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Research Article

Evaluation of the Coverage of Iron Requirements in Young Children Aged 6 to 59 Months from Basic Foods in Two Localities in North Togo: Awandjelo and Lama (Kara)

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Abstract

Iron deficiency is one of the most widespread nutritional disorders in the world. It affects almost 60% of the population in developing countries, i.e. 3.5 billion people. Women of childbearing age and young children are the most vulnerable. Iron deficiency occurs when the intake and absorption of iron cannot compensate physiological needs, which are particularly high in young children because of their growth. Due to its impact on children's health, iron deficiency remains a major public health problem in Togo, with 70% of children aged between 6 and 59 months suffering from anaemia. In the face of this problem, the present study aims to establish the adequacy between dietary iron intake and physiological needs in order to contribute to strategies for handling this nutritional deficiency. To achieve this, 479 children (243 urban and 236 rural) aged 6-59 months from 447 households were the subject of this study. Food consumption was assessed using the 24-hour recall method; the nutritional value of the rations was assessed using the food composition table available in Africa. The results showed that 62% of the children studied had dietary iron intakes below the recommended levels and only 38% were able to cover their iron requirements. In fact, the mother's level of school education and the mother's economic activity were found to be strongly correlated with iron status in children. In the light of these data, it would seem wise to consider better nutritional intervention strategies, including nutritional education for women of childbearing age. The introduction of nutritional counselling through Information, Education and Communication (IEC), mobilisation and social marketing campaigns should therefore be promoted.

Keywords

Young Children, Iron Deficiency, Socio-Demographic Status, Iron Deficiency Anaemia, Kara, Togo

1. Introduction

Food insecurity is strongly associated with macro- and micronutrient undernutrition [1]. Among micronutrients, iron deficiency remains the most common nutritional challenge and the most important for public health. It affects 3.5 billion

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people, 60% of whom live in developing countries, with more than half suffering from severe anaemia [2]. Women of childbearing age, infants and young children are the most vulnerable groups. In addition to its impact on haematopoiesis, iron deficiency has harmful consequences for health and reduces individual productivity [3]. In young children, it alters psychomotor and physical development, increases the risk of morbidity, foetal and neonatal mortality, and reduces resistance to infection [4, 5].

In developing countries, 43% of children under the age of 5 suffer from iron deficiency [6]. Due to its repercussions on the psychological and physical development of young children, iron deficiency remains a public health problem in developing countries, and particularly in Togo. The results of the EDST-2014 survey show that in Togo, more than two out of three children (70%) aged between 6 and 59 months suffer from anaemia [7].

Anaemia is the most noticeable clinical manifestation of iron deficiency [8]. Iron deficiency anaemia, occurs after depletion of iron reserves, followed by a deficit in erythropoiesis. This nutritional clinical manifestation occurs when iron absorption cannot compensate physiological needs, which are particularly high in young children due to their growth. It is also due to inadequate dietary iron intake, when the infant's diet is monotonous, consisting mainly of cereals, roots and tubers whose iron is often poorly bioavailable and sometimes rich in inhibiting substances that interfere with its absorption [4].

Indeed, the period when young children go from exclusive breastfeeding to eating family meals is particularly at risk of developing deficiencies because of the body's high nutritional requirements between 6 and 24 months [9]. However, it is particularly important at this stage of life to cover mineral requirements, such as iron, because of the irreversible consequences that deficiencies can have on a child's development [10]. During this period, the food given to the child as a supplement to breast milk must not only provide sufficient quantities of micronutrients, but also ensure that these can be assimilated by the body [11].

The discovery that there are two types of iron (haem iron and non-haem iron) with different rates of absorption in the diet has led to a better estimation of its bioavailability [12]. Easily absorbed haem iron is found in foods of animal origin (meat, fish and poultry) and non-haem iron, which has a low absorption rate, is found in foods of plant origin (cereals and legumes). The low haem iron content of complementary foods for infants partly explains martial deficiency and also the high prevalence of anaemia in young children. Iron absorption also depends on the nature of the meal and the presence of substances that activate or inhibit its use by the body [8]. An individual's iron status is therefore function of the quantity of iron ingested during the diet, its bioavailability and its losses. It is therefore necessary to consider the coverage of iron requirements, in the interests of preventing and managing iron deficiency, especially in young children.

This is the context of the present study, the general aim of which is to assess the coverage of iron requirements in young children in two localities in the prefecture of Kozah (Kara) in Togo.

2. Study Setting, Material and Methods

2.1. Study Setting and Sample Considered

This study was carried out in rural area (Awandjelo) then in urban area (Lama) in the Kozah prefecture (Kara), in the north of Togo.

The sample consisted of 479 children (243 in the urban area and 236 children in the rural area) aged 6 to 59 months, distributed by age group as follows:

1) [6-11] months: 44 children;
2) [12-23] months: 126 children;
3) [24-59] months: 309 children;

This distribution by age group respects the ideal (6-11 months) and acceptable (12-23 and 24-59 months) stratification recommended by Amoussa (2011) [13] for a more appropriate analysis of the data.

2.2. Household Recruitment Method

The villages or neighborhoods surveyed in the two selected municipalities were chosen at random. In households, the objectives of the survey were explained to the child's parents. The child's date of birth is then requested to verify whether he or she is eligible, and then parental participation agreement is obtained. If there is no parental consent, the household is not surveyed. If there are no eligible children in a house, the next house is considered.

2.3. Ethical Considerations Child Eligibility Criteria

After checking the child's eligibility, the objectives of the study were explained to the child's mother or the head of the family in order to encourage household participation in the survey. Oral consent was obtained from each participant. Following this consent the survey was carried out through the administration of the pre-established questionnaire to the mother, the head of the household or the person in charge of the child in question.

To be eligible, the child considered should meet the following criteria:

1) be in one of the three age groups: 6-11 months, 12-23 months or 24-59 months;
2) receive complementary foods in addition to breast milk.

2.4. Survey Methods

The children's ages were calculated on the basis of the date of birth shown on the supporting documents (birth certificate or health record). For children without documents, local events were used as a reference to estimate age to the nearest month.

2.5. Food Consumption by Weighing and its Frequency

A 24-hour reminder of the foods consumed by the child in the form of a food diary was given to the mothers. The quantity of food ingested by the child was estimated using a bowl of known mass.

For each child, mothers were asked about the foods consumed during the week preceding the survey.

2.6. Questionnaire on the Socio-Economic Situation of Households

This part of the questionnaire enabled us to characterise the socio-economic environment in which the mothers of the children in the sample live, and their breastfeeding and complementary feeding practices.

2.7. Calculation Micronutrient Intakes and Coverage

Intake and coverage calculations were performed using data recorded in the Excel spreadsheet. The data consisted of identification codes for each child and the quantities of food ingested. The West African Food Composition Table (FCT) was used to estimate intakes.

The following parameters were determined for each child, based on the results obtained.

1) Daily iron intake.
2) The level of coverage of the recommended daily allowances (RDA) for nutrients.

The nutritional intake of foods is obtained by the algebraic sum of the quantities of nutrients provided by each of the ingredients making up the foods consumed during the day [13]. Let "Xi" be the quantity, in grams, of an ingredient "i" used in the composition of a dish eaten by the child during the day; "Yi" the quantity of nutrient, in milligrams, contained in 100 g of ingredient "i" according to the food composition table [13]. The nutrient intake of complementary foods consumed by a child per day was obtained using the following formula:

$$\text{INCF} = \sum_{i=1}^{n} \frac{\text{Xi} * \text{Yi}}{100}$$

n= number of meals eaten

i= ingredient

INCF= Ingested Nutrients from Complementary foods

For breastfed children, nutrient intake from breast milk (INBM) was taken into account using data from the WHO (1998) [14] on the nutritional value of breast milk and the average quantities of milk consumed by breastfed children at different ages in developing countries.

The total daily nutrient intake (INtotal) was calculated according to the following formula:

$$\text{INtotal} = \sum_{i=1}^{n} \frac{\text{Xi} * \text{Yi}}{100} + \text{INBM}$$

n= number of meals eaten

i= ingredient

INtotal= Ingested as a total daily nutrient

The coverage rate of the recommended daily allowances is calculated by dividing the average daily intake for each child by the nutritional allowances recommended by the FAO and WHO (2004) [15] and multiplying by 100, using the following formula:

$$\text{Nutrient coverage rate (\%)} = \frac{\text{Average daily nutrient intake from food and milk}}{\text{RDA nutrient}} * 100$$

RDA = Recommended Daily Allowance

2.8. Questionnaires and Information Collection Forms

Ultimately, the questionnaire and data collection form used contained the following information:

1) information on the socio-demographic status of the children and the mother;
2) information on the frequency of consumption of iron-rich foods, including the number of meals eaten per day.

Six community health workers and a supervising technician were trained the day before data collection began, on how to carry out field surveys and how to use field data collection tools. The training took place in three steps.

The first step consisted of training the recruited investigators on the objectives and conduct of the surveys. The need to obtain reliable and unbiased data was highlighted. The behavior required of an interviewer to gain the trust of the population and collect quality data was also discussed. All parts of the questionnaire were reviewed and explained in detail with translation into the local language (kabye) where necessary. Paired investigation scenarios were organized, followed by discussions and constructive comments. This first step took place at the Peripheral Care Unit (USP) of Awandjelo.

The second step of the training took place in the field, in a pilot area, in order to test the questionnaires and familiarise the interviewers with the use of the data collection tools.

The third step of the training consisted of sharing experiences and lessons learned from this pre-test phase of the questionnaires. Some corrections were then made, mainly concerning the rewording of the questions and their sequence to facilitate a better understanding of the people to be surveyed.

2.9. Food Measuring Equipment and Timetable for the Investigation

All the equipment used to measure foodstuffs during the survey is summarised below:

1) 1 electronic scale with a maximum capacity of 40 kg and an accuracy of 10 g;
2) 1 electronic scale with maximum range of 5000 g and accuracy of 1 g;
3) 6 sample pots with a capacity of 100 ml.

The survey lasted approximately three days in each locality and the schedule of main activities is summarised in Table 1.

Table 1. *Activity summary table.*

ACTIVITY	DATE	OBSERVATION
Interviewer training and pre-testing of questions	11 to 13/08/2023	Training at the USP of Awandjelