Individual and community level determinants of iron intake among children 6–59 months old in Ethiopia: multilevel logistic regression analysis

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Abstract
Background: Iron deficiency is one of the most important factors of anemia which is caused by poor iron intake. In addition, children need more iron because of their rapid growth. On the other side, daily intake of iron is also recommended as a standard approach for the treatment and prevention of iron deficiency anemia. In Ethiopia, although more than half of children 6–59 months of age were affected by anemia, the magnitude and factors associated with iron intake among them are understudied. Therefore this study aimed to assess the magnitude and community and individual level determinants of iron intake among 6–59 months children in Ethiopia.

Methods: Demographic and Health Survey datasets (EDHS) were used for this study. The data were weighted using sampling weight to get valid statistical estimates. The total weighted samples of 9,218 children aged 6–59 months were included. A multilevel binary logistic regression model was fitted to identify factors associated with iron intake among 6–59 months of children in Ethiopia. In the final model adjusted odds ratio with a 95% confidence interval and p-value < 0.05 was taken to declare statistical significance.

Results: The magnitude of iron intake among children 6–59 months in Ethiopia was 9.24% (95% CI: 8.31%, 10.15%). Individual level variables such as having at least one antenatal care visit (ANC) [AOR = 1.27; 95%CI; 1.01, 1.61], having health institution delivery [AOR = 1.46; 95%CI; 1.04, 2.04], age of children ≥ 24 months [AOR = 1.82; 95%CI; 1.29, 2.57], being female child [AOR = 0.81; 95%CI; 0.67, 0.99], being greater than three birth order [AOR = 0.73, 95%CI: 0.55, 0.98], whereas community level variables such as living in large central regions [AOR = 3.68; 95%CI; 1.47, 9.21], and living in community with high women education [AOR = 1.96; 95%CI; 1.28, 2.98] have an association with iron supplements among children 6–59 months years old in Ethiopia.

Conclusion and recommendations: The magnitude of iron intake among children 6–59 months old in Ethiopia is relatively low. Individual level factors such as; ANC visit, institution delivery, age of children, sex of the child, and birth order as well as; community level variables such as regions, and community women's education have a significant association with iron intake among children 6–59 months in Ethiopia. Prior attention should be given for under two...
Background

Anemia is a global public health problem that affects preschool-aged children disproportionately [1, 2]. Globally, 47.4% of preschool-aged children and in Africa, two out of three children (67.6%) are affected by anemia [2–4]. Moreover, in Ethiopia, 57% of children 6–59 months of age were touched by it [5].

Iron deficiency (ID) is one of the most important factors of anemia [2] and is caused by a lack of iron in the diet or a parasite infection in low-income countries [6, 7]. The risks for anemia in children start during gestation [6]. Low birth weight and preterm infants are born with lower iron stores and will go at increased risk of IDA [8]. The pace at which infant iron is used after delivery is determined by the infant’s rate of growth, iron intake, and iron losses [7]. Because they grow so quickly, infants have higher iron demands than other age groups [9]. Iron is needed by infants in the first few months after birth to form red blood cells [7]. Furthermore, they frequently use iron stored during the latter months of pregnancy, which can lead to low or exhausted stores by the time the infant is 4–6 months old [10]. Beyond six months of age the iron content of milk is not sufficient to meet many infants requirements [9]. Prolonged milk feeding is also associated with several micronutrient deficiencies [6].

Global efforts to reduce anemia are directed toward increasing the intake of iron through intake since iron deficiency makes a large contribution [2]. Daily intake of iron is one of the World Health Organization (WHO) recommendations and is considered a standard approach for the treatment and prevention of IDA [11–13]. WHO recommended that all preschool aged children receive a course of daily iron intake where the baseline prevalence of anemia is > 40% or severe [14]. Where the diet does not include fortified foods or the prevalence of anemia in children at approximately one year of age is severe (above 40%), supplements of iron at a dosage of 2 mg/kg of body weight per day should be given to all children [9].

