non-EBF	**EBF**	**Total**
7-Day Recall	**Non-EBF**	99	5	104
	EBF	0	405	405
	Total	99	410	509

b. Since-birth vs 24-hour recall

		Since-birth recall		
		Non-EBF	**EBF**	**Total**
24-hour Recall	**Non-EBF**	48	51	99
	EBF	81	329	410
	Total	129	380	509

c. Since-birth vs 7day recall

		Since-birth recall		
		Non-EBF	**EBF**	**Total**
7-Day Recall	**Non-EBF**	49	55	104
	EBF	80	325	405
	Total	129	380	509

When comparing agreement between the 7-day and 24-hour recall methods, there was discordance of only 5 observations (table 3a). These five observations were classified as EBF using 24-hour recall but not EBF using the 7-day recall. However, there was a greater discordance between the point-in-time (24-hour and 7-day recall) methods and the since-birth recall method. Of the 509 respondents, 132 were classified differently by the 24-hour and since-birth recall methods (table 3b). Eighty-one of the 410 respondents classified as EBF using the 24-hour recall method were classified as non-EBF by the since-birth method. Among these 81 respondents, the since-birth recall at midline showed that 43 stopped exclusive breastfeeding *after* the time of the baseline survey. Therefore, we are unable to assess discordance in these 43 respondents. The other 38 respondents are discordant; they were classified as exclusively breastfed at baseline but at midline, reported consumption of non-breastmilk fluids/foods prior to the baseline survey. Inversely, of the 99 classified as non-EBF by the 24-hour recall method, 51 were classified as EBF using the since-birth recall method.

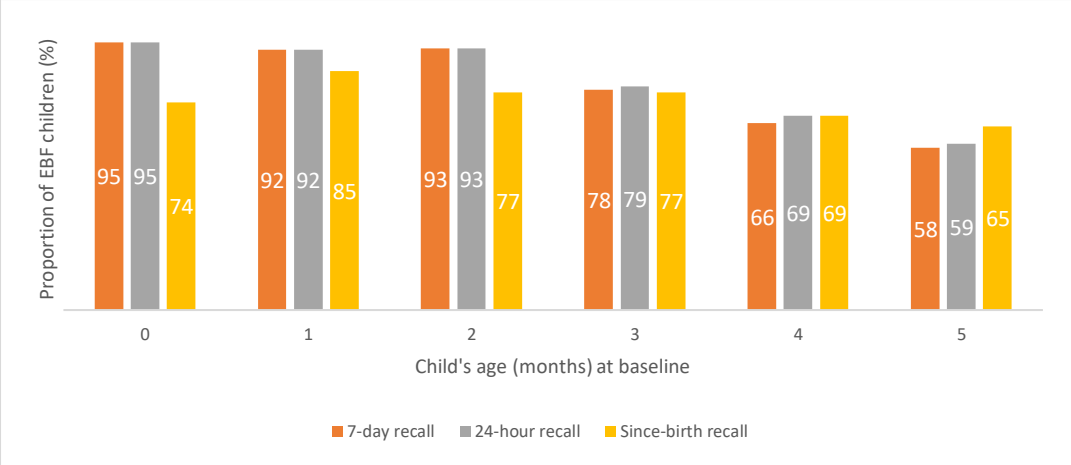

Figure 5. Proportion of exclusively breastfed children by age group calculated using the three different methods. For the since-birth recall, proportions were calculated based on the number of children that stopped EBF at that age subtracted from the total number of children of that age group reported at baseline. n=509.

Of those that introduced foods or liquids in the first 6 months, water was the most commonly given item (figure 4). While the 24-hour and 7-day recall show similar results in the items consumed, the since-birth recall shows a larger number of children consumed thick porridge, traditional foods and *hamesa*[4] than when using the other two methods.

