The Effect of Maternal Depressive Symptoms on Infant Feeding Practices in Rural Ethiopia: Community Based Birth Cohort Study

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Abstract

Background: Infant feeding is a multidimensional and multi-risk factor practice with a vital role in ensuring optimal child health, growth and development. Maternal depressive symptoms have been shown to have adverse consequences on feeding practices. However, most of these findings were based on single infant feeding practice (IFP) dimension; e.g. early initiation of breastfeeding, exclusive breastfeeding or introduction of complementary foods. This study aims to explore the longitudinal relationship between maternal depressive symptoms and IFPs in rural Ethiopia using summary IFP index.

Methods: This study uses existing data from the ENGINE birth cohort study. The study had an open cohort design, with rolling recruitment and follow up of pregnant women for a period of two years. It was conducted from March 2014 to March 2016 in three districts (Woliso, Tiro-Afeta and Gomma) in the southwest of Ethiopia. The sample size was 4680 with pregnant women recruited between 12 and 32 weeks of gestation. Data were collected once during pregnancy for all women (twice for those in the first trimester), at birth, and then every three months until the child was 12 months old. Data collection was conducted by trained nurses electronically using Open Data Kit (ODK) software. A composite measure of IFP index was computed using 14 WHO recommended infant and young child feeding (IYCF) practice indicators. Maternal depressive symptoms (prenatal and postnatal) were assessed using the patient health questionnaire (PHQ-9). Linear multilevel mixed effects model was fitted to assess longitudinal relationship of IFPs and maternal depression.

Results: Early postnatal depressive symptoms were inversely and significantly
associated with IFPs (β= -1.031, P=0.001). However, prenatal maternal depression was not significantly associated with IFPs (β= -0.024, P=0.953). Similarly, intimate partner violence (β= -0.208, P=0.001) was negatively associated with IFPs. On the other hand, maternal social support (β= 0.107, P=0.002) and maternal social participation (β= 0.552, P<0.001) were positively associated with IFPs. Maternal education and gestational age at birth were other important factors positively associated with IFPs. Moreover, contrary to expected, moderate household food insecurity (β= 0.836, P=0.003), severe household food insecurity (β= 1.034, P=0.01) and infant morbidity episodes (β= 0.625, P=0.013) were positively associated with IFPs.

Conclusion: Early postnatal depressive symptoms and intimate partner violence were negative predictors of IFPs. On the other hand, maternal education, gestational age at birth, maternal social support and social participation are positive predictors of IFPs. Overall, we conclude that a multitude of factors are related to IFPs and hence coordinated, multi-sectoral and multi-stakeholder interventions including maternal depressive symptoms screening and management are needed to improve IFPs.

Key words: Infant feeding practices, prenatal depression, postnatal depression, household food insecurity, intimate partner violence, social support, Ethiopia

Background

According to recent WHO reports, significant global progress has been made in reducing child mortality since 1990 [1]. The global under-5 mortality rate has dropped by 59% between 1990 and 2018. However, there are still disparities in under-5 mortality across regions and countries. Sub-Saharan Africa remains the
region with the highest rate in the world. Half of all under-five deaths in 2018 occurred in just five countries: India, Nigeria, Pakistan, Ethiopia and the Democratic Republic of the Congo. Nutrition-related factors contribute to about 45% of deaths in children under-5 years of age [1].

Nutritional deficits during the first 2 years of life are associated with stunting, leading to the adult being shorter than his or her potential height [2]. Adults who were malnourished in early childhood have been found to have impaired intellectual performance, delayed childhood development, reduced capacity for physical work, reduced reproductive capacity and more complicated deliveries in women [3–7]. The first two years of life is a critical window of opportunity for prevention of growth faltering and undernutrition through prevention of low birth weight and appropriate IFPs [8].

As the 2005 Innocenti Declaration on IYCF recognized, appropriate feeding practice during infancy and early childhood is vital for ensuring optimal child health, growth and development[9]. The World Health Organization (WHO) and the United Nations Children’s Fund (UNICEF) set a global strategy for optimal IYCF [10]. The Ministry of Health in Ethiopia has also developed and implemented the IYCF guidelines in 2004 [11]. However, IYCF practices are still suboptimal throughout the globe and particularly in Ethiopia [12–17].

According to social cognitive theory[18], factors influencing IFPs can be broadly categorized into internal personal and socio-environmental factors. Internal personal factors include cognitive/affective (knowledge, attitudes and beliefs), outcome expectations (best for infant), self-efficacy (confidence and previous experience), biological (for example mothers age) or psychosocial (comfort with breastfeeding in public). Socio-environmental factors include institutional (health
care practice, policy etc.), social (family support/dynamics), socio-demographic (education, income ethnicity), physical (fatigue, pain etc.) and others (cost, availability and the like). Several previous studies focused on exploring those associations[19–22]. There are limited literature suggesting that maternal depression could lead to poor infant feeding practices, consequently leading to malnutrition and reduced physical growth [23–25]. However, very little attention has been paid to explore maternal depression influence on infant feeding practices, especially in the rural communities.

Infant and young child feeding practices are multidimensional, age specific and are more likely to cluster as mothers who early initiate breastfeeding and exclusively breastfeed will also be more aware of recommended optimal complimentary feeding[26]. However, most previous research on feeding practices has focused on only one or two dimensions at a time leading to fragmented information and blurred and inconsistent overall feeding patterns. Child feeding indices have the potential to handle such challenges. Child feeding index is a composite indicator which allows to measure IYCF practices in their entirety[27–29]. Reinbott et al. reported that a child feeding index is superior to WHO IYCF indicators in explaining length-for-age Z-scores of young children[30]. However, use of IYCF indices has gained impetus only after early 2000’s and to the authors best knowledge there is no study that utilize IFP indices to explore the effect of maternal depression on IFP scores. Thus, the main objective of this study is to determine the longitudinal association of maternal depressive symptoms and IFPs in rural Ethiopia using summary IFP indices.

Methods

This manuscript is based on ENGINE birth cohort study data. The ENGINE birth
A cohort study is a prospective, community-based study within Empowering New Generations to Improve Nutrition and Economic opportunities (ENGINE) program. ENGINE was a USAID funded five years nutrition intervention program implemented from September 2011 to September 2016 in 100 selected districts in rural Ethiopia. Its main goal was to improve nutritional status of mothers’ and young children through a multi-sectoral approach targeting health, nutrition and agriculture. The ENGINE birth cohort study was led by Tufts University and aimed to investigate the benefits of an integrated nutrition program and its co-location with agricultural growth program on household agricultural production and productivity, food security, diet diversity, socio-economic status and livelihoods, as well as health and nutritional status of mothers and their children.