The implementation of iron intake for children was reported by 40% of countries [4]. The weekly iron and folic acid intake program in a province of Viet Nam resulted in a 48% reduction in the prevalence of anemia [4]. A study conducted in India showed that there is a significant negative correlation between iron utilization and anemia among children [13]. Moreover, the study showed that low iron intake causes decreased physical capacity and reduced immunity, low cognitive development, and retarded growth in preschool children [15]. But in Ethiopia, the magnitude of iron intake among those under five at the national level is understudied. Therefore this study aimed to assess the magnitude and community and individual level determinants of iron intake among 6–59 months children in Ethiopia.

Methods

Study design, setting, and period

This study was based on the recent standard Ethiopian Demographic and Health Survey (EDHS, 2016) data, which was crosssectional and conducted from January 18, 2016, to June 27, 2016. The standard EDHS data set is with large sample size and is used to get all parameters that can be representative of the source [16].

Ethiopia is an East African country found in 3°-14° North and 33°–48°Eastern directions with 1.1 million Sq.km coverage. It is the second-most populous country in Africa with an estimated population of 114,963,588 in 2021 [17]. Administratively, Ethiopia is federally decentralized into two city administrations and nine regions. Kebele is the lowest administrative unit [16].

Populations

Source and study population

The source population was all children aged 6–59 months preceding five years of the survey period in Ethiopia whereas, children aged 6–59 months preceding five years of the survey period in the selected Enumeration Areas (EAs) were the study population. Children who have incomplete data for the outcome variable were excluded from the analysis.

Sample size determination and Sampling method

The most recent standard census of Ethiopia (2016 EDHS) was used. DHS samples are stratified by geographic region and by urban/rural areas within each region. DHS sample designs are usually two-stage probability samples drawn from an existing sample frame. Enumeration Areas (EAs) were the sampling units for the first stage of sampling. In selected EAs, households (HHs) comprise the second stage of sampling. Following the listing of the households, a fixed number of households is selected by equal probability systematic sampling in the selected cluster [16].
The detailed sampling procedure was available in each DHS report from the Measure DHS website [16].

To restore the representativeness of the sample data, weighted values were used and calculated from children's records or kid's records (KR) datasets. Finally, a total weighted sample of 9,218 children in the age category of 6–59 months was included in this study.

**Study variables**

The outcome variable of this study was iron intake in children 6–59 months. During the survey, their mother was asked questions about their living children 6–59 months who received iron pills, sprinkles, or syrup in the seven days preceding the interview [16].

Individual and community-level independent variables have been studied. The individual-level factors include socio-demographic characteristics such as; the age of the mother, marital status, mother’s employment, maternal education, family size, household wealth status, and media exposure were included. Child-related factors such as the sex of the child, age of the child, the plurality of birth, birth order, and breastfeeding status are all considered. Health service utilization-related factors such as pregnancy wanted-ness, place of delivery, PNC, and ANC visit were also considered. The community-level factors include; distance from health facilities, place of residence, region, community-level media exposure, community-level women's education, and community poverty were considered.

Community-level poverty was determined by the proportion of women in the poor and poorest quintile. It was coded as "0" for low (communities in which < 50% women had poor and poorest wealth quintiles), "1" for high (communities in which ≥ 50% women had poorest and poorer wealth quintiles) poverty communities. Community-level media exposure was assessed by the proportion of women who had at least been exposed to one media. It employs "0" to indicate low-level and "1" to indicate high-level media coverage at the community level, the same method is also used for community level women's education [18, 19].

**Data processing and analysis**

Data from the dataset were downloaded as standard DHS data in STATA format and then cleaned, integrate, transformed, and append to produce favorable variables for the analysis. Microsoft Excel was used to generate descriptive analysis and for aggregation of some community level variables whereas STATA 14 software was used for analytic statistics.

**Model building for multi-level analysis**

The DHS data has hierarchical nature, and children aged 6–59 months were nested within a cluster. This might violate the independence and equal variance assumptions. Therefore, a multilevel binary logistic regression model was fitted. Four models were fitted for multi-level analysis. The first was the null model (Model 1) containing no exposure variables which was used to check the variability across the cluster. The second (Model 2) and the third (Model 3) multilevel models contain individual-level variables and community-level variables respectively. In the fourth model (Model 4), both individual and community level variables were fitted simultaneously with the prevalence of iron intake among those under five.

\[
\log\left(\frac{\pi_{ij}}{1 - \pi_{ij}}\right) = \beta_0 + \beta_1 x_{ij} + \beta_2 x_{ij} + \ldots + u_j + e_{ij}
\]

where, \(\pi_{ij}\): the probability of iron intake, \(1 - \pi_{ij}\): the probability of no iron intake. While the \(\beta_0\) is the intercept that is the effect on feeding iron intake when the effect of all explanatory variables is absent. \(\beta_1 x_{ij}\) are individual and community level variables for the \(i\)th individual in group \(j\), respectively. Moreover, the \(\beta\)'s are fixed coefficients indicating a unit increase in \(X\) can cause a \(\beta\) unit increase in the probability of iron intake.

