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Core and optional infant and young child feeding indicators in Sub-Saharan Africa: a cross-sectional study

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ABSTRACT

Objective The objective of the study is to determine the status of infant and young child feeding (IYCF) in Sub-Saharan Africa (SSA) based on multiple indicators.

Design Secondary data analysis of 32 Demographic and Health Surveys conducted in SSA since 2010.

Setting Thirty-two countries in SSA.

Participants 151 575 infants and young children born in the preceding 2 years of the surveys.

Indicators determined Eight core and six optional IYCF indicators.

Results Majority (95.8%) of the children born in the preceding 24 months were ever breastfed, and 50.5% initiated breastfeeding within the first hour of birth. Among infants 0–5 months of age, 72.3% were predominantly breastfed and 41.0% were exclusively breastfed. Continued breastfeeding at 1 year (89.5%) was reasonably high, but only 53.7% continued breastfeeding at 2 years and 60.4% had age-appropriate breastfeeding. About two-thirds (69.3%) of infants 6–8 months of age received solid, semisolid or soft food over the previous day across the countries. Among children 6–23 months of age, 41.9% met the minimum recommended meal frequency, while smaller proportions satisfied the minimum dietary diversity (21.0%) and acceptable diet (9.8%). About one-third (37.6%) of children 6–23 months of age consumed iron-rich or iron-fortified food over the previous day. Among non-breastfed children, only 15.0% received the recommended two or more milk feedings. Thirteen per cent were fed with a bottle with a nipple in the previous day. Country-level estimates for most indicators showed remarkable variations. Yet the minimum dietary diversity and acceptable diet indicators were consistently low.

Conclusion Most breastfeeding-related indicators, except exclusive and early initiation of breastfeeding, are in an acceptable level in SSA. However, complementary feeding indicators are generally low.

BACKGROUND

Between 1990 and 2016, globally the total number of deaths under the age of 5 dropped by 56%.[1 2] Yet the figure falls short of the Millennium Development Goal 4, which targeted for a two-thirds reduction between 1990 and 2015.[2 3] Globally every year 41 childhood deaths per 1000 live births, equivalent to 5.6 million deaths, happen. The problem

Strengths and limitations of this study

► The study is based on recent and nationally representative surveys conducted in multiple Sub-Saharan African (SSA) countries.
► The study provided a recent summary of all core and optimal infant and young child feeding indicators that have not been available at this scale before.
► The huge sample size allowed for precise estimation of the indicators, including those defined based on narrow age groups.
► The findings of the study might not be generalisable to other SSA countries that have not been represented in the analysis.
► Due to the cross-sectional nature of the original studies, indicators related to complementary feeding practice could have been affected by seasonality bias.

is especially evident in Sub-Saharan Africa (SSA), where half of the global deaths occur.[1]

Undernutrition is an important underlying cause of mortality and a significant predictor of a child's survival. According to a recent estimate, nutrition-related factors contribute to 45% of the global under-5 deaths.[4] Beyond survival, optimal nutrition is indispensable to children to reach their physical and mental development potentials. Vitamin A deficiency and iodine deficiency disorders remain the leading causes of preventable blindness and mental retardation. Further, stunting, as well as iodine, iron and zinc deficiencies, may limit cognitive development.[4] Globally, 23% of children are stunted.[5] The magnitude of hidden hunger is also high. About 43% of children are anaemic, 33% are vitamin A-deficient, 30% of school children have inadequate iodine intake and 17% of the global population has insufficient zinc intake.[6–9]

The first 2 years of life are the most critical for the physical and mental development of children. Nutritional deprivation over this period is likely to result in largely irreversible physical and cognitive deficits. Thus, this period is regarded as the 'window of

opportunity' for interventions against undernutrition.[10 11] Conversely, in low-income and middle-income countries including the SSA, this period poses a significant vulnerability to children's well-being.[10] Especially the complementary feeding period, which extends between 6 and 23 months of age, is characterised by growth retardation and onset of micronutrient deficiencies in many low-income and middle-income countries.[12] A study concluded that promotion of optimal infant and young child feeding (IYCF) practice in the first 2 years could avert up to 220 000 childhood deaths each year.[13]

Optimal IYCF has multiple dimensions. Infants should initiate breastfeeding within 1 hour of birth, breastfeed exclusively for the first 6 months and continue to receive breast milk up to 2 years of age and beyond. Starting at 6 months, age-appropriate complementary foods should be introduced with optimal feeding frequency and nutrient density.[14] In 2008 the WHO proposed a set of core and optional indicators that can be used in population-based surveys for the assessment of IYCF practices and for the evaluation of interventions.[14] The new standard has replaced a previous guideline,[15] and created a consensus on IYCF indicators and provided methodological standardisation for their measurement.[13]

Since the development of the guideline, the indicators have been widely generated by localised and national population-based surveys. Especially the Demographic and Health Surveys (DHS) presented a special opportunity to measure the indicators in many low-income and middle-income countries using similar and standardised approach. However, pooled indicators for the entire SSA have not been made available so far. Pooled indicators are important to show the critical cross-cutting gaps in IYCF practices in SSA, where malnutrition and child mortality are major concerns. Further, the indicators can be used as background information for the IYCF efforts in the region and may help to track the progress on IYCF and child nutrition. Accordingly, the purpose of the current study is to determine the status of the 14 core and optional IYCF indicators for the SSA region based on the recent DHS conducted since 2010.