The study had an open cohort design, with rolling recruitment and follow up of pregnant women for a period of two years. It was conducted from March 2014 to March 2016 in three Districts (Woliso, Tiro-Afeta and Gomma) in the South Western part of Ethiopia. The total sample size for this study was 4680 pregnant women recruited between 12 and 32 weeks of gestation. Data was collected once during pregnancy for all women (twice for those in the first trimester), at birth, and then every three months until the child was 12 months old. Data collection was conducted by trained nurses electronically using Open Data Kit (ODK) software on handheld tablets and submitted to a secured server via an internet connection.

Measurement

Infant Feeding Practices (IFPs)

Infant feeding index was constructed using data collected at birth and then every three months until 12 months of age. Mothers were asked about timing of
breastfeeding initiation, colostrum feeding, anything given to the infant before giving breast milk, number of times the infant was breastfed during the day and night, whether the infant was still breastfed, and what the infant ate yesterday. Based on these information, five separate IFP indices were prepared to assess age-specific infant feeding practices; namely, within three days of birth, at three months, six months, nine months and 12 months of child age. The indices were computed following the methods suggested by Ruel and Menon [29]. Each item was scored depending on whether a practice was appropriate based on the WHO infant feeding recommendations [17, 31]. A practice that was appropriate for a specific age group received a score of 1, and a practice that was inappropriate received a score of 0. Practices that are considered particularly relevant for a given time point received a score of 2 or 3. For example, breastfeeding received a score of 2 for an infant from birth to 12 months of age. A score of 0 was given to non-breastfed infants. Use of a infant bottle with a nipple was scored as 0 because the practice is considered inappropriate for all age groups; avoidance of infant bottles received a score of 1, indicating an appropriate practice. The dietary diversity score was calculated by adding the number of food groups consumed in the last 24 hours and received a score of 0 if the child got below three food groups, 1 if the child got three food groups or scored 2 if the child got four or more than four food groups in the past 24 hours (Table 1). The unstandardized total score could reach a maximum of 9–15 scoring points depending on the time point. The indices were standardized by converting each score into percentage of the maximum total score of the scales at each time point. A higher score in the feeding scales indicated a better infant feeding practice. The index was treated as continues variable. Table 1 below depicts the infant feeding
Maternal depressive symptoms were assessed using validated 9 items patient health questionnaire (PHQ-9) two times during pregnancy, within 72 hours after birth and three months postpartum. The PHQ-9 is a 9-item self-administered questionnaire designed to evaluate the presence of depressive symptoms during the prior two weeks. The nine items of the PHQ-9 are based directly on the nine diagnostic
criteria for major depressive disorder in the DSM-IV (Diagnostic and Statistical Manual Fourth Edition) [32]. Each of the nine items can be scored from 0 (not at all) to 3 (nearly every day). Thus, total score can range from 0 (absence of depressive symptoms) to 27 (most severe depressive symptoms).

This instrument had been validated for Afaan Oromo Language in a similar population prior to the commencement of the ENGINE birth cohort study and possessed good psychometric properties. A PHQ-9 score of 8 or above was taken as a cut off to define depressive symptoms[33]. For this study maternal depressive symptoms were classified as prenatal, postnatal (immediately after birth and three months postpartum) and persistent. Persistent depressive symptoms were defined as mothers screened positive for depressive symptoms during all the three assessment periods; pregnancy, at birth and three months postpartum. We used the prenatal and postnatal depressive symptoms (measured during pregnancy and within three days of birth) in the final model.

Household Food Insecurity
The household food insecurity was measured using the Household Food Insecurity Access Scale [34] at baseline (recruitment), at infants 6 months and 12 months of age. For this article we used the baseline measurement. The index women were asked nine questions (yes/no) to determine if anyone in their household had experienced problems of food access over four weeks preceding the interview. An affirmative response to any of the nine questions was followed by a question to determine how often the condition happened: rarely (1-2 times), sometimes (3-10 times), and often (> 10 times). Responses were coded as 0 = never (i.e., no experience), 1 = rarely, 2 = sometimes, or 3 = often. Household food insecurity was categorized into four severity levels: food secure, mildly food insecure, moderately
food insecure, and severely food insecure as per the algorithm described by Coates et al [34].

Intimate Partner Violence (IPV)
A screening tool called HITS (Hurt, Insult, Threaten and Scream) was applied to assess intimate partner violence. This screening tool measures the emotional (psychological) aspects of intimate partner violence. The scale has four items and each item was scored on a scale of 1 (never) to 5 (frequently) and later the sum score was computed. The score was treated as a continuous variable in this study.

Maternal Social Support
Maternal social support was measured using the Maternity Social Support Scale (MSSS) developed by Webster and colleagues [35]. The scale contains six items. Each item has measured on a five-point Likert scale and a total score of 30 was possible. Similarly, the score was treated as a continuous variable in this study.

Statistical Analysis
We examined whether missing data on feeding practices and maternal depressive symptoms differed from those who were not missing these data. We compared these two groups on infants’ birth weight, household food security, and other key baseline sociodemographic variables. For the continuous variables, we used a t test for equality of means, and, for the categorical variables, we used Pearson’s chi-square tests.

Participants’ characteristics, IFPs and maternal depressive symptoms were summarized using descriptive statistics. To assess longitudinal relationship of infant feeding practice (IFP) and maternal depressive symptoms, we assumed that the repeated measurements of IFPs taken from each infant, overtime, are correlated and it is expected that study participants changed feeding practices over time as infants gets older. To examine differences in IFP within individual subjects over the
follow up period, a linear multilevel mixed effects (fixed effects and random effects) model with a random intercept and a random slope was fitted with maximum likelihood estimation method. The fixed effects describe a population intercept and population slopes for a set of covariates, which include exposures and potential confounders. Random effects describe individual variability in IFP and changes over time. By considering individual random slopes and intercepts, this model allows to examine the influence of covariates on the change in IFP over time. Subjects with data from at least two assessment intervals were included in the analysis.

Results
Missing data and attrition
A total of 4,680 pregnant women were recruited and followed-up between March 2014 and March 2016. Of these, 1090 study participants (23.3%) were lost to follow-up between recruitment and 12 months’ post-partum. The most lost to follow up (47.7% of the total lost to follow) occurred at time point three. The main reasons for the lost to follow-up were still-births (3.3%), infant death unrelated to the study (3.0%), twin pregnancy (1.3%), abortion (0.9%) and others such as relocation, refusal to continue participation, and absence during data collection after three repeated trial (6.7%). The data collection was stopped before 378 (8.1%) of the infants reached 12 months of age and hence time point seven data missed for these participants. Potential biases related to missing data were assessed based on infant and maternal demographic and socio-economic characteristics. Study participants with missing data on maternal depression and IFPs did not differ from participants with complete data on basic socio-demographic or other study variables.
Characteristics of the study participants
Characteristics of the study participants are presented in Table 2 below. The median
age of study participants at the time of recruitment was 26 years [inter-quartile range (IQR) 22, 30]. More than half of the pregnant women (55.2%) were illiterate and only 241(5.1%) of the respondents had completed secondary education or higher. Just over two-third (67.3%) of the respondents were Muslim and 97.7% were married. The infant girls were slightly higher than boys in number. Over 95% of the infants were normal birth weight (weigh greater than 2.5 kg), however, more than a third of them were born preterm. In terms of morbidity, 57.5% of babies were ill at least once during the infancy period.