The UK shows the random effect (effect of the community on the mother’s decision to provide iron intake) for the \(j^{th}\) community. The clustered data nature and the within and between community variations were taken into account assuming each community has a different intercept (\(\beta_0\)) and fixed coefficient (\(\beta\)) [18, 20, 21].

Model comparisons were done using the likelihood test and the model with the highest value was model 4 and selected as the best-fitted model. The variance inflation factor (VIF) was used to detect multicollinearity, and all variables had VIF values less than 10 and the mean VIF value of the final model was 1.50.

The association between dependent and independent variables was assessed using Crude Odds Ratio (COR) and the Adjusted Odds Ratio (AOR). Factors with a \(p\)-value ≤ 0.2 in COR have been selected as candidates for the final model. Associations between dependent and independent variables were assessed and their strength has been presented using adjusted odds ratios and 95% confidence intervals with a \(p\)-value of < 0.05.

The measure of variation was estimated using the following parameters; the Median Odds Ratio (MOR) is defined as the median value of the odds ratio between the area at the lowest risk and the highest risk when randomly picking out two clusters. \(\text{MOR} = \exp(\sqrt{2} \times \text{VA}) \times 0.6745\), where; \(\text{VA}\) is the area
level variance [18, 20, 22]. The Proportional Change in Variance (PCV) reveals the variation in bottle-feeding among children 0–23 months explained by factors. The PCV is calculated as; $PCV = \frac{V_{null} - VA}{V_{null}} \times 100\%$ where; $V_{null} =$ variance of the initial model, and $VA =$ variance of the model with more terms. Moreover, Intra Class Correlation Coefficient (ICC), which reveals the variation of bottle feeding between clusters is calculated as; $ICC = \frac{VA}{VA + 3.29} \times 100\%$, where; $VA =$ area/cluster level variance [18, 20, 22].

Results

Socio demographic characteristics of mothers or caregivers

In this study, a total weighted sample of 9,218 children of age 6–59 months were included. More than half (53.81%) of mothers of children were in the age group of 20–35 years, with a median age of 29 (IQR: 25, 34) years. Three-fifths of women (66.75%) had no formal education. Most (88.92%) of the respondents were rural inhabitants. Ninety percent (90.15%) of women included in the study were from large central regions (Table 1).

| Variables                              | Categories | Weighted Frequency (n) | Weighted Percentage (%) |
|----------------------------------------|------------|------------------------|-------------------------|
| Age of women (years)                   | 15–19      | 1,920                  | 20.83                   |
|                                        | 20–34      | 4,960                  | 53.81                   |
|                                        | 35–49      | 2,338                  | 25.36                   |
| Sex of household head                  | Male       | 7,926                  | 85.99                   |
|                                        | Female     | 1,291                  | 14.01                   |
| Educational attainment of women        | No education | 67              | 66.75                   |
|                                        | Primary education | 2,434              | 26.41                   |
|                                        | Secondary & above | 631              | 6.84                    |
| Occupation of women                    | Not working | 5,047                | 54.76                   |
|                                        | Worked     | 4,170                  | 45.24                   |
| Marital status of the mother           | Married    | 8,638                  | 93.71                   |
|                                        | Not married | 580              | 6.29                    |
| Household family size                  | 1–4        | 2,403                  | 26.07                   |
|                                        | 5–10       | 6,517                  | 70.7                    |
|                                        | ≥11        | 297                    | 3.23                    |
| Media exposure                         | No         | 6,217                  | 67.45                   |
|                                        | Yes        | 3,000                  | 32.55                   |
| Wealth index                           | Poorest    | 4,313                  | 46.79                   |
|                                        | Middle     | 1,939                  | 21.04                   |
|                                        | Richest    | 2,966                  | 32.17                   |
| Community level women’s education      | Low        | 4,731                  | 51.33                   |
|                                        | High       | 4,486                  | 48.67                   |
| Community level media usage            | Low        | 4,072                  | 44.17                   |
|                                        | High       | 5,146                  | 55.83                   |
| Community level poverty                | Low        | 5,637                  | 61.16                   |
|                                        | High       | 3,579                  | 38.84                   |
| Residence                              | Urban      | 1,021                  | 11.08                   |
|                                        | Rural      | 8,196                  | 88.92                   |
| Region                                 | Metropolis | 270                | 2.93                    |
|                                        | Large central | 8,310             | 90.15                   |
|                                        | Small periphery | 638               | 6.92                    |
Child related characteristics and health service utilization-related factors

From the total weighted sample of 9,218 children of age 6–59 nearly similar proportions of males (51.63%) and females (48.37%) were studied. Nearly three-fifths (66.64%) of the children were above two years with a median age of 32 (IQR: 18 46,) months. 66.35% of the child were singleton. Moreover, three fourth (74.82%) of infants were delivered at home (Table 2).

The magnitude and associated factors of iron intake among children 6–59 months old in Ethiopia

The magnitude of iron intake among children 6–59 months old in Ethiopia was 9.24% (95% CI: 8.31, 10.15).

In the random-effects analysis, the null model ICC showed that 34.4% of the variations in iron supplements among children 6–59 months old were attributed to cluster differences. The median odds ratio (MOR) between the lower-risk and higher-risk area of iron supplement among clusters were 3.34. Moreover, the final model (model four) expressed about 21.89% of the variation in iron supplements among 6–59 months old children. Log-likelihood and deviance were used for model comparison and model four has the lowest deviance (3386) and the highest log likelihood (-1693) which is considered the best fit model (Table 3).

In the fixed effect analysis, individual level factors such as; ANC visit, institution delivery, age of children, sex of the child, family size, and birth order have a statistically significant association with iron intake among children 6–59 months old.

In this study, as the age of children increased to 12–23 months old, and > 24 months old, they were 1.49 and 1.82 times more likely to get iron supplements as compared to 6–11 months old children [AOR=1.49; 95%CI; 1.08, 2.06] and [AOR = 1.82; 95%CI; 1.29, 2.57].

In our study, mothers who had at least one ANC visit during pregnancy, and had health institution delivery had 1.27 and 1.46 times more likely to access their child's iron supplements as compared to no ANC visit and home delivery mothers [AOR=1.27; 95%CI;1.01, 1.61], and [AOR = 1.46; 95%CI;1.04, 2.04] respectively.

In our study, female children were 19% less likely to have iron supplements as compared to males [AOR=0.81; 95%CI; 0.67, 0.99]. The odds of getting iron intake among children who have a birth order greater than three were decreased by 27% [AOR=0.73, 95%CI: 0.55, 0.98].

Moreover, community level factors such as; regions and community level women’s education have a statistically