METHODS
Study design
This descriptive cross-sectional study was conducted based on the secondary data of all 32 recent and nationally representative DHS conducted in the SSA region between 2010 and 2016. The surveys included in the analysis with their respective weighted and unweighted sample sizes are listed in table 1.

Study area description
According to the World Bank classification, the SSA region includes 48 predominately low-income African countries located south of the Sahara. In 2016 the population size of the region was nearly a billion. Despite the fast economic growth recorded in the region in the last

Table 1 List of countries represented in the analysis and their respective sample size

		Sample size (n=151 575)	
Country	Survey year	Unweighted	Weighted
Angola	2015–2016	6553	4659
Burkina Faso	2010	7029	3394
Benin	2011–2012	5792	1983
Burundi	2010	3465	1807
Congo (Democratic Republic)	2013–2014	8642	14213
Congo (Republic of the)	2011–2012	4256	866
Cote d'Ivoire	2011–2012	3668	4254
Cameroon	2011	5503	4010
Ethiopia	2016	4654	19087
Gabon	2012	2761	345
Ghana	2014	2615	5043
Gambia	2013	3754	372
Guinea	2012	3339	2011
Kenya	2014	4185	8335
Comoros	2012	1386	144
Liberia	2013	3495	744
Lesotho	2014	1517	351
Mali	2012–2013	4620	3274
Malawi	2015–2016	7330	3000
Mozambique	2011	5235	5153
Nigeria	2013	14847	33398
Niger	2012	5634	3473
Namibia	2013	2107	420
Rwanda	2014–2015	3431	2083
Sierra Leone	2013	5611	1198
Senegal	2016	2917	2603
Chad	2014–2015	8080	2516
Togo	2013–2014	3183	1300
Tanzania	2015–2016	4687	9390
Uganda	2011	3488	6825
Zambia	2013–2014	5195	2842
Zimbabwe	2015	2596	2484

two decades, SSA remains the least developed part of the world, with a gross national income (GNI) per capita of US$3700. Of the countries in the region, 41 are either low-income or lower middle-income economies, with a GNI of US$3955 or less.[16] SSA has the lowest index of essential health services in the world, and life expectancy at birth is about 60 years.[17]

Eligibility criteria
All DHS conducted in the SSA since 2010 were eligible for the study. On the other hand, all children who were
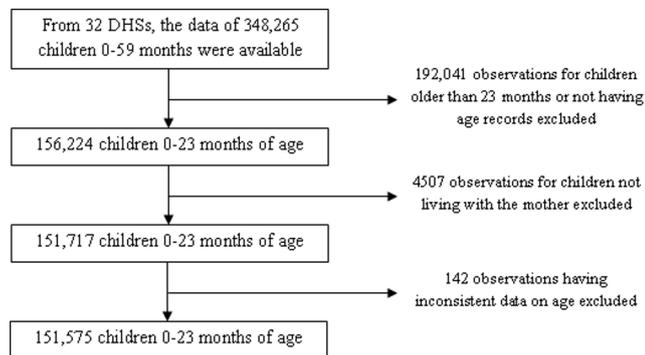
Figure 1 Flow chart of the study. DHS, Demographic and Health Survey.

born within 24 months preceding the surveys, irrespective of being living or deceased, were considered for the analysis. Conversely, data of living children who were not staying with the respondent at the time of the surveys were excluded (figure 1).

Sampling approach of the DHS

Each DHS is designed to generate representative data at national, place of residence (urban-rural) and subnational (federal or regional states) levels. The sampling is typically based on two-stage cluster sampling approach stratified for place of residence. First, enumeration areas (EA) are drawn from recent national census files, then in each EA selected a complete listing of households is made. Afterwards a sample of 25–30 households are drawn from each EA using systematic random sampling approach. The households that have been selected were visited, household members got enumerated and all the eligible were enrolled in the study.[18 19] Then data were collected from the three groups of eligible subjects: women and men 15–49 years of age and children 0–59 months of age.[18 19] However, this specific analysis included data collected from women in the reproductive age who gave at least one birth in the preceding 24 months of the survey.

Data collection

Data were collected from the mothers of the index children using standardised and pretested questionnaires prepared in the major local languages of the respective countries. DHS data were collected by interviewers, supervisors and field editors who received an intensive training lasting at least 4 weeks.

The DHS collects a range of IYCF-related information in compatible manner with the existing WHO guideline.[14] Information gathered included history of ever breastfeeding and timely initiation of breastfeeding for both deceased and living children; breastfeeding, consumption of plain water and other liquids, meal frequency, types of food the child consumed, and practice of bottle feeding over the previous day for all infants and young children living with the respondents; and frequency of milk or formula feeding for all non-breastfed children.