Only 39.7% of mothers had had four plus ANC visits and about one fifth of mothers had suffered birth complication during the current birth. More than 30% of the infants were born at home. Moreover, 25.9% and 11.5% of mothers reported a history of past child death and spontaneous abortion respectively. Only 34% of the study participants live in food secure households. About 9.0% of mothers reported intimate partner violence during time point three (within three days of birth) interview. Whereas, 56.2% mothers feel they have good social support and 61.7% of mothers reported active social participation.


**Table 2**

Characteristics of study participants, Ethiopia, 2019

| Variables                          | Number | Percent |
|------------------------------------|--------|---------|
| **Maternal age**                   |        |         |
| Less than 25 years                 | 1615   | 34.5    |
| 25–35 years                        | 2831   | 60.5    |
| Above 35 years                     | 234    | 5.0     |
| Median (IQR)                       | 26(22–30) |       |
| **Religion**                       |        |         |
| Orthodox                           | 1057   | 22.6    |
| Protestant & Catholic              | 472    | 10.1    |
| Muslim                             | 3148   | 67.3    |
| **Maternal educational status**    |        |         |
| Illiterate                         | 2585   | 55.2    |
| Primary                            | 1491   | 31.9    |
| Junior                             | 363    | 7.8     |
| Secondary & above                  | 241    | 5.1     |
| **Marital status**                 |        |         |
| Married                            | 4572   | 97.7    |
| Unmarried                          | 108    | 2.3     |
| **Infants gender**                 |        |         |
| Male                               | 2252   | 49.7    |
| Female                             | 2276   | 50.3    |
| **Birth weight**                   |        |         |
| Normal birth weight                | 3972   | 95.6    |
| Low birth weight                   | 183    | 4.4     |
| **Gestational age at birth**       |        |         |
| Preterm                            | 1442   | 34.7    |
| Term                               | 2717   | 65.3    |
| **Child illness during the infancy period** |        |         |
| Yes                                | 2690   | 57.5    |
| No                                 | 1990   | 42.5    |
| **Antenatal care**                 |        |         |
| No ANC                             | 1626   | 34.8    |
| 1–3 ANC visits                     | 1194   | 25.5    |
| 4 plus visits                      | 1859   | 39.7    |
| **Place of delivery**              |        |         |
| Health facility                    | 2934   | 66.4    |
| TBA                                | 75     | 1.7     |
| Home                               | 1345   | 30.4    |
| Other                              | 66     | 1.5     |
| **Birth complication**             |        |         |
| Yes                                | 927    | 19.8    |
| No                                 | 3753   | 80.2    |
| **History of spontaneous abortion**|        |         |
| Yes                                | 539    | 11.5    |
| No                                 | 4140   | 88.5    |
| **History of child death**         |        |         |
| Yes                                | 1213   | 25.9    |
| No                                 | 3466   | 74.1    |
| **Intimate partner violence**      |        |         |
| Yes                                | 417    | 8.9     |
| No                                 | 4263   | 91.1    |
| **Maternal social support**        |        |         |
| Good                               | 2631   | 56.2    |
| Poor                               | 2049   | 43.8    |
| **Maternal social participation**  |        |         |
| Yes                                | 2886   | 61.7    |
| No                                 | 1794   | 38.3    |
| **Household food insecurity**      |        |         |
| Secured                            | 1600   | 34.2    |
| Mildly insecure                    | 600    | 12.8    |
| Moderately insecure                | 1846   | 39.4    |
| Severely insecure                  | 634    | 13.5    |
| **Wealth index**                   |        |         |
| Lowest                             | 928    | 19.8    |
| Second                             | 957    | 20.4    |
| Middle                             | 863    | 18.4    |
| Fourth                             | 986    | 21.1    |
| Highest                            | 934    | 20.0    |

Infant feeding practices

Patterns of IFPs are presented in Table 3 below. Nearly three-fourth (72.5%) of mothers initiated breastfeeding within an hour of birth and majority of them (87.4%) gave colostrum to their infants. Prelacteal feeding was reported only for 36 infants (0.9%). Exclusive breastfeeding prevalence within three days of birth and at three months postpartum were 4097 (97.2%) and 2936 (89.3%) respectively. At infants’
age of 6 months, 993 (34.3%) infants were still exclusively breastfed. The study shows that few infants were still exclusively fed only breast milk at 9 and 12 months of age. We found that applying only the WHO recommendation of 24 hours recall for exclusive breastfeeding assessment is rather misleading. Using the 24-hour recall methods, the prevalence of exclusive breastfeeding was 14.6% (n = 683) and 11.3% (n = 530) at 9 and 12 months of age respectively. However, when plausibility was checked against introduction of solid and semi-solid food and exclusivity during the previous assessments, this prevalence reduced to 1.6% (n = 64) and 0.1% (n = 3) at 9 and 12 months in that order. Frequency of breastfeeding was optimal (8 times and above a day) for majority of the study participants (73.3% – 91.6%) throughout the infancy period.

Only 1,707 (42.1%) of infants were given complementary foods at six months of age. Overall, 90.2% and 95.7% of infants at 9 and 12 months of age respectively were on complementary feeding. Few mothers started complementary feeding early; immediately after birth (0.2%) and at three months postpartum (5.2%). Grains, roots and tubers were the most common eaten food groups by the infants with a prevalence of 26.1%, 84.8% and 89.9% at 6, 9 and 12 months of age respectively. Dairy products are the second common food group mothers use to start complementary feeding (11.5%) next to grains, roots and tubers and its consumptions decreases as the child gets older (8.9% and 5.0% at 9 and 12 months respectively). Fleshy foods are the least consumed food groups throughout the infancy period. We found that only 10 (0.6%), 16 (0.4%) and 64 (1.9%) of infants received the recommended diversified diet. However, the minimum meal frequency was achieved by majority of infants. Among those infants who had already started complementary feeding, 1405 (82.5%), 1914 (53.1%) and 2158 (62.7%) of them had
received the minimum meal frequency of WHO recommendation at 6, 9 and 12 months of age respectively.

As indicated in Table 3, the proportion of mothers using bottle to feed their infants continuously increased from birth to 9 months and gets lower at year one again. Responsive feeding shows slight increment between 6 and 12 months of infants’ age (56.9% – 59.6%).
## Table 3
Core Infant Feeding Practices Status, Ethiopia, 2019

| Infant Feeding Practices Indicators | Number | Percent |
|------------------------------------|--------|---------|
| **Core indicators**                |        |         |
| Timely Initiation of breastfeeding  |        |         |
| Within an hour                      | 3031   | 72.5    |
| Within 24 hours                     | 1048   | 25.1    |
| After one day                       | 100    | 2.4     |
| Exclusive breastfeeding at:         |        |         |
| Within 3 days of birth              | 4097   | 97.2    |
| 3 months                            | 2936   | 89.3    |
| Continued Breastfeeding at one year|        |         |
| Introduction of solid/semi-solid/soft food at: |        |         |
| Within 3 days of birth              | 8      | 0.2     |
| 3 months                            | 217    | 5.2     |
| 6 months                            | 1707   | 42.1    |
| 9 months                            | 3605   | 90.2    |
| 12 months                           | 3442   | 95.7    |
| Minimum dietary diversity at:       |        |         |
| 6 months                            | 13     | 0.8     |
| 9 months                            | 27     | 0.7     |
| 12 months                           | 88     | 2.6     |
| Minimum meal frequency at:          |        |         |
| 6 months                            | 1405   | 82.3    |
| 9 months                            | 1914   | 53.3    |
| 12 months                           | 2158   | 62.7    |
| Minimum acceptable diet at:         |        |         |
| 6 months                            | 4      | 0.4     |
| 9 months                            | 12     | 0.3     |
| 12 months                           | 16     | 0.3     |
| Consumption of iron rich food       |        |         |
| 6 months                            | 4      | 0.2     |
| 9 months                            | 12     | 0.3     |
| 12 months                           | 16     | 0.3     |
| **Optional indicators**             |        |         |
| Frequency of breastfeeding at:      |        |         |
| Within three days of birth          |        |         |
| < 8 months                          | 1007   | 24.6    |
| 8-11 months                         | 1880   | 46.0    |
| >=12 months                         | 1200   | 29.4    |
| 3 months                            |        |         |
| < 8 months                          | 340    | 8.3     |
| 8-11 months                         | 1802   | 44.2    |
| >=12 months                         | 1935   | 47.5    |
| 6 months                            |        |         |
| < 8 months                          | 470    | 11.8    |
| 8-11 months                         | 1753   | 44.0    |
| >=12 months                         | 1766   | 44.3    |
| 9 months                            |        |         |
| < 8 months                          | 624    | 15.9    |
| 8-11 months                         | 1907   | 48.5    |
| >=12 months                         | 1397   | 35.6    |
| 12 months                           |        |         |
| < 8 months                          | 864    | 24.6    |
| 8-11 months                         | 1669   | 47.5    |
| >=12 months                         | 976    | 27.8    |
| Colostrum feeding                   | 3653   | 87.4    |
| Prelacteal feeding                  | 36     | 0.9     |
| Bottle feeding                      |        |         |
| Within 3 days of birth              | 136    | 3.1     |
| 3 months                            | 635    | 15.2    |
| 6 months                            | 1394   | 34.4    |
| 9 months                            | 1460   | 35.2    |
| 12 months                           | 992    | 27.6    |
| On demand BF                        |        |         |
| Within 3 days of birth              | 3280   | 78.3    |
| 3 months                            | 2662   | 64.4    |
| 6 months                            | 2189   | 54.4    |
| 9 months                            | 1765   | 44.6    |
| 12 months                           | 1321   | 37.3    |
| Active feeding                      |        |         |
| 6 months                            | 972    | 56.9    |
| 9 months                            | 2114   | 58.6    |
| 12 months                           | 2050   | 59.6    |

Maternal depressive symptoms prevalence

*Among women who screened for depressive symptoms, cumulative incidence*
proportions were 10.8%, 18.5% and 7.5% during pregnancy, within three days after birth and three months’ post-partum, respectively. Overall, 1156 (26.2%) of mothers had depressive symptoms at least once during the period between recruitment and 3 months’ post-partum and 56 respondents (1.2%) were having depressive symptoms persistently during the three measurement times. PHQ-9 mean scores (standard deviation) during the three occasions were 3.11 (4.53), 4.35 (4.04) and 2.13 (3.20) respectively.

Longitudinal relationship of IFP and maternal depression
Based on the standardized composite indices of IFP, the poorest IFP practice occurred at 6 months of infancy (only 54% of the potential score). The practice was better during the first 6 months than the second half of the infancy period (Table 4).

As presented in Table 5, linear mixed effects model showed that early postnatal maternal depressive symptoms was negatively associated with IFPs (β= -1.031, P = 0.001). However, prenatal maternal depressive symptoms was not associated with IFPs (β= -0.024, P = 0.953). Similar to early postnatal depressive symptoms, intimate partner violence was negatively associated with IFPs (β= -0.208, P = 0.001). On the other hand, maternal social support (β= 0.107, P = 0.002) and social participation (β= 0.552, P < 0.001) were positively associated with IFPs. Compared with Orthodox Christians, Protestant and Catholic Christians have better (β= 1.497, P = 0.002) but infants from Muslim families have poorer IFP scores (β= -2.587, P <
Contrary to expected, mild household food insecurity ($\beta = 0.836, P = 0.003$), severe household food insecurity ($\beta = 1.034, P = 0.01$) and infant morbidity episodes ($\beta = 0.625, P = 0.013$) were positively associated with IFPs. Maternal education and gestational age at birth were other important factors positively associated with IFPs in this study.

**Table 5**
Multilevel model results of the association between infant feeding practices and maternal depressive symptoms and other predictors, Ethiopia, 2019

| Factors                                      | Estimates | 95% CI   | P-value | SE  |
|----------------------------------------------|-----------|----------|---------|-----|
| Maternal age                                 | 0.010     | -0.036   | 0.057   | 0.66| 0.024|
| Mother Education                             |           |          |         |     |      |
| Illiterate                                   | 0.787     | 0.240    | 1.333   | 0.005| 0.279|
| Primary                                      | 1.357     | 0.567    | 2.146   | 0.001| 0.403|
| Secondary & above                           |           |          |         |     |      |
| Orthodox                                     | 1.497     | 0.548    | 2.447   | 0.002| 0.484|
| Protestant & Catholic                        | -2.587    | -3.209   | -1.965  | <0.001| 0.317|
| Muslim                                       | -0.007    | -0.073   | 0.060   | 0.844| 0.034|
| Wealth index                                 |           |          |         |     |      |
| Secured                                      | -0.692    | -1.458   | 0.073   | 0.076| 0.391|
| Mildly insecure                              | 0.836     | 0.293    | 1.380   | 0.003| 0.277|
| Moderately insecure                          | 1.034     | 0.251    | 1.816   | 0.01 | 0.399|
| Severely insecure                            |           |          |         |     |      |
| Maternal social support                      | 0.107     | 0.041    | 0.174   | 0.002| 0.034|
| Social participation                         | 0.552     | 0.298    | 0.806   | <0.001| 0.129|
| Intimate partner violence                    | -0.208    | -0.337   | -0.080  | 0.001| 0.065|
| Prenatal Depression                          | Yes       | -0.024   | -0.802  | 0.755| 0.953|
| No                                           | -1.031    | -1.647   | -0.414  | 0.001| 0.314|
| Postnatal Depression (within 3 days of birth)|       |          |         |     |      |
| Yes                                          | 0.625     | 0.134    | 1.117   | 0.013| 0.251|
| No                                           |           |          |         |     |      |
| Child gender                                 |           |          |         |     |      |
| Male                                         | -0.128    | 0.580    | 0.326   | 0.58 | 0.232|
| Female                                       | 0.517     | 0.035    | 0.998   | 0.036| 0.246|
| Gestational age at birth                     | No ANC    | -0.418   | -1.023  | 0.186| 0.175|
| 1-3 ANC visits                               | 0.261     | -0.325   | 0.847   | 0.382| 0.299|
| 4 plus visits                                | Yes       | 0.625    | 0.134   | 1.117| 0.013| 0.251|
| No                                           |           |          |         |     |      |
| Child Illness                                | Constant  | 67.389   | 64.723  | 70.054| <0.001| 1.360|
| Random-effects                               |           |          |         |     |      |
| Variance of random intercept                 | 7.208     | 6.971    | 7.453   | 0.123| |
| Variance of random slope                     | 24.743    | 23.741   | 25.789  | 0.522| |
| Covariance of random intercept and slope     | -0.998    | -0.999   | -0.994  | 0.001| |
| Variance of measurement errors               | 13.29416  | 13.09836 | 13.49288| 0.10064| |
| SE = standard error                          |           |          |         |     |      |

**Discussion**
In this study we examined the association between maternal depressive symptoms and IFPs using a computed index suggested by Ruel and Menon [29]. The key contribution of this study is to show the effect of maternal depressive symptoms on IFPs in rural Ethiopia. The findings have important implications for policy makers, researchers, donors and program implementers working on child nutrition in Ethiopia, where the burden of child malnutrition is the highest [14].

The IFPs score is relatively higher during the first 6 months than the second 6 months of age. During the first six months, IFP components need no significant additional costs for rural Ethiopian women but mothers’ commitment and knowledge. However, during the second six months of the infancy period, the IFP components need resources particularly to fulfill the required quality of meal and the frequency. As revealed in this study, less than three percent of infants received a quality diet as measured by dietary diversity. Several previous studies in Ethiopia came up with similar findings of unacceptably low percentage of infant dietary diversity [36–39]. Moreover, we found that the IFP score was the poorest particularly at six months of age. This might be explained by the small proportion of mothers who practiced timely initiation of complementary feeding in this study.

Besides, 6–8 months of infancy is the transition period where mothers/caretakers struggle to teach babies to take solid and semi-solid foods.

A statistically significant negative association was found between early postnatal depressive symptoms (within three days of birth) and overall IFP score in this study. So far only few studies have used IFP index in feeding practice studies and to the researchers’ best knowledge there is no study which explores the longitudinal relationship between IFPs and maternal depressive symptoms using an IFP index. However, several previous observational studies reported that maternal postnatal
depression is associated with specific components of IFPs; though, the direction of association between breastfeeding and postpartum depression remains unclear [40]. Systematic reviews in 2019 and 2015 concluded that depressed women breastfed their child for shorter duration than non-depressed women[23, 41]. Other previous studies also reported a negative association between maternal depression and early initiation of breastfeeding [42], complementary feeding initiation [43] and infants’ dietary diversity [44, 45]. Infants born to women who experienced intimate partner violence were at greater risk of poor IFPs. This finding is consistent with previous studies [46-48] and has important implications, particularly in Ethiopia, where 34 percent of ever-married women experienced such violence [14]. There are many pathways that intimate partner violence can affect maternal health and behavior [49]. Through its biological pathway, intimate partner violence is a stressor to which the autonomic nervous system, the hypothalamic-pituitary-adrenal (HPA) axis, and the cardiovascular, metabolic, and immune systems respond and hence leads to depression [50-52]. As stated above, maternal depression leads to poor IFPs. Furthermore, intimate partner violence has negative outcome on poverty and household food security by affecting couples capacity to organize and manage resources available in order to assure food and nutrition security of the family. Contrary to many of previous studies, we found that infants in moderately and severely food insecure households rather have better IFP scores. Several previous studies reported that household food insecurity was negatively associated with IFPs [53–55]. However, the direction of the association does not mean that all infants in food secure households received appropriate and adequate feeding. In Uganda, Pascal et al. found that 8 out of 10 infants in food secure households were not
receiving the minimum dietary diversity required and reported that household food insecurity explains only 10 percent of the variance of dietary quality determinants [56]. Conversely, our finding agrees with the studies in Kenya and Tanzania [57, 58]; both studies concluded that infants from food insecure households were less likely to receive cow milk before they reached 6 months. Particularly in Kenya, dairy producing households had a 12-fold increased risk for exclusive breastfeeding interruption by early animal milk introduction compared to those in households without cattle.

Another probable reason for the positive association between food insecurity and IFPs in this study could be ENGINE program vulnerable households focused IYCF interventions. ENGINE end-line impact assessment reported that the program achieved over 10 percentage point increase in infant and child feeding index (ICFI) in 50% of intervention Districts [59]. Studies showed that IYCF focused nutrition education for caregivers improved child dietary diversity and nutrition knowledge of caretakers even in food insecure areas [60, 61]. Moreover, as we indicated earlier, the IFP scores were relatively higher during the first 6 months than the second half of infants’ age; during this period the IFP elements are more amenable to improve by IYCF focused social and behavior change communications costing no or minimal resources for a rural mother.

In this study, only half of women reported that they feel they have good social support during pregnancy (43.8%) and immediately postpartum (56.2%). We found that maternal social support was positively associated with IFPs. In agreement with our findings, previous studies reported that maternal social support helps mothers to practice appropriate infant and young child feeding [62, 63]. Similarly, our study revealed that infants whose mothers actively participated in social groups have a
better IFP scores than those with poor participation. Previous studies consistently reported that social participation is associated with mental and physical health benefits. Seeman and colleagues found that having three or more regular social contacts, as opposed to zero to two such contacts, is associated with lower allostatic load scores [64]. Lower allostatic load mean lower depression [65, 66] and then better IFP scores. In Ethiopia social groups are main platforms to reach mothers with IYCF messages [67].

Gestational age at birth was positively associated with IFP scores. This implies that preterm infants were not receiving good IFPs as their full term counterparts. Consistent with our findings, previous studies reported that mothers of preterm infants initiated breastfeeding late and that pre-term infants are breastfed for a shorter duration [54-56]. Similarly, observational studies in Italy and the United Kingdom reported early introduction of solid foods with a majority of preterm infants receiving a solid food prior to 4 months of age [71, 72].

A systematic review by Kajali and Vector revealed that restriction or interruption of complementary foods during illness is frequent because of children's anorexia, poor awareness by caregivers' about the feeding needs of sick children, traditional beliefs and behaviors, and/or suboptimal counseling and support by health workers [73]. However, we found that infants with higher morbidity episodes have higher IFP scores too. We presumed that frequent episodes of illness increase mothers’ frequency of contact with health care providers and hence repetitive IYCF counseling which improves mothers’ IYCF awareness and practices. Abegaze and colleagues reported, that in Ethiopia, mothers with prior experience of infant illness were more likely to seek health care for their sick children than their counterparts [74]. Moreover, as a sick infant loses appetite, mothers could frequently serve
different type of foods to the infant that potentially increases diet diversity and/or frequency and increase the IFP scores.

Mothers with primary and above school qualification seemed to perform better with respect to IFPs than illiterate mothers. This finding is in agreement with previous studies in Ethiopia and elsewhere [13, 42, 44, 45, 75]. This may be explained by educated mothers having better understanding of IYCF itself and/or had exposure to IYCF awareness raising campaigns (through their ability to read leaflets, posters and banners) that have been conducted for several years by the Ministry of Health and development partners in Ethiopia.

One of the main strengths of this study is that it is based on community based longitudinal data (prospective birth cohort) with appropriate analytical techniques applied. The study had a large sample size, high response rate and low attrition. Data were collected on regular intervals on several important socio-demographic, nutritional and clinical risk factors that could be harvested for this analysis. In addition, we used 14 WHO recommended IYCF core and optional indicators to compute the IFP score[31]. One limitation of this study is that IFP data were based on mothers/caretakers reports and, thus, are subject to possible recall biases. Moreover, presence of depressive symptoms may cause mothers to have more negative views about things around them, including household food security, child health and feeding practices.

Conclusions

Infant feeding practices in Ethiopia are very poor; particularly, dietary diversity and consumption of iron rich foods are unacceptable low and prenatal and postnatal maternal depressive symptoms are quite common. About two third of the
households are food insecure. Early postnatal depressive symptoms and intimate partner violence are negative predictors of IFPs. Whereas, maternal education, maternal social support, maternal social participation and gestational age at birth are positively associated with IFPs.

The implications of our findings for practice are to emphasize the need for prevention, early detection and treatment of early postpartum depression, intimate partner violence and strengthen household food security interventions so that mothers are healthy, food secured and practicing appropriate infant feeding as per WHO infant feeding recommendation. In this regard, we recommend the Ethiopian Ministry of Health to integrate postnatal maternal depression and intimate partner violence screening into the routine postnatal care service and Ministry of Agriculture together with other relevant ministries, donors and implementers to strengthen household food security interventions. Moreover, we recommend all relevant stakeholders particularly Ministry of Women Affaires to promote maternal social support and social participation. Overall, we concluded that a multitude of factors are related to IFPs and need coordinated, multi-sectoral and multi-stakeholder interventions.

**Abbreviations**

CI: Confidence Interval; HITS: Hurt, Insult, Threaten and Scream; IFP: Infant Feeding Practice; IPV: Intimate Partner Violence; IYCF: Infant and Young Child Feeding; MSS: Maternal Social support; OR: Odds Ratio; PHQ-9: Patient health questionnaire-9; USAID: United States Agency for International Development

**Declarations**
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**Authors’ contributions**

YK designed/implemented the study, analyzed the data and drafted the manuscript; SG & TB designed/implemented the study and critically reviewed the final version of the manuscript; VS, EK, & HKB assisted data analysis and write up and critically reviewed the manuscript. All authors read and approved the final manuscript.

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**Availability of data and materials**

The data that support the findings of this study are available from Tufts and Jimma Universities but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of Tufts and Jimma Universities.

**Ethics approval and consent to participate**

The study was conducted in accordance with the WHO’s ethical and safety recommendations for research on domestic violence against women [76]. The main principals to justify this research were also fulfilled according to the World Medical Association Declaration of Helsinki [77]. During data collection, all measures were taken to ensure that women could get support if it was deemed necessary. Study
participants who were screened positive for depressive symptoms or IPV were referred to a nearby health facility for possible social and medical support. Ethical clearance was obtained from Jimma University ethical review board. Informed written consent was obtained from all individual participants included in the study. All interviews were conducted in private and confidentiality was ensured for each study participants.

Consent for publication
Not applicable

Competing interests
We declare that we have no financial or non-financial competing interests.

References
1. WHO. Children: reducing mortality [Internet]. 2019. Available from: https://www.who.int/news-room/fact-sheets/detail/children-reducing-mortality
2. Martorell R, Khan LK, Schroeder DG. Reversibility of stunting: epidemiological findings in children from developing countries. Eur J Clin Nutr. 1994;48 Suppl 1:S45-57.
3. Laurent Bossavie, Harold Alderman, John Giles, Cem Mete. The Effect of Height on Earnings: Is Stature Just a Proxy for Cognitive andNon-cognitive Skills? Washington, D.C.: World Bank; 2017. Report No.: Report No. 8254.
4. Sudfeld CR, McCoy DC, Danaei G, Fink G, Ezzati M, Andrews KG, et al. Linear growth and child development in low- and middle-income countries: a meta-analysis. Pediatrics. 2015;135:e1266-1275.
5. Addo OY, Stein AD, Fall CHD, Gigante DP, Guntupalli AM, Horta BL, et al. Parental childhood growth and offspring birthweight: pooled analyses from four
birth cohorts in low and middle income countries. Am J Hum Biol Off J Hum Biol Coun. 2015;27:99-105.

6. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet. 2013;382:427-51.

7. Pollitt E, Gorman KS, Engle PL, Rivera JA, Martorell R. Nutrition in early life and the fulfillment of intellectual potential. J Nutr. 1995;125:1111S-1118S.

8. Victora CG, de Onis M, Hallal PC, Blossner M, Shrimpton R. Worldwide Timing of Growth Faltering: Revisiting Implications for Interventions. PEDIATRICS. 2010;125:e473-80.

9. UNICEF. Infant and Young Child Feeding: Innocenti Declaration 2005. [Internet]. 2005. Available from: www.ennonline.net/iycfinnocentideclaration2005

10. Weltgesundheitsorganisation, editor. Global strategy for infant and young child feeding. Geneva: WHO; 2003.

11. Ethiopian Ministry of Health. National Strategy for Infant and Young Child Feeding. 2004.

12. Tadesse F, Alemayehu Y, Shine S, Asresahegn H, Tadesse T. Exclusive breastfeeding and maternal employment among mothers of infants from three to five months old in the Fafan zone, Somali regional state of Ethiopia: a comparative cross-sectional study. BMC Public Health. 2019;19:1015.

13. Demilew YM, Tafere TE, Abitew DB. Infant and young child feeding practice among mothers with 0-24 months old children in Slum areas of Bahir Dar City, Ethiopia. Int Breastfeed J. 2017;12:26.

14. CSA and ICF. ETHIOPIA Demographic and Health Survey. 2016.
15. Safari JG, Kimambo SC, Lwelamira JE. Feeding practices and nutritional status of infants in Morogoro Municipality, Tanzania. Tanzan J Health Res. 2013;15:178–85.

16. Caetano MC, Ortiz TTO, Silva SGL da, Souza FIS de, Sarni ROS. Complementary feeding: inappropriate practices in infants. J Pediatr (Rio J). 2010;86:196–201.

17. World Health Organization. Infant and young child feeding: Model Chapter for textbooks for medical students and allied health professionals. Geneva: World Health Organization; 2009.

18. Bandura, A., National Inst of Mental Health. Prentice-Hall series in social learning theory. Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ, US: Prentice-Hall, Inc.; 1986.

19. Anjomshoa H, Mirzai M, Iranpour A. The Application of Social Cognitive Theory on Mothers’ Feeding Practices for Children Aged 6 to 24 Months old in Iran. Int J Pediatr [Internet]. 2018 [cited 2019 Oct 24]; Available from: http://doi.org/10.22038/ijp.2018.28326.2459

20. Shepherd L, Walbey C, Lovell B. The Role of Social-Cognitive and Emotional Factors on Exclusive Breastfeeding Duration. J Hum Lact. 2017;33:606–13.

21. Minas AG, Ganga-Limando M. Social-Cognitive Predictors of Exclusive Breastfeeding among Primiparous Mothers in Addis Ababa, Ethiopia. PloS One. 2016;11:e0164128.

22. Williams PL, Innis SM, Vogel AM, Stephen LJ. Factors influencing infant feeding practices of mothers in Vancouver. Can J Public Health Rev Can Sante Publique. 1999;90:114–9.

23. Slomian J, Honvo G, Emonds P, Reginster J-Y, Bruyère O. Consequences of maternal postpartum depression: A systematic review of maternal and infant
outcomes. Womens Health. 2019;15:174550651984404.

24. Anoop S, Saravanan B, Joseph A, Cherian A, Jacob KS. Maternal depression and low maternal intelligence as risk factors for malnutrition in children: a community based case-control study from South India. Arch Dis Child. 2004;89:325-9.

25. Rahman A, Harrington R, Bunn J. Can maternal depression increase infant risk of illness and growth impairment in developing countries? Child Care Health Dev. 2002;28:51-6.

26. Srivastava N, Sandhu A. Infant and child feeding index. Indian J Pediatr. 2006;73:767-70.

27. Chaudhary S, Govil S, Lala M, Yagnik H. Infant and young child feeding index and its association with nutritional status: A cross-sectional study of urban slums of Ahmedabad. J Fam Community Med. 2018;25:88.

28. Lohia N, Udipi SA. Infant and child feeding index reflects feeding practices, nutritional status of urban slum children. BMC Pediatr. 2014;14:290.

29. Ruel MT, Menon P. Child feeding practices are associated with child nutritional status in Latin America: innovative uses of the demographic and health surveys. J Nutr. 2002;132:1180–7.

30. Reinbott A, Kuchenbecker J, Herrmann J, Jordan I, Muehlhoff E, Kevanna O, et al. A child feeding index is superior to WHO IYCF indicators in explaining length-for-age Z-scores of young children in rural Cambodia. Paediatr Int Child Health. 2015;35:124-34.

31. World Health Organization (WHO). Indicators for assessing infant and young child feeding practices: conclusions of a consensus meeting held 6-8 November 2007 in Washington D.C., USA. Washington, D.C.: World Health Organization
32. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: Validity of a brief depression severity measure. J Gen Intern Med [Internet]. 2001 [cited 2014 Nov 4];16:606-13. Available from: http://link.springer.com/10.1046/j.1525-1497.2001.016009606.x

33. Woldetensay YK, Belachew T, Tesfaye M, Spielman K, Biesalski HK, Kantelhardt EJ, et al. Validation of the Patient Health Questionnaire (PHQ-9) as a screening tool for depression in pregnant women: Afaan Oromo version. LoBello S, editor. PLOS ONE. 2018;13:e0191782.

34. Coates, J., Swindale, A., & Bilinsky, P. Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide [Internet]. Washington, D.C.; 2007. Available from: http://www.fao.org/fileadmin/user_upload/eufao-fsi4dm/doc-training/hfias.pdf

35. Mercer RT, Ferketich SL. Stress and social support as predictors of anxiety and depression during pregnancy. ANS Adv Nurs Sci. 1988;10:26–39.

36. Eshete T, Kumera G, Bazezew Y, Mihretie A, Marie T. Determinants of inadequate minimum dietary diversity among children aged 6–23 months in Ethiopia: secondary data analysis from Ethiopian Demographic and Health Survey 2016. Agric Food Secur. 2018;7:66.

37. Temesgen H, Negesse A, Woyraw W, Mekonnen N. Dietary diversity feeding practice and its associated factors among children age 6–23 months in Ethiopia from 2011 up to 2018: a systematic review and meta-analysis. Ital J Pediatr. 2018;44:109.

38. Belew AK, Ali BM, Abebe Z, Dachew BA. Dietary diversity and meal frequency among infant and young children: a community based study. Ital J Pediatr.
39. Dangura D, Gebremedhin S. Dietary diversity and associated factors among children 6-23 months of age in Gorche district, Southern Ethiopia: Cross-sectional study. BMC Pediatr. 2017;17:6.

40. Pope CJ, Mazmanian D. Breastfeeding and Postpartum Depression: An Overview and Methodological Recommendations for Future Research. Depress Res Treat. 2016;2016:1-9.

41. Dias CC, Figueiredo B. Breastfeeding and depression: A systematic review of the literature. J Affect Disord. 2015;171:142-54.

42. Hoche S, Meshesha B, Wankari N. Sub-Optimal Breastfeeding and Its Associated Factors in Rural Communities of Hula District, Southern Ethiopia: A Cross-Sectional Study. Ethiop J Health Sci. 2018;28:49-62.

43. Dunn S, Davies B, McCleary L, Edwards N, Gaboury I. The relationship between vulnerability factors and breastfeeding outcome. J Obstet Gynecol Neonatal Nurs JOGNN. 2006;35:87-97.

44. Ali NB, Tahsina T, Hoque DMeE, Hasan MM, Iqbal A, Huda TM, et al. Association of food security and other socio-economic factors with dietary diversity and nutritional statuses of children aged 6-59 months in rural Bangladesh. Cardoso MA, editor. PLOS ONE. 2019;14:e0221929.

45. Marinda PA, Genschick S, Khayeka-Wandabwa C, Kiwanuka-Lubinda R, Thilsted SH. Dietary diversity determinants and contribution of fish to maternal and under-five nutritional status in Zambia. PloS One. 2018;13:e0204009.

46. Miller-Graff LE, Ahmed AH, Paulson JL. Intimate Partner Violence and Breastfeeding Outcomes in a Sample of Low-Income Women. J Hum Lact. 2018;34:494-502.
47. Zureick-Brown S, Lavilla K, Yount KM. Intimate partner violence and infant feeding practices in India: a cross-sectional study: IPV and infant feeding practices in India. Matern Child Nutr. 2015;11:792–802.

48. Misch ES, Yount KM. Intimate Partner Violence and Breastfeeding in Africa. Matern Child Health J. 2014;18:688–97.

49. García-Moreno C, Pallitto C, Devries K, Stöckl H, Watts C, Abrahams N. Global and regional estimates of violence against women: prevalence and health effects of intimate partner violence and non-partner sexual violence. Geneva, Switzerland: World Health Organization; 2013.

50. Bitew T, Hanlon C, Medhin G, Fekadu A. Antenatal predictors of incident and persistent postnatal depressive symptoms in rural Ethiopia: a population-based prospective study. Reprod Health. 2019;16:28.

51. Woldetensay YK, Belachew T, Biesalski HK, Ghosh S, Lacruz ME, Scherbaum V, et al. The role of nutrition, intimate partner violence and social support in prenatal depressive symptoms in rural Ethiopia: community based birth cohort study. BMC Pregnancy Childbirth. 2018;18:374.

52. McEwen BS. Protective and damaging effects of stress mediators: central role of the brain. Dialogues Clin Neurosci. 2006;8:367–81.

53. Macharia TN, Ochola S, Mutua MK, Kimani-Murage EW. Association between household food security and infant feeding practices in urban informal settlements in Nairobi, Kenya. J Dev Orig Health Dis. 2018;9:20–9.

54. Macharia TN, Ochola S, Mutua MK, Kimani-Murage EW. Association between household food security and infant feeding practices in urban informal settlements in Nairobi, Kenya. J Dev Orig Health Dis. 2018;9:20–9.

55. Owais A, Kleinbaum DG, Suchdev PS, Faruque A, Das SK, Schwartz B, et al.
Household food security and infant feeding practices in rural Bangladesh.
Public Health Nutr. 2016;19:1875-81.

56. Pascal Agbadi, Helga Bjørnøy Urke, Maurice B. Mittelmark. Household food
security and adequacy of child diet in the food insecure region north in Ghana.
PLoS ONE. 2017;12.

57. Hanselman B, Ambikapathi R, Mduma E, Svensen E, Caulfield LE, Patil CL.
Associations of land, cattle and food security with infant feeding practices
among a rural population living in Manyara, Tanzania. BMC Public Health.
2018;18:159.

58. Wyatt AJ, Yount KM, Null C, Ramakrishnan U, Webb Girard A. Dairy
intensification, mothers and children: an exploration of infant and young child
feeding practices among rural dairy farmers in Kenya: Dairy intensification and
child feeding practices. Matern Child Nutr. 2015;11:88-103.

59. Valid International. Empowering New Generations to Improve Nutrition and
Economic Opportunities (ENGINE): Impact Assessment. Ethiopia; 2016.

60. Waswa LM, Jordan I, Herrmann J, Krawinkel MB, Keding GB. Community-based
educational intervention improved the diversity of complementary diets in
western Kenya: results from a randomized controlled trial. Public Health Nutr.
2015;18:3406-19.

61. Kuchenbecker J, Reinbott A, Mtimuni B, Krawinkel MB, Jordan I. Nutrition
education improves dietary diversity of children 6-23 months at community-
level: Results from a cluster randomized controlled trial in Malawi. van Wouwe
JP, editor. PLOS ONE. 2017;12:e0175216.

62. Ickes SB, Wu M, Mandel MP, Roberts AC. Associations between social support,
psychological well-being, decision making, empowerment, infant and young
child feeding, and nutritional status in Ugandan children ages 0 to 24 months. Matern Child Nutr. 2018;14:e12483.

63. Mukuria AG, Martin SL, Egondi T, Bingham A, Thuita FM. Role of Social Support in Improving Infant Feeding Practices in Western Kenya: A Quasi-Experimental Study. Glob Health Sci Pract. 2016;4:55-72.

64. Seeman TE, Singer BH, Ryff CD, Dienberg G, Levy-Storms L. Social relationships, gender, and allostatic load across two age cohorts. Psychosom Med. 2002;64:395-406.

65. McEwen B, Rasgon N. Brain and body on stress: allostatic load and mechanisms for depression and dementia. Depress Syst Illn. Strain JJ, Blumenfield M, editors. Oxford: Oxford University Press; 2018.

66. Kobrosly RW, van Wijngaarden E, Seplaki CL, Cory-Slechta DA, Moynihan J. Depressive symptoms are associated with allostatic load among community-dwelling older adults. Physiol Behav. 2014;123:223-30.

67. Sanghvi T, Martin L, Hajeebhoy N, Abrha TH, Abebe Y, Haque R, et al. Strengthening Systems to Support Mothers in Infant and Young Child Feeding at Scale. Food Nutr Bull. 2013;34:S156-68.

68. Giannì ML, Bezze E, Sannino P, Stori E, Plevani L, Roggero P, et al. Facilitators and barriers of breastfeeding late preterm infants according to mothers’ experiences. BMC Pediatr. 2016;16:179.

69. Rayfield S, Oakley L, Quigley MA. Association between breastfeeding support and breastfeeding rates in the UK: a comparison of late preterm and term infants. BMJ Open. 2015;5:e009144.

70. Demirci JR, Sereika SM, Bogen D. Prevalence and predictors of early breastfeeding among late preterm mother-infant dyads. Breastfeed Med Off J
71. Fanaro S, Borsari G, Vigi V. Complementary feeding practices in preterm infants: an observational study in a cohort of Italian infants. J Pediatr Gastroenterol Nutr. 2007;45 Suppl 3:S210-214.

72. Norris FJ, Larkin MS, Williams CM, Hampton SM, Morgan JB. Factors affecting the introduction of complementary foods in the preterm infant. Eur J Clin Nutr. 2002;56:448-54.

73. Paintal K, Aguayo VM. Feeding practices for infants and young children during and after common illness. Evidence from South Asia. Matern Child Nutr. 2016;12 Suppl 1:39-71.

74. Abegaz NT, Berhe H, Gebretekle GB. Mothers/caregivers healthcare seeking behavior towards childhood illness in selected health centers in Addis Ababa, Ethiopia: a facility-based cross-sectional study. BMC Pediatr. 2019;19:220.

75. Habibi M, Laamiri FZ, Aguenaou H, Doukkali L, Mrabet M, Barkat A. The impact of maternal socio-demographic characteristics on breastfeeding knowledge and practices: An experience from Casablanca, Morocco. Int J Pediatr Adolesc Med. 2018;5:39-48.

76. World Health Organization. Putting women first: Ethical and safety recommendations for research on domestic violence against women [Internet]. Geneva; 2001 [cited 2017 Feb 1]. Available from: https://www.who.int/gender/violence/womenfirtseng.pdf

77. World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA. 2013;310:2191-4.