| Variables                     | Categories            | Weighted Frequency(n) | Weighted Percentage (%) |
|-------------------------------|-----------------------|-----------------------|-------------------------|
| Sex of child                  | Male                  | 4,759                 | 51.63                   |
|                               | Female                | 4,458                 | 48.37                   |
| Age of child                  | 6–11 months           | 1,071                 | 11.62                   |
|                               | 12–23 months          | 2,004                 | 21.74                   |
|                               | ≥ 23 months           | 6,142                 | 66.64                   |
| Plurality                     | Single                | 9,006                 | 97.7                    |
|                               | Multiple              | 212                   | 2.3                     |
| Birth order                   | ≤ 3                   | 4,508                 | 48.9                    |
|                               | > 3                   | 4,710                 | 51.1                    |
| Breastfeeding status          | No                    | 3,102                 | 33.65                   |
|                               | Yes                   | 6,116                 | 66.35                   |
| Pregnancy wortedness          | Wanted                | 6,559                 | 71.16                   |
|                               | Unwanted              | 2,658                 | 28.84                   |
| ANC visits                    | No ANC                | 2,258                 | 37.03                   |
|                               | At least one ANC      | 3,839                 | 62.97                   |
| Place of delivery             | Home delivery         | 6,897                 | 74.82                   |
|                               | Health facilities     | 2,321                 | 25.18                   |
| Distance from health facilities| Not big problem      | 3,622                 | 39.29                   |
|                               | Big problem           | 5,596                 | 60.71                   |
| Variables                        | Categories | Null model | Model 2 AOR [95% CI]               | Model 3 AOR [95% CI]               | Model 4 AOR [95% CI]               |
|--------------------------------|------------|------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Age of women (years)           | 15–24      | 1.00       |                                   |                                   | 1.00                              |
|                                | 25–34      |            | 1.33 [0.99, 1.79]                 |                                   | 1.34 [0.99, 1.79]                 |
|                                | 36–49      |            | 1.13 [0.76, 1.67]                 |                                   | 1.13 [0.77, 1.67]                 |
| Sex of household head          | Male       | 1.00       |                                   |                                   | 1.00                              |
|                                | Female     |            | **0.67 [0.48, 0.95]**             |                                   | 0.73 [0.48, 1.05]                 |
| Educational attainment of women| No education| 1.00       |                                   |                                   | 1.00                              |
|                                | Primary education | 1.11 [0.86, 1.41] |                                   | 1.03 [0.80, 1.31] |                                   |
|                                | Sec. & above | 1.49 [0.97, 2.29] |                                   | 1.37 [0.89, 2.11] |                                   |
| Occupation of women            | Not worked | 1.00       |                                   |                                   | 1.00                              |
|                                | Worked     |            | **0.933 [0.76, 1.15]**           |                                   | 0.94 [0.76, 1.15]                 |
| Marital status of the mother   | Married    | 1.00       |                                   |                                   | 1.00                              |
|                                | Not married|            | **0.83 [0.53, 1.31]**            |                                   | 0.84 [0.53, 1.32]                 |
| Household family size          | 1–4        | 1.00       |                                   |                                   | 1.00                              |
|                                | 5–10       |            | **1.46 [1.12, 1.91]**            | 1.45 [1.11, 1.89]                 |                                   |
|                                | > 11       |            | **1.66 [0.88, 3.14]**            | 1.69 [0.89, 3.19]                 |                                   |
| Media exposure                 | No         | 1.00       |                                   |                                   | 1.00                              |
|                                | Yes        |            | 1.03 [0.78, 1.31]                 |                                   | 1.02 [0.79, 1.30]                 |
| Wealth index                   | Poorest    | 1.00       |                                   |                                   | 1.00                              |
|                                | Middle     |            | **1.22 [0.93, 1.61]**            | 1.17 [0.88, 1.55]                 |                                   |
|                                | Richest    |            | **1.37 [1.03, 1.82]**            | 1.29 [0.96, 1.73]                 |                                   |
| Sex of child                   | Male       | 1.00       |                                   |                                   | 1.00                              |
|                                | Female     |            | **0.64 [0.46, 0.90]**            | 0.81 [0.67, 0.99]                 |                                   |
| Age of child                   | 6–11       | 1.00       |                                   |                                   | 1.00                              |
|                                | 12–23      |            | **1.47 [1.07, 2.03]**            | 1.49 [1.08, 2.06]                 |                                   |
|                                | > 24       |            | **1.86 [1.32, 2.63]**            | 1.82 [1.29, 2.57]                 |                                   |
| Plurality of birth             | Single     | 1.00       |                                   |                                   | 1.00                              |
|                                | Multiple   |            | **0.84 [0.34, 2.08]**            | 0.82 [0.33, 2.02]                 |                                   |
| Birth Order                    | ≤ 3        | 1.00       |                                   |                                   | 1.00                              |
|                                | > 3        |            | **0.74 [0.55, 0.98]**            | 0.73 [0.55, 0.98]                 |                                   |
| Breastfeeding status           | No         | 1.00       |                                   |                                   | 1.00                              |
|                                | Yes        |            | **0.86 [0.67, 1.11]**            | 0.87 [0.678, 1.11]                |                                   |
| Pregnancy wantedness          | Wanted     | 1.00       |                                   |                                   | 1.00                              |
|                                | Unwanted   |            | **0.82 [0.65, 1.03]**            | 0.81 [0.64, 1.02]                 |                                   |
| ANC visits                     | No ANC     | 1.00       |                                   |                                   | 1.00                              |
|                                | At least one ANC | 1.29 [1.03, 1.64] |                                   | 1.27 [1.01, 1.61] |                                   |
| Place of delivery              | Home delivery | 1.00       |                                   |                                   | 1.00                              |
|                                | Health facilities | **1.46 [1.04, 2.04]** |                                   | 1.46 [1.04, 2.04] |                                   |
| Community level variables      | Not big problem | 1.00       |                                   |                                   | 1.00                              |
|                                | Big problem | 1.16 [0.96, 1.41] |                                   | 1.09 [0.87, 1.39] |                                   |
| Residence                      | Urban      | 1.00       |                                   |                                   | 1.00                              |
|                                | Rural      | 1.00       |                                   |                                   | 1.00                              |
| Region                         | Metropolis | 1.00       |                                   |                                   | 1.00                              |
|                                | Large central | 3.39 [1.53, 7.52] |                                   | 3.68 [1.47, 9.21] |                                   |
|                                | Small periphery | 1.74 [0.70, 4.31] |                                   | 2.56 [0.88, 7.39] |                                   |
| Community-women education      | Low        | 1.00       |                                   |                                   | 1.00                              |
|                                | High       | 2.13 [1.48, 3.06] |                                   | 1.96 [1.28, 2.98] |                                   |
| Community media usage          | Low        | 1.00       |                                   |                                   | 1.00                              |
|                                | High       | 1.02 [0.70, 1.48] |                                   | 0.92 [0.59, 1.42] |                                   |
significant association with iron intake among children 6–59 months old.

In this study, those living in a large central region were 3.68 times more likely to have iron intake \( \text{AOR} = 3.68; 95\% \text{CI}; 1.47, 9.21 \). Women who were living in high community level education were 1.28 times more likely to have iron supplements among children 6–59 months in Ethiopia \( \text{AOR} = 1.96; 95\% \text{CI}; 1.28, 2.98 \) (Table 3).

**Discussions**

In Ethiopia, 57% of children 6–59 months of age were affected by anemia [5]. World Health Organization (WHO) recommended that all preschool-aged children receive a course of daily iron intake where the baseline prevalence of anemia is severe (> 40%) [14]. Therefore this study aimed to determine the magnitude and associated factors of iron supplements among 6–59 months children in Ethiopia. Based on this, the magnitude of iron intake among children 6–59 months old in Ethiopia was 9.24% (95% CI: 8.31, 10.15). This is higher than in Afghanistan (6%) [6] but lower than in a study conducted in India (24.1%) [15]. This might be due to the implementation difference in nutritional programs including iron supplements and the socioeconomic difference between countries [15].

In this study, as the age of children increases, they are more likely to get iron. This is supported by a study in India [15]. A study in Ethiopia also showed that as a child ages increase the probability of being anemic decreases [23]. This is common because most mothers think that, the child can resist medication side effect when the age becomes increase and most supplements and deworming have been given in Ethiopia during preschool ages.

In our study, mothers who had at least one ANC visit during pregnancy, and had health institution delivery have more likely to access their child’s iron supplements as compared to no ANC visit and home delivery mothers. This is because of having information and knowledge during follow up, mothers who have ANC follow have a positive health behavior like utilization of iron for them and their child as well to prevent anemia [23].

In this study, female children were less likely to have iron supplements than males. This is might be due to the caregiving behaviors of mothers because of preference. In Ethiopia, parents give more meal freedom and caretaking to male children than to females [24]. In this study higher birth order has a negative association with iron supplements among children 6–59 months. This is in line with a study in India [15], and a study in Asia and India [25] which show when birth order increases the use of iron supplements decreases. A study conducted in Ethiopia among 6–59 months children showed that higher birth-order children had higher odds of anemia than first-order children [23]. This is because birth order matters in the care taken and the nutritional status of children [26].

In high women’s education community has a positive association with iron supplements among children 6–59 months in Ethiopia. This is supported by a study in Afghanistan [6] and a study in India [15]. This might be due to the that, educated mothers’ had health advantages in understanding the information [24]. They ensure better dietary practices for children, including iron-rich food consumption, and taking iron intake [13].