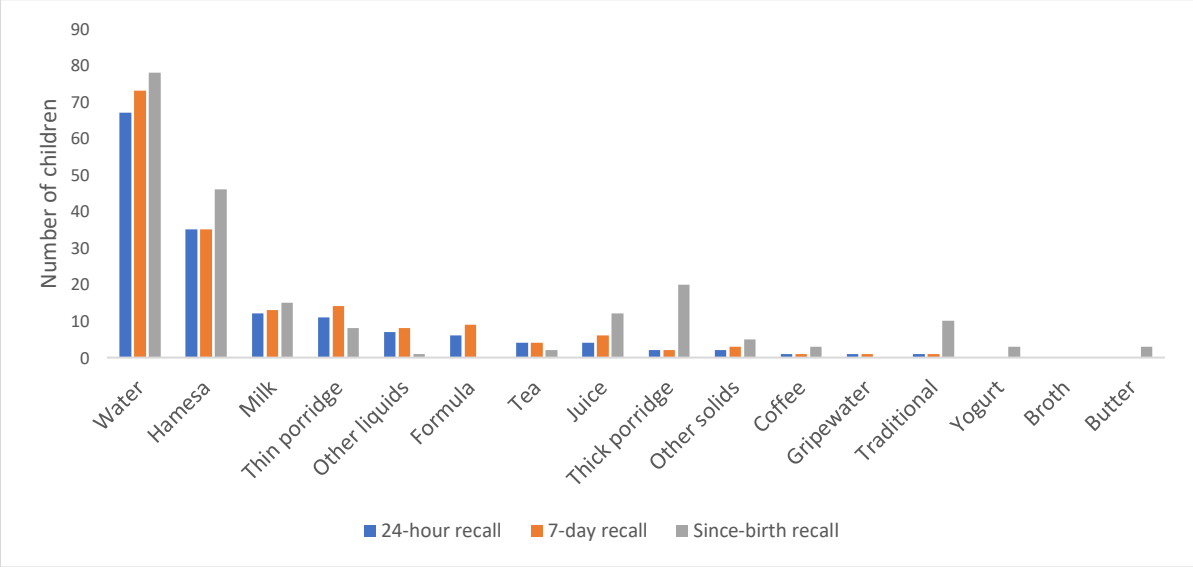

Figure 6. Food/liquid items consumed in the first 6 months based on the 24-hour, 7-day and since-birth recall methods. For the since-birth recall, the graph shows the number of children that were given each food/liquid as the first non-breastmilk feed (i.e. foods that "broke" their EBF status) (n=509).

Crude logistic regression analysis to assess whether any sociodemographic factors are associated with discordance (defined as respondents classified as non-EBF in the 24-hour recall and EBF using the since-birth recall method) showed that child's age and woreda were

[4] *Hamesa* is an herbal medicine that is commonly given to newborns in liquid form

significantly associated with the outcome (table 5). For every one month increase in child's age at baseline, the odds of being discordant increased by 85% (CI: 1.47, 2.34). Children in the Dila Zuria and Wonago were less likely to be discordant compared to those in Aleta Chuko woreda.

Although there were no other sociodemographic factors assessed in this study that were statistically significantly associated with discordance in the bivariate logistic regression, place of delivery, number of antenatal care (ANC) visits, parity and intervention group showed meaningful change in their odds ratios (ORs) when controlling for child's age at baseline and woreda of residence (table 5). The odds ratio for the association between place of delivery and discordance went from a crude OR of 1.02 (0.57, 1.83) to an age and woreda adjusted OR of 0.70 (0.37, 1.34). This shows that the odds of being discordant among those that delivered at a health facility is 30% lower than those that delivered in a home. Similarly, the crude OR for the association between number of ANC visits and discordance was close to the null (1.40 [0.55, 3.55]) when comparing mothers that attended 1-3 ANC visits to those that didn't attend any ANC visits. When adjusting for child's age at baseline and woreda, the odds of discordance among those that received 1-3 ANC visits is 44% lower than those that didn't receive any visits.

Table 3. Logistic regression to explore associations of sociodemographic factors with discordance (n=509)

Variable	Discordance [OR, (CI)]			
	Crude	**Adjusted for child age at baseline**	**Adjusted for age at baseline and woreda**	**Fully adjusted[a]**
Child's age at baseline	1.85 (1.47, 2.34)		1.80 (1.42,2.28)	1.48 (0.79, 2.78)
Child's age at midline	1.65 (1.35, 2.03)		1.68 (1.36, 2.08)	1.22 (0.68, 2.20)
Child's sex (male vs female)	1.06 (0.60, 1.85)	1.05 (0.56, 1.87)	1.01 (0.56, 1.83)	1.04 (0.56, 1.91)
Mother's age	1.00 (0.987, 1.009)	1.00 (0.98, 1.01)	1.00 (0.98, 1.03)	1.03 (0.96, 1.12)
Caregiver's highest education level	1.00 (0.96, 1.05)	1.01 (0.97, 1.01)	0.98 (0.92, 1.04)	0.99 (0.93, 1.06)
Wealth	0.94 (0.71, 1.24)	0.94 (0.71, 1.26)	0.89 (0.66, 1.20)	0.88 (0.64, 1.22)
Place of delivery				
Health facility vs home	1.02 (0.57, 1.83)	1.04 (0.57, 1.91)	0.70 (0.37, 1.34)	0.66 (0.33, 1.33)
Other vs home	4.28 (0.74, 24.84)	3.88 (0.51, 29.74)	1.86 (0.22, 15.62)	2.33 (0.26, 20.58)
Number of ANC visits				
1-3 vs 0	1.40 (0.55, 3.55)	1.33 (0.51, 3.47)	0.56 (0.31, 2.34)	0.87 (0.31, 2.43)
4+ vs 0	1.49 (0.58, 3.79)	1.46 (0.57, 3.85)	1.02 (0.37, 2.79)	1.16 (0.41, 3.32)
Parity (multiparous vs primiparous)	1.20 (0.64, 2.23)	1.42 (0.74, 2.75)	1.16 (0.59, 2.30)	0.62 (0.27, 1.47)
Intervention group (control vs intervention)	0.55 (0.30, 1.00)	0.64 (0.35, 1.20)	0.98 (0.50, 1.94)	0.99 (0.47, 2.10)
Woreda				
Dila Zuria vs Aleta Chuko	0.30 (0.15, 0.57)	0.35 (0.18, 0.68)		0.39 (0.18, 0.83)
Wonago vs Aleta Chuko	0.14 (0.04, 0.46)	0.14 (0.04, 0.48)		0.12 (0.03, 0.43)

[a]Fully adjusted model included all variables listed on table
All confidence intervals were calculated at the 95% confidence level
Discordance is defined as those classified as non-EBF in the 24-hour recall method and EBF in the since-birth recall
51 respondents were classified as discordant in the sample

Although the crude association between intervention group and discordance indicated that children in the control group were 45% less likely to be discordant than the intervention group, adjusting for child's age and woreda shows that there is almost no association between discordance and intervention group (OR=0.98, CI: 0.50, 1.94).

In the final, fully-adjusted model that includes all listed variables, woreda of residence is the only variable statistically significantly associated with discordance (table 5). The odds of being discordant for respondents in Dila Zuria woreda is 0.39 (0.18, 0.83) times that of Aleta Chuko while the odds of being discordant in Wonago woreda is 0.21 times that of Aleta Chuko. However, comparing the change in ORs in the fully adjusted model to those in the age and woreda adjusted model, place of delivery, number of ANC visits and parity resulted in greater than a 10% change. Giving birth at a health facility, attending 1-3 ANC visits, having more than one child and living in Dila Zuria or Wonago woredas all seem to have a "protective" association with discordance.

DISCUSSION

At the time of the baseline survey, the proportion of exclusively breastfed children in the sample was 80.6% using the 24-hour recall and 79.6% using the 7-day recall method. According to the since-birth recall method calculations, 74.7% of children in the sample were exclusively breastfed until 6 months. These three methods of measurement result in different interpretations of the exclusive breastfeeding status of the sample. The first two methods provide a snapshot of a specific point in time; they indicate the proportion of children in the sample that were exclusively breastfeeding at the time of the baseline survey. The third indicates the proportion of children, based on the mothers' report, that were exclusively breastfed for the WHO recommended time period of 6 months. However, from a public health programming perspective, these indicators often serve a similar purpose in determining the funds, targeting and messaging allocated towards exclusive breastfeeding interventions in a specific area. This study showed that, as a measure of overall exclusive breastfeeding, the differences between methods are minimal.

A closer comparative analysis of classification status by the different methods shows a greater discrepancy. The 24-hour and 7-day recall methods were similar in their classification; only 5 children were classified differently (table 2a) by the two methods. Although these five children consumed only breastmilk in the 24-hours preceding the survey, they were fed other solids/fluids in the 7-days before the survey. There was complete agreement between the two methods in EBF classification of the other 504 children in the sample, indicating that both the 24-hour and 7-day recall methods provide similar information. In this regard, because the 7-day recall method introduces a higher respondent burden by asking mothers to recall over a longer period of time, the 24-hour recall method may be preferable in assessing the prevalence of EBF in the population.

On the other hand, comparing the 24-hour and since-birth recalls, there was a mismatch in the EBF classification of 132 respondents (26% of the total sample) (table 2b). In the since birth recall at midline, 51 of these respondents reported exclusively breastfeeding their children until 6 months at midline; however at baseline, they reported that their children consumed non-breastmilk fluids in the preceding 24 hours. These mothers misreported their child's EBF status at midline and were the subject of further regression analysis. Eighty-one respondents were classified as non-EBF at midline but EBF at baseline. Forty-three out of the 81 respondents introduced non-breastmilk fluids/foods after the date of the baseline survey and are not discordant. Because the 24-hour recall is not restricted to a sample of 5-6 month old children, it fails to accurately capture the 43 respondents that changed their EBF status between the time of the baseline survey and their 6th month. Disagreement among the two methods in the other 38 respondents shows that either mothers failed to accurately recall their children's EBF status during the midline survey or gave their children non-breastmilk fluids outside of the 24-hour period captured by the baseline survey.

With both point-in-time methods, EBF prevalence decreased with increasing age; approximately 93% of 2-month olds were EBF, compared to 79% of 3-month olds and 59% of 5-6 month olds. The drop in the proportion of exclusively breastfed children is most noticeable at 3 months. This suggests that 3 months is a critical time for exclusive breastfeeding messaging and interventions. However, the since-birth method shows that a smaller percentage of children were exclusively breastfed during the earlier months than calculated by the 7-day and 24-hour recalls. For example, among children 0-1 month olds, 95.1% were classified as exclusively breastfed by the 24-hour and 7-day recall whereas only 73.8% were classified as EBF using the since birth recall. A discrepancy this early on in the child's life suggests that the 24-hour and 7-day recalls may be missing prelacteal feeds given during the first few days of life. This

suggests that in addition to focusing interventions at 3 months, public health efforts focused on exclusive breastfeeding need to target mothers in the early days of a child's life.

The assertion that the 24-hour recall is missing prelacteal feeds is further supported when looking closer at the foods that were missed by the point-in-time recalls but captured by the since-birth recall. These foods included *hamesa*, thin porridge and traditional foods, all of which are common prelacteals in Ethiopia. *Hamesa* is an herbal medicine that is commonly given to newborns in liquid form in the Sidama area (Degefie, Amare, & Mulligan, 2014). People in this area believe that *hamesa* protects newborns from diseases. Of the 41 children for whom *hamesa* was their first non-breastmilk fluid, 40 were in the Sidama zone (Aleta Chuko woreda). EBF classification by the 24-hour and since-birth recall methods only matched for 20 of these children.

Results of the logistic regression analysis to explore any associations between sociodemographic factors and misreporting of EBF status showed that discordance is statistically significantly higher in Aleta Chuko woreda than in Dila Zuria and Wonago woredas. Aleta Chuko woreda is located in Sidama zone while the other two woredas are located in Gedeo zone. Sidama is more rural and houses are further apart. Exclusive breastfeeding in Sidama was generally lower than in the Gedeo woredas by all methods of measurement. People in Sidama owned more land and household wealth in the area was higher. However, there was no association between household wealth and discordance in this sample, suggesting that there is another reason for the difference between zones.

It is possible that recall bias was higher in Sidama than in Gedeo. During the period of the midline survey, there was significant ethnic violence in the Gedeo zone that resulted in thousands being displaced from their homes (Yarnell, 2018). Significant events can create a benchmark for which respondents can remember health behaviors (Fadnes, 2008), possibly decreasing recall bias in Gedeo and thereby decreasing discordance.

Although social desirability bias was expected to play a part in discordance of exclusive breastfeeding classification, this data suggests it did not substantially influence responses. If social desirability was influencing mothers' responses at midline, discordance would be higher among mothers that attended more antenatal care visits, gave birth at a health facility or lived in the intervention kebeles where nutrition education was provided. Although not statistically significant, there was a negative relationship between number of ANC visits and discordance. Similarly, mothers that gave birth at a health facility were less likely to be discordant than those that gave birth at home. These statistics indicate the absence of social desirability bias and suggest that targeted health messaging about exclusive breastfeeding may in fact reduce probability of discordance. It is also possible that, because exclusive breastfeeding is widely promoted as part of a government initiative, all mothers are aware of these expected practices, regardless of their exposure to additional health promotion.

Strengths and Limitations

One of the major strengths of the study is the ability to compare, not only different methods, but also different time points with the same sample. In this way, the study was able to compare results before and after the 6th month of the children's lives. While there are other studies that have compared different methods or across time points, there are few that include both components (Agampodi et al., 2011; Mulol & Coutsoudis, 2018). Additionally, although determinants of EBF have been extensively studied in different parts of the world, there are few studies on determinants of misreporting exclusive breastfeeding, as well as the potential biases that might influence responses on EBF status. This study begins to explore that question.

A major weakness of the study is the absence of a gold standard against which the survey tools were compared. A gold standard, such as the DTM, or a prospective assessment of breastfeeding status would enable validation of the three methods to understand which is the closest to the true exclusive breastfeeding patterns. However, as mentioned in the introduction,

gold standard methods such as DTM are expensive and often require more time. Ultimately, even methods such as DTM can only estimate whether a child has been exclusively breastfed over a short period of time and can neither retrospectively determine the feeding patterns of the child nor predict whether the child will be EBF for the full 6 months. Therefore, it is imperative that survey instruments are refined to minimize bias.

Another weakness of the study is the small number of discordant respondents used to determine associations between sociodemographic factors and discordance. Although there was disagreement between the 24-hour and since-birth recalls on 26% (132 respondents), we can only ascertain misreporting among the 51 respondents that reported giving their children non-breastmilk fluids/foods at baseline but said that their children exclusively breastfed when asked at midline. Although logistic regression models for 51 respondents are not impossible, results would be more robust with a larger sample, especially for categorical independent variables.

Conclusions and Future Recommendations:

All three methods computed similar prevalence of exclusive breastfeeding in this sample. However, the since-birth method is useful in capturing the first non-breastmilk food/liquid item that was introduced to the child, including prelacteals. The point-in-time methods have two major shortcomings: 1) they fail to capture foods that a child consumes outside of their designated time period, especially in the first two months of life and 2) they underestimate the burden of non-exclusively breastfed children in the population by sampling children who have not yet reached their 6th month of life.

Future studies should investigate determinants of discordance with a larger sample size and borrow methods from the field of psychology to be able to adjust for social desirability and recall bias. Public health research publications should be clear about the methods used to measure and calculate exclusive breastfeeding and take more caution in their interpretation. Although the WHO recommends the 24-hour recall method, public health programs should

choose a method of measurement that aligns with their specific goal. For example, those wishing to determine the critical postpartum ages for EBF messaging should consider employing the since-birth recall whereas the 24-hour recall survey should be used when only a snapshot of a population's exclusive breastfeeding status is needed. Guidelines that outline the strengths of each method along with the appropriate function of the method would be beneficial in decreasing confusion in interpretation and utility of the different methods.

Future studies should also explore different methods of validating maternal recalls. Taking a smaller, representative sample and assessing EBF prevalence using the DTM method could be one avenue for validation. As mentioned, although the DTM method is accurate, it has shortcomings in estimating EBF for the full 6 months. Other methods of validation could include ensuring that both point-in-time and since-birth recalls are used, employing multiple 24-hour recalls at different points in a child's life or asking respondents to keep records of their child's dietary consumption. Since EBF is known to be associated with lower morbidity, measurement methods may be validated by examining association of calculated EBF prevalence with diarrheal diseases and other infections in the sample.

Chapter 3: Conclusions, Future Recommendations and Public Health Implications

Summary

Based on the results of this study, the point-in-time recall methods (24-hour and 7-day recalls) fail to capture some children that change their exclusive breastfeeding status after the time of the survey but before their 6th month. They also underestimate the prevalence of exclusive breastfeeding in the first month, possibly because they miss foods that are given to the child outside of the 24-hour or 7-day period. These foods could include prelacteal feeds given to the child shortly after birth.

The study also showed that mothers whose children were older at baseline had higher odds of misreporting their child's EBF status at midline. Additionally, mothers that live in Sidama zone had higher odds of misreporting their child's EBF status at midline than mothers that live in Gedeo zone. Although the reasons for these differences are unclear, it is possible that recall bias is lower in Gedeo zone where ethnic violence and political turmoil were taking place at the time; significant life events are known to decrease recall bias. The study also indicated that social desirability bias may not have introduced much bias; mothers that had more nutrition education and prenatal counseling were just as likely to misreport their child's EBF status as mothers that didn't.

Bigger Picture and Recommendations

International targets, such as the Global Nutrition Targets, often use 24-hour recalls as surveillance methods to determine progress. However, because this indicator does not completely capture children who were breastfed for the full 6 months and those who break their exclusive breastfeeding status in the first month of life, we do not know the true progress that has been made. The following recommendations could mitigate the issue:

1. Studies that are focused on exclusive breastfeeding and EBF surveillance methods should oversample children who are 5-6 months old to get a more realistic idea of the proportion of children that exclusively breastfeed for 6 months.
2. Using a combination of the 24-hour and since-birth recall may decrease some inaccuracy by capturing both daily and long-term diet patterns.
3. More rigorous methods of assessing foods given to a child in the first few days and the first month after birth should be tested and possibly included in maternal recall methods.
4. Because maternal recalls are still the most feasible methods of measuring EBF, future research should focus on understanding, measuring and controlling for social desirability and recall biases, borrowing techniques from other fields such as psychology.

Public Health Implications

The results of this study contribute to the growing conversation around appropriate methods to accurately determine exclusive breastfeeding. The study indicates the need to develop comprehensive guidelines that outline the benefits and limitations of different exclusive breastfeeding measurement methods to help public health researchers or interventions determine which method is best for their specific purposes. Such guidelines will also increase the consistency across research studies to allow comparison of results. Although the WHO recommends the 24-hour recall method, studies and interventions that aim to understand variations in feeding patterns, especially in the first month of life, should consider other methods as a supplement.

Increasing accuracy in measuring and tracking the prevalence of exclusive breastfeeding for 6 months has implications for setting global health focus and global targets, deciding funding allocation to the issue and designing health promotion and interventions.

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Appendix 1: Supplemental Table

Supplemental Table. Comparison of sociodemographic factors between analytic sample and respondents removed from the analytic sample (n=509 for analytic sample and n=96 for removed sample).

Variables	Analytic sample	Removed sample[a]	P-value
Child's age at baseline [mean (SE)]*	2.65 (0.07)	2.66 (0.16)	0.96
Child's sex•			
Male	253 (49.7)	54 (56.3)	0.24
Female	256 (50.3)	42 (43.8)	
Caregiver age [mean (SE)]*	26.05 (0.23)	26.00 (0.55)	0.92
Caregiver's highest education level•			
No education	149 (29.4)	36 (37.5)	
Early primary (Grade 1-4)	143 (28.2)	24 (25.0)	
Late primary (Grade 5-8)	154 (30.4)	23 (24.0)	0.45
Secondary (Grade 9-12)	55 (10.9)	11 (11.5)	
Technical/vocational training	6 (1.2)	2 (2.1)	
Wealth [mean (SE)]*	0.03 (0.04)	-0.14 (0.10)	0.12
Place of delivery •			
In home	191 (37.7)	48 (40.0)	
Health facility	310 (61.1)	46 (48.0)	0.05
Other	6 (1.2)	2 (2.1)	
Number of ANC visits [mean (SE)]*	2.92 (0.07)	3.63 (0.90)	0.09
Intervention group•			
Control	221 (42.4)	48 (50.0)	0.23
Intervention (full and partial combined)	288 (56.6)	48 (50.0)	
Woreda•			
Aleta Chuko	208 (40.9)	36 (37.5)	
Dila Zuria	203 (39.9)	42 (43.8)	0.77
Wonago	98 (19.3)	18 (18.8)	

•Chi-square test was used to determine whether there was a significant difference between analytic and removed sample
*Two-sample independent t-test was used to determine whether there was a significant difference

Appendix 2: Baseline Exclusive Breastfeeding Questionnaire

Next, I would like to ask you about some liquids that (child's name) may have had in the last 7 days or yesterday during the day or at night.