The height and weight of the children were measured using calibrated tools following standard procedures. Stunting, wasting and underweight were defined as height-for-age, weight-for-height and weight-for-age below −2 standardised scores, respectively, whereas children who fell below −3 z-scores were considered severely malnourished.

Among children 6–23 months of age, haemoglobin levels were determined onsite from capillary blood using a portable HemoCue analyser and the measurements were adjusted for altitude. Ultimately, based on the haemoglobin concentration, anaemia status was classified as non-anaemic (above 110 g/L), mild (100–109 g/L), moderate (70–99 g/L) and severe (less than 70 g/L) following standard threshold values.

Patient and public involvement

As the study was conducted based on secondary data, patients and/or the public were not involved.

Data analysis

Initially the 'children's record' data sets for all of the 32 surveys were separately downloaded from the DHS programme website in SPSS V.22 format[20] and merged into one mega file. Then with the exception of basic sociodemographic and IYCF relevant variables, all the other variables were dropped. Frequency distribution and measures of central tendency and dispersion were used to describe the data. Recoding of children's age, meal frequency and dietary diversity was made following the WHO guideline.[14] No attempt was made to impute or estimate missing values in the data set.

Data were analysed using weighted data analysis approach. Country-level estimates were weighted using the sampling weight already provided in the DHS data sets. Indicators pooled across the countries were further weighted using poststratification fractions defined based on the 2016 population size of the 32 countries. Further, normalisation of the poststratification weight was made, so that the weighted and unweighted samples would be equal.

Dietary diversity was assessed by asking the mother whether the child had received from 14 different food groups in the preceding day, without setting minimum intake restrictions. During analysis the food groups were recategorised into the basic seven food groups recommended by WHO for infants and young children. The seven food groups were grains, roots and tubers, legumes and nuts, dairy products excluding breast milk, flesh foods (meat, fish, poultry or organ meats), eggs, vitamin A-rich fruits and vegetables, and other fruits and vegetables.[14] Ultimately, dietary diversity score that ranges from 0 to 7 was computed. Consumptions of sweets, oil, fats or butter have not been counted in the dietary diversity calculation.

The study generated eight core and six optional IYCF indicators for the SSA region as well as for each of the 32 countries included in the study. Age-disaggregated figures were also presented for most of the indicators.

Table 2 Summary of core and optional indicators generated in the study

Indicators	Numerator	Denominator
Core indicators		
Early initiation of breastfeeding	Children born in the last 24 months (living or deceased) who were put to the breast within 1 hour of birth.	Children born in the last 24 months.
Exclusive breastfeeding under 6 months	Infants 0–5 months who received only breast milk during the previous day.	Infants 0–5 months.
Continued breastfeeding at 1 year	Children 12–15 months who received breast milk during the previous day.	Children 12–15 months.
Introduction of solid, semisolid or soft foods	Infants 6–8 months who received solid, semisolid or soft foods during the previous day.	Infants 6–8 months.
Minimum dietary diversity	Children 6–23 months who received foods from 4 or more food groups out of the standard 7 food groups during the previous day.	Children 6–23 months.
Minimum meal frequency	Children 6–23 months who received solid, semisolid or soft foods the minimum number of times or more during the previous day.*	Children 6–23 months.
Minimum acceptable diet	Breastfed children 6–23 months who had at least the minimum dietary diversity and meal frequency, and non-breastfed children 6–23 months who received at least 2 milk feedings and had at least the minimum dietary diversity not including milk feeds and the minimum meal frequency during the previous day.	Children 6–23 months.
Consumption of iron-rich or iron-fortified foods	Children 6–23 months who received an iron-rich food or food that was specially designed for infants and young children and was fortified with iron.	Children 6–23 months.
Optimal indicators		
Children ever breastfed	Children born in the last 24 months (living or deceased) who were ever breastfed.	Children born in the last 24 months.
Continued breastfeeding at 2 years	Children 20–23 months who received breast milk during the previous day.	Children 20–23 months.
Age-appropriate breastfeeding	Infants 0–5 months who received only breast milk plus, children 6–23 months who received breast milk as well as foods during the previous day.	Children 6–23 months.
Predominant breastfeeding under 6 months	Infants 0–5 months of age who received breast milk as the predominant source of nourishment during the previous day.	Infants 0–5 months.
Bottle feeding	Children 0–23 months who were fed with a bottle during the previous day.	Children 0–23 months.
Milk feeding frequency for non-breastfed children	Non-breastfed children 6–23 months of age who received at least 2 milk feedings during the previous day.	Non-breastfed children 6–23 months.

*2 and 3 times for breastfed children 6–8 and 9–23 months, respectively; 4 times for non-breastfed children. The number of milk feeds is counted for non-breastfed children as meals.