In our study children who were living in large central regions were more likely to have iron supplements than metropolitan ones. This is supported by a study that showed that Children from Dire Dawa, Harrie, Afar,

| Variables Categories | Null model | AOR [95% CI] | Model 2 AOR [95% CI] | Model 3 AOR [95% CI] | Model 4 AOR [95% CI] |
|----------------------|------------|--------------|----------------------|----------------------|----------------------|
| Community poverty    | Low        | –            | 1.00                 | 1.00                 |                      |
|                      | High       | –            | 0.81 [0.56, 1.19]    | 0.82 [0.52, 1.30]    |                      |
| Random effect        | Community level variance 1.69 | 1.54 | 1.58 | 1.32 |
|                      | ICC        | 34.4%        | 32.35%               | 32.92%               | 29.73%               |
|                      | MOR        | 3.44         |                      |                      |                      |
|                      | PCV        | Ref          | 8.87%                | 6.51%                | 21.89%               |
| Model comparison     | Logliklihood | -2611       | -1707                | -2588                | -1693                |
|                      | Deviance   | 5222         | 3414                 | 5176                 | 3386                 |

\* = P-value < 0.05  
\** = P-value < 0.01  
\*** = P-value < 0.001  

ICC Inter cluster correlation coefficient, MOR Median odds ratio, PCV Proportional change in variance, AOR Adjusted odds ratio, CI Confidence interval, Ref Reference.
and Somali (metropolis and small peripheral regions) had higher odds of anemia than children from the Tigray region (large central) [23]. This might due to that large central regions has increased accessibility and affordability of maternal and child health service when compared to small peripheral which is an emerging region [27].

The main strength of this study was the use of the weighted nationally representative data with a large sample which makes it representative at country levels. Therefore, it has appropriate statistical power that can be generalized of the estimates in iron supplements in the study setting to all children 5–59 months during the study period. Since the data were collected cross-sectional by self-reported interviews would be prone to recall and social desirability bias. The drawback of the secondary nature of data was inevitable.

**Conclusion**

The magnitude of iron intake among children 6–59 months old in Ethiopia is relatively low. Individual level factors such as; ANC visit, institution delivery, age of children, sex of the child, and birth order as well as; community level variables such as regions, and community women's education have a significant association with iron intake among children 6–59 months in Ethiopia. Prior attention should be given for under two years old children, children greater than three birth orders, and children living in small peripheral regions. Moreover, policymakers and other stakeholders had better plan and implement programs that empower women, enhance ANC visits, and health institution delivery to have a sustainable increment in iron intake for children in Ethiopia.

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**Authors' contributions**

The conception of the work, design of the work, acquisition of data, analysis, and interpretation of data was done by DGB, AAK, DTF, BTA, MHA, and KS. Data curation, drafting of the article, revising it critically for intellectual content, validation and final approval of the version to be published was done by DGB, AAK, DTF, BTA, MHA, YFS and KS. All authors read and approved the final manuscript.

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**Availability of data and materials**

Data is available online from the "measures DHS program" and taken after writing a concept note to the DHS program and getting permission to use it. Then register through this website, https://dhsprogram.com/data/new-user-registration.cfm.

**Declarations**

**Ethics approval and consent to participate**

The DHS surveys have been collected from more than 90 countries with the main objective to improve the collection, analysis, and dissemination of population, health, and nutrition data and facilitate the use of these data for planning, policy-making, and program management.

Since it is secondary data, the ethics to do this topic and to access the data is approved by the "measures DHS program"; they gave an ethical permission letter and a data set after registering and asking permission to do on this topic. We can attach the permission letter to the supplementary file of the next revision.

All methods were carried out following relevant guidelines and regulations of the Demographic and Health Surveys (DHS) program. From preliminary, the data were collected by "The DHS program" by taking informed consent from individuals. Informed consent was waived then, the International Review Board of Demographic and Health Surveys (DHS) program data archivists, waived the consent after the concept paper was submitted to DHS Program/ICF International Inc, a letter of permission to download the dataset for this study The dataset was not shared or passed on to other bodies and has maintained its confidentiality. The study is not an experimental study.

**Consent for publication**

Not applicable.

**Competing interests**

The authors declare that they have no competing interests.

There are no financial, non-financial, or commercial organizations competing for interests.

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