	(a) In the past 7 days, on how many days did [name] have [ITEM]: Enter numer 88 = Don't know 99 = Refuse	(b) Did (child's name) have any (item from list) yesterday during the day or at night? 0 = No 1 = Yes 88 = Don't know 99 = Refuse	(c) How many times yesterday during the day or at night did (child name) have this item? Enter numer 88 = Don't know 99 = Refuse
K08 Plain water	☐☐	☐☐	
K09 Infant formula	☐☐	☐☐	☐☐
K10 Milk (such as tinned, powdered, or fresh	☐☐	☐☐	☐☐
K11 Juice or juice drinks	☐☐	☐☐	
K12 Yogurt	☐☐	☐☐	☐☐
K13 Thin porridge	☐☐	☐☐	

	(a) In the past 7 days, on how many days did [name] have [ITEM]: Enter numer 88 = Don't know 99 = Refuse	(b) Did (child's name) have any (item from list) yesterday during the day or at night? 0 = No 1 = Yes 88 = Don't know 99 = Refuse
K14 Hamesa / fenugreek water	☐☐	☐☐
K15 Other traditional medicines not prescribed by a doctor	☐☐	☐☐
K16 Clear broth	☐☐	☐☐
K17 Coffee	☐☐	☐☐
K18 Tea	☐☐	☐☐
K19 Griper water	☐☐	☐☐
Any other liquids? (If so, specify) **K20** _____ **K21** _____ **K22** _____	☐☐ ☐☐ ☐☐	☐☐ ☐☐ ☐☐
K23 Thicker porridge?	☐☐	☐☐
Any other solid, semi-solid, or soft foods? **K24** _____ **K25** _____ **K26** _____	☐☐ ☐☐ ☐☐	☐☐ ☐☐ ☐

Appendix 3: Midline Exclusive Breastfeeding Questionnaire

Next I would like to ask you about when [NAME] started taking different liquids and foods. I will first ask if s/he has ever had this item and then at what age it was first given.

		Has [NAME] ever had (liquid)? 0 = No 1 = Yes 8 = Don't know 9 = Refuse	How old was [NAME] when he/she first had (liquid)? 88 = Don't know 99 = Refuse
B01	Plain water (includes boiled and not boiled)	☐ *If 1* →	☐☐ days OR ☐☐ months
B02	Butter	☐ *If 1* →	☐☐ days OR ☐☐ months
B03	Infant formula	☐ *If 1* →	☐☐ days OR ☐☐ months
B04	Milk (for example tinned, powdered, or fresh)	☐ *If 1* →	☐☐ days OR ☐☐ months
B05	Juice or juice drinks	☐ *If 1* →	☐☐ days OR ☐☐ months
B06	Yogurt or fermented milk	☐ *If 1* →	☐☐ days OR ☐☐ months
B07	Hamesa	☐ *If 1* →	☐☐ days OR ☐☐ months
B08	Other traditional medicines not prescribed by a doctor	☐ *If 1* →	☐☐ days OR ☐☐ months
B09	Broths or soups	☐ *If 1* →	☐☐ days OR ☐☐ months
B10	Coffee	☐ *If 1* →	☐☐ days OR ☐☐ months
B11	Tea	☐ *If 1* →	☐☐ days OR ☐☐ months
B12	Thin porridge/gruel	☐ *If 1* →	☐☐ days OR ☐☐ months
B13	Thick porridge	☐ *If 1* →	☐☐ days OR ☐☐ months
	Any other liquids? (specify)		
B14	☐ →		☐☐ days OR ☐☐ months
B15	☐ →		☐☐ days OR ☐☐ months
B16	☐ →		☐☐ days OR ☐☐ months

B17	Did [NAME] have any other solid, semi-solid, or soft foods before 6 months of age?	0 = No 1 = Yes 8 = Don't know 9 = Refuse	☐ *If 0, skip to C01*
	If so, what were they? How old was [NAME] when he/she had this item?		
B18	☐ →		☐☐ days OR ☐☐ months
B19	☐ →		☐☐ days OR ☐☐ months
B20	☐ →		☐☐ days OR ☐☐ months