The manuscript primarily describes the IYCF indicators at the SSA level, while online supplementary file 1 tabulates the summary of the indicators for each of the 32 countries. As summarised in table 2, the indicators were generated as per the recommendation of the WHO guideline (table 2).[14]

Among the IYCF indicators recommended by the WHO, the median duration of breastfeeding was not determined for two reasons: first, unlike the others the indicator requires a different age range (0–35 months of children), and second among children 0–35 months of age more than half (52%) were still breastfeeding at the time of the study, hence determining the median duration was not possible.

RESULTS
Sociodemographic characteristics
The data of 151 575 children born in the previous 2 years of the survey were included in the analysis. Most of the

Table 3 Sociodemographic characteristics of the respondents and the index infants and young children from 32 Sub-Saharan African countries, 2010–2016

Variables	Frequency	Percentage
Type of place of residence (n=151 575)		
Urban	43 313	28.6
Rural	108 262	71.4
Age of the mother (years) (n=151 575)		
15–24	50 646	33.4
25–34	70 892	46.8
35–49	30 037	19.8
Maternal educational status (n=151 566)		
No education	61 650	40.7
Primary	52 128	34.4
Secondary	32 844	21.7
Higher	4944	3.3
Respondents currently working (n=151 328)		
No	61 693	40.8
Yes	89 636	59.2
Marital status (n=151 568)		
Married/Living with partner	135 904	89.7
Not ever married	7561	5.0
Separated	4384	2.9
Divorced	2084	1.4
Widowed	1635	1.1
Husband's/partner's education (n=141 069)		
No education	46 668	33.1
Primary	43 370	30.7
Secondary	38 330	27.2
Higher	10 090	7.2
Don't know	2610	1.9
Children ever born to the respondent (n=151 575)		
1	28 309	18.7
2–4	70 967	46.8
5 or more	52 300	34.5
Number of under-5 children in the household (n=151 632)		
1	53 082	35.0
2	58 846	38.8
3 or more	39 647	26.2
Child alive (n=151 575)		
No	22 695	15.0
Yes	128 880	85.0
Age (years) (n=128 880)		
0	66 748	51.8
1	62 132	48.2
Age (months) (n=124 338)		
0–5	32 980	26.5
6–11	33 014	26.6

Continued

Table 3 Continued

Variables	Frequency	Percentage
12–17	32 779	26.4
18–23	25 566	20.6
Sex of the child (n=151 575)		
Boys	77 007	50.8
Girls	74 569	49.2

children (71.4%) were selected from rural areas. The mean (±SD) age of the mothers was 28.0 (±6.9) years, and a little less than half (46.8%) were between 25 and 34 years of age. The vast majority (89.7%) of the respondents were married or living with their partners.

More than one-third of the respondents (40.7%) had no formal education. The median number of children ever born to the mothers was 3, and nearly one-third (34.5%) were grandmultiparous. The median number of children under the age of 5 per household was 2, and 65.0% had two or more of the children under the age of 5.

During the surveys, 15% of children born in the last 24 months were deceased. The mean (±SD) age of the living children was 10.9 (±6.6) months, and the children were almost uniformly distributed across the four age groups, except for a minor under-representation of the age group 18–23 months. The boys to girls ratio was 1.03 (table 3).

Prevalence of malnutrition and anaemia

The three main anthropometric indices were determined for about 93 000 infants and young children. Nearly a quarter (24.1%) had low height-for-age z-scores (below −2 SD), indicating stunting, whereas 9.2% were severely stunted (below −3 SD). More than one-fifth of the children (22.6%) were underweight (weight-for-age below −2 SD), and 6.0% were severely underweight. One in ten (11.9%) had low weight-for-height z-scores (below −2 SD), suggesting wasting, and 2.4% were severely wasted. Conversely, based on weight-for-height index, 4.1% of the infants and young children were overweight or obese (above +2 SD).

The haemoglobin concentration values were available for about 40 000 children 6–23 months of age. The mean (±SD) haemoglobin was 99 (±19) g/L. About three-fourths (74.0%) of the children had some degree of anaemia and 4.2% were severely anaemic (table 4).

Children ever breastfed and early initiation of breastfeeding

Unlike the other core and optional IYCF indicators, children ever breastfed and early initiation of breastfeeding are determined based on the historical data of children born over the past 2 years, irrespective of being living or deceased at the time of the survey[14] (figure 2).

Among 150 677 children born in the last 24 months, the vast majority (95.8%) were ever breastfed at least once before. Among the living children, 99.0% were ever breastfed, whereas the corresponding figure for the deceased children was lower (77.1%). Among the living

Table 4 Prevalence of undernutrition and anaemia among children 0–23 months old in 32 Sub-Saharan African countries, 2010–2016

Variable	Frequency	Percentage
Height-for-age (z-score) (n=90 490)		
Above +2 SD	3496	3.9
Normal (−2 to +2 SD)	65 175	72.0
Moderately stunted (−2 to −3 SD)	13 499	14.9
Severely stunted (below −3 SD)	8321	9.2
Weight-for-age (z-score) (n=90 490)		
Above +2 SD	2080	2.3
Normal (−2 to +2 SD)	67 954	75.1
Moderately underweight (−2 to −3 SD)	15 035	16.6
Severely underweight (below −3 SD)	5421	6.0
Weight-for-height (z-score) (n=90 677)		
Overweight or obese (above +2 SD)	3748	4.1
Normal (−2 to +2 SD)	76 141	84.0
Moderately wasting (−2 to −3 SD)	8598	9.5
Severely wasting (below −3 SD)	2191	2.4
Anaemia status (n=40 638)		
Not anaemic	10 556	26.0
Mild	10 971	27.0
Moderate	17 401	42.8
Severe	1711	4.2

children, age-disaggregated data indicated that 99.2% of infants 0–11 months of age and 98.8% of children 12–23 months of age were ever breastfed. In all countries except Gabon, the proportion of children ever breastfed exceeded 90%.

Among 136 029 children having complete information about timely initiation of breastfeeding, 50.5% were put to breast immediately or within 1 hour of birth (figure 2). The remaining commenced breastfeeding between 1 and 24 hours of birth or after the first day of birth (12.5%). Substantial differences were observed with regard to the timely initiation of breastfeeding between living (52.6%) and deceased (28.4%) children. Further
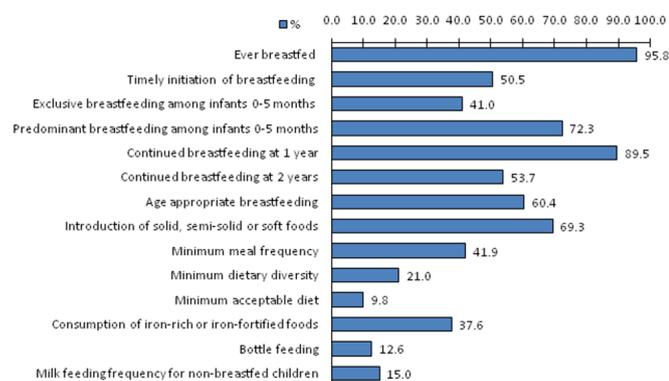
Figure 2 Summary of core and optional infant and young child feeding indicators in 32 Sub-Saharan African countries, 2010–2016.
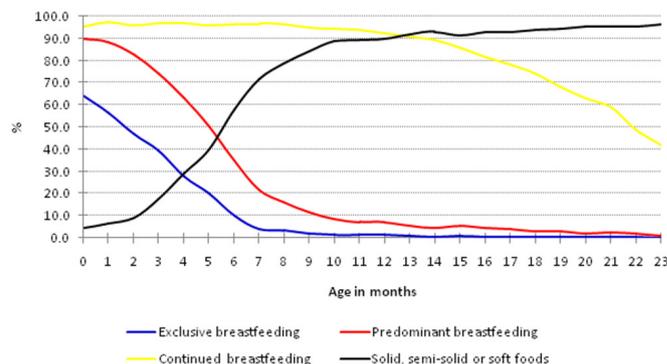
Figure 3 Exclusive, predominant and continued breastfeeding and introduction of food among children 0–23 months of age in 32 Sub-Saharan African countries, 2010–2016.

disaggregation based on age showed 52.3% of infants 0–11 months and 52.8% of children 12–23 months initiated breastfeeding within 1 hour of birth. In Rwanda, Mozambique, Malawi, Burundi, Ethiopia and Namibia, more than two-thirds of the children were put to breast timely. Conversely, in Congo Republic and Chad the corresponding figures were below 25%.

Exclusive and predominant breastfeeding
Among infants younger than 6 months, 41.0% received only breast milk during the previous day. The exclusive breastfeeding practices among infants 0–1, 2–3 and 4–5 months were 59.5%, 43.1% and 23.9%, respectively. Exclusive breastfeeding exceeds 70% in Rwanda, Zambia and Lesotho. Conversely, in Comoros, Cote d'Ivoire, Gabon and Nigeria, less than 20% of infants 0–5 months were exclusively breastfed. Surprisingly, almost none (0.3%) of the infants in Chad were exclusively breastfed.

Likewise, 72.3% of infants 0–5 months were predominantly breastfed. Age-disaggregated values indicated that the figure was 87.8% among young infant 0–1 month, whereas the corresponding proportions for infants 2–3 (76.8%) and 4–5 (55.2%) months were substantially lower.

Figure 3 shows the pattern of exclusive and predominant breastfeeding across 0–23 months of age. Exclusive breastfeeding sharply declines from 64% around the time of birth to 20% at the end of the fifth month of age. Similarly predominant breastfeeding declines from 89.6% to 50.6% between the two time points (figure 3).

Continued breastfeeding at 1 year and 2 years
In SSA a significant proportion of infants and young children remain breastfed through the first and second years of age. Continued breastfeeding at 1 year (12–15 months of age) was 89.5%, whereas at 2 years (20–23 months) was 53.7% (figure 2). Continued breastfeeding at 2 years was relatively higher (>80%) in Rwanda, Burkina Faso, Malawi, Burundi and Mozambique. Conversely, the lowest level was observed in Gabon (4.8%).
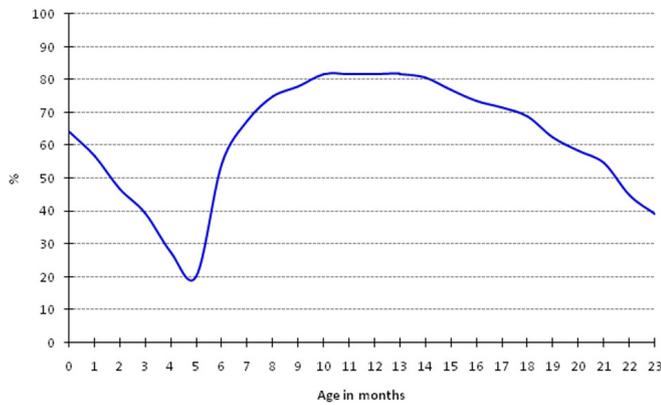
Figure 4 Age-appropriate breastfeeding among children 0–23 months of age in 32 Sub-Saharan African countries, 2010–2016.

Figure 3 shows the proportion of children 0–23 months of age who were breastfed in the preceding day of the survey. In the first 12 months of age, more than 90% of infants were breastfed. At the age of 18 and 23 months, still about three-fourths (74%) and one-third (42%), respectively, were breastfed.

Introduction of complementary foods
Among 16 775 infants 6–8 months of age, two-thirds (69.3%) received solid, semisolid or soft foods in the preceding day of the survey (figure 2). The proportion of children who received food in the preceding day starts to exponentially increase from the second month of age onwards. On the other hand, about 10% and 5% of children 18 and 23 months of age did not receive solid, semisolid or soft foods in the previous day (figure 3). Country-specific estimates suggested that more than 90% of infants 6–8 months of age in Tanzania, Mozambique, Congo Republic and Zimbabwe received food in the previous day, whereas less than 50% did the same in Guinea, Liberia, Mali and Burkina Faso.

Age-appropriate breastfeeding
More than half (60.3%) of the infants and young children 0–23 months had age-appropriate breastfeeding. Among children 6–23 months, age-appropriate breastfeeding (ie, proportion of children who received breast milk, as well as solid, semisolid or soft foods) was 66.9%. Figure 4 shows the pattern of age-appropriate breastfeeding between 0 and 23 months. The indicator sharply declines between 0 and 5 months, increases again between 6 and 12 months, and then declines. By the end of the second year of age, about 40% of the children had age-appropriate breastfeeding. The indicator was relatively high (>70%) in Rwanda, Burundi, Malawi, Zambia, Tanzania and Kenya. Conversely, it falls below 30% in Gabon (figure 4).

Meal frequency, dietary diversity and acceptable diet
The meal frequency and dietary diversity patterns were assessed among children 6–23 months of age. Less than half (41.9%) of the children received solid, semisolid or soft foods the minimum recommended number of times or more in the previous day (figure 2). The WHO guideline sets different meal frequency standards for breastfed and non-breastfed children. Breastfed children (43.5%) were found to be more likely to receive adequate number of meals than the non-breastfed children (34.9%). Proportions who had received the recommended number of meals over the preceding day were 38.5% in infants 6–11 months, 45.0% in children 12–17 months and 43.3% in children 18–23 months. The indicator was relatively higher (>50%) in Gambia, Lesotho, Nigeria and Niger. Conversely, it falls below 30% in Malawi, Mali, Angola and Burundi.

The mean (±SD) dietary diversity score computed out of the standard seven food groups was 2.29 (±1.59), and only 21.0% of the children 6–23 months received from four or more food groups over the previous day. Proportions of children who met the minimum standard for dietary diversity among children 12–17 months (24.0%) and 18–23 months (26.0%) were relatively higher than that of younger infants (13.2%). Proportions of children who met the minimum dietary diversity remain low (less than 40%) in all of the studied countries. In Niger, Burkina Faso and Guinea, the indicator falls below 10%.

In the preceding day of the surveys, more than three-fourths (76.3%) of the children received grains, roots or tubers, and nearly half (44.4%) received vitamin A-rich fruits and vegetables. Conversely, a smaller proportion of infants and young children consumed flesh foods (32.4%), dairy products (24.5%), legumes and nuts (20.8%), other fruits and vegetables (18.0%), and eggs (12.7%).

A very small proportion (9.8%) of infants and young received a minimum acceptable diet. The indicator was more or less comparable for breastfed (9.8%) and non-breastfed (9.7%) children. Among infants 6–11 only 6.3% received a minimum acceptable diet. Of children 12–17 and 18–23 months old, the corresponding figures were 12.3% and 11.6%, respectively. Across all the countries, the proportion of children who met the minimum acceptable diet was less than 20%.

Consumption of iron-rich or iron-fortified foods
More than one-third (37.6%) of the infants and young children consumed iron-rich or iron-fortified foods including flesh foods, fortified foods designed for infants or infant formula the previous day. Of the total 28.2% consumed flesh foods only and 9.4% were given fortified foods. Age-disaggregated figures indicated that consumption of iron-rich or iron-fortified foods increased from 30.0% in infants aged 6–11 months old, to 40.4% in children aged 12–17 months and 41.5% in those aged 18–23 months old. The indicator ranged from 12% in Ethiopia to 76% in Gabon.

Milk feeding frequency for non-breastfed children
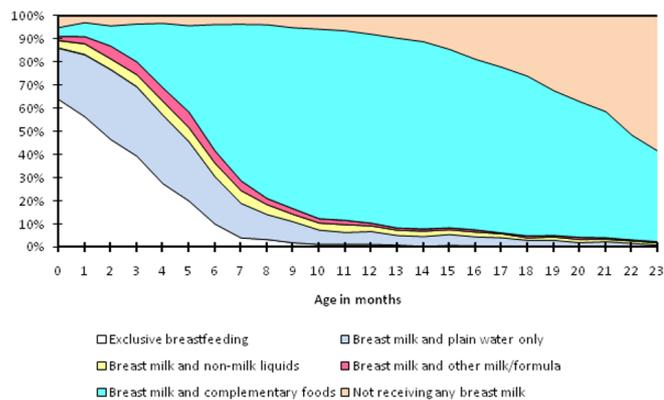The adequacy of milk feeding frequency among non-breastfed children was determined in 29 countries

Figure 5 Summary of infant and young child feeding practices by child's age in 32 Sub-Saharan African countries, 2010–2016.

(excluding Gabon, Congo Republic and Cameroon) that have data on the frequency of consumption of milk and infant formula over the previous day. Among infants and young children who were not breastfed, only 15.0% received the recommended two or more milk feedings. The proportion of non-breastfed children who had at least the minimum milk feeding frequency did not substantially vary between infants and young children aged 6–11 (19.3%) and 12–17 (19.4%) months. However, it was lower (12.9%) among children 18–23 months.

Bottle feeding

About one-tenth (12.6%) of the children 0–23 months were fed with a bottle with a nipple in the previous day. Bottle feeding was relatively higher (16.6%) among children 6–11 months. The disaggregated figures for the other age groups were 11.0% in infants 0–5 months and 11.7% among children 12–23 months. Bottle feeding was found to be very common in Mozambique (69.5%), Gabon (43.3%) and Namibia (35.5%). Conversely it was low (<5%) in Burkina Faso, Niger, Burundi, Tanzania, Togo, Malawi and Zambia.

Feeding practices by age

Figure 5 summarises the IYCF practices by child's age. Among infants younger than 6 months, proportions who received breast milk alone or along with other liquids sharply decline starting from birth to 6 months of age. Between 0 and 5 months of age, 20%–30% of infants received only breast milk and plain water. Between 6 and 12 months of age, significant proportions of children (about 10%–40%) remain predominately dependent on breast milk without receiving solid, semisolid or soft foods. The percentage of children who were not receiving any breast milk remains less than 10% in the first year of age, and it starts to substantially increase after 12 months of age (figure 5).

DISCUSSION

The study provided a summary of the 14 core and optional IYCF indicators for the SSA based on 32

nationally representative surveys conducted in the region since 2010. It suggested that most of the breastfeeding-related indicators, except exclusive breastfeeding and early initiation of breastfeeding, were in a better situation in the region, while complementary feeding indicators were generally low. The analysis indicated that most of the IYCF indicators largely vary across the countries studied. However, the minimum dietary diversity and minimum acceptable diet indicators were consistently low.

The analysis showed that 41% of children were exclusively breastfed in the preceding day of the survey, and remarkable variations were observed among the studied countries. According to the WHO guideline for rating of exclusive breastfeeding, of the 32 countries surveyed 2 were in the poor (0%–11%), 17 were in the fair (12%–49%), 13 were in the good (50%–89%) categories, while none were in the very good category (90%–100%).[21] Additional studies might be needed to explore why countries like Chad and Gabon are not performing well in terms of exclusive breastfeeding practice. In these countries, interventions to improve exclusive breastfeeding practice are critically needed.

The study indicated that predominant breastfeeding is reasonably high (72%), and there is huge discrepancy between predominant and exclusive breastfeeding practices between 0 and 5 months of age. Especially provision of breast milk with plain water is found to be a common practice in SSA. The big discrepancy between predominant and exclusive breastfeeding practices in the study may suggest that interventions targeting at discouraging provision of plain water to infants can increase exclusive breastfeeding rate by as high as 30 percentage points.

Although most of the core and optional IYCF indicators are determined based on the current status data of the children, two indicators—'early initiation of breastfeeding' and 'children ever breastfed'—require historical information about deceased and living children born in the preceding 24 months of the survey.[14] However, frequently surveys determine the two indicators only based on the data of living children. In the current analysis it was observed that the aforementioned two indicators may vary by more than 20 percentage points between living and deceased children, in favour of living children. Accordingly, excluding historical data of deceased children from IYCF surveys may significantly overestimate the two indicators, especially when the level of child mortality in the population is high.

Meeting the minimum standards for complementary feeding is challenging in SSA and other low-income and middle-income regions of the world. In this study only 42% of children 6–23 months met the minimum recommended meal frequency, whereas even smaller proportions satisfied the benchmarks for dietary diversity (21.0%) and acceptable diet (10%). A study based on nationally representative data from eight South Asian countries concluded the same. The study estimated the minimum standards for meal frequency (48%), dietary diversity (33%) and acceptable diet (21%) in the South

Asian region were only met by a smaller proportion of children 6–23 months of age.[22]

In Africa, as the vast majority of babies are breastfed, little programmatic attention has been given so far to non-breastfed children. Yet this analysis indicated that about 15% of children 6–23 months of age were not breastfed in the preceding day, and non-breastfed children were largely exposed to suboptimal feeding practices. Only 35% of such children met the minimum required meal frequency, and merely 15% received at least two milk feedings during the previous day.[14 23] The finding may indicate that, on top of promoting breastfeeding of children for 2 years of age and beyond, optimal feeding practices for non-breastfed children should be advocated.

WHO recommends that in the estimation of the indicator 'consumption of iron-rich or iron-fortified foods' among children 6–23 months, three dietary sources should be considered: animal source flesh foods, commercially fortified foods with iron that are specially designed for infants and young children, and foods that are fortified at home with iron. However, due to limitation of the data, two specific alterations have been made in this analysis. First, all commercial infant formula and industrially fortified baby foods were assumed to be iron-fortified. Second, household level of iron fortification with micronutrient powder was assumed to be negligible. The alterations might have overestimated or underestimated the iron consumption pattern in the SSA.

In general this study suggested nearly all of the complementary feeding-related indicators are consistently low across the subcontinent. Further, exclusive breastfeeding among children 0–5 months is suboptimal in many countries in the region, including Chad, Gabon, Comoros and Cote d'Ivoire. Enhancing the status of minimum acceptable diet and improving exclusive breastfeeding practice in the first 6 months should be given priority in IYCF programmes. Countries in the region can enhance IYCF-related indicators through multiple strategies. A systematic review suggested that promoting breastfeeding through health professionals, trained volunteers and peers can improve breastfeeding practices.[24] Nutrition education through front-line health workers and investments in nutrition-specific interventions also help to improve complementary feeding practices including dietary diversity.[13]

The study indicated that 74% of the infants and young children in SSA are anaemic. Multifaceted factors might have contributed to the remarkably high burden of anaemia in the region. One key factor might be the low dietary diversity and suboptimal consumption of iron-rich foods during the complementary feeding period. Further, in the first 6 months of age, most infants in Africa are predominately breastfed, and breast milk is known to contain inadequate amount of iron. Studies suggested, despite being exclusively breastfed, young infants are unlikely to be anaemic because full-term infants have adequate iron stores at birth lasting for 4–6 months.[25 26] However, in low-income and middle-income countries, newborn iron store is likely to be suboptimal due to the high prevalence of maternal anaemia and low prenatal iron supplementation coverage.[25] Frequent diarrhoea, malaria and other infections among infants and young children can also contribute to the burden. Accordingly, interventions to improve anaemia status, including promotion of maternal iron supplementation, enhancing consumption of diversified diet including flesh foods, improving access to iron-fortified complementary foods and prevention of infections, should be given priority in the region.

One strength of the current study is that it is based on large-scale, recent and nationally representative surveys from 32 countries that contribute to more than 85% of the SSA population. Further it provided a summary of all core and optimal IYCF indicators (except the median duration of breastfeeding) that have not been available at such scale before. The presented indicators include 'consumption of iron-rich or iron-fortified foods' and 'milk feeding frequency for non-breastfed children', which are not typically included in the DHS reports. The sample size was also huge, and it allowed for precise estimation of indicators including timely introduction of foods and continued breastfeeding at 1 and 2 years, which are defined in narrow age ranges. Further, in line with the WHO guideline, the study provided age-disaggregated figures for all of the indicators with reasonable precision.

However, there were some limitations and possible biases to this study. Although the original surveys represented more than 85% of the SSA population, there is no guarantee that the IYCF profile of the non-represented countries is similar to the studied ones. Hence, generalisability of the findings to the entire SSA might be theoretically dubious. Further, due to the cross-sectional nature of the original studies, indicators related to complementary feeding practice, especially dietary diversity and consumption of iron-rich foods, might have been affected by seasonality bias. Finally, as described above, the indicator 'consumption of iron-rich or iron-fortified foods' might have been overestimated or underestimated.

CONCLUSION

The study provided a summary of 14 core and optional IYCF indicators for the SSA region. Most of breastfeeding-related indicators, except exclusive breastfeeding and early initiation of breastfeeding, were found to be in a relatively better situation. Yet complementary feeding indicators were generally low. The analysis indicated that most of the IYCF indicators largely vary across the studied countries. Yet the minimum dietary diversity and minimum acceptable diet indicators remained consistently low across all the countries.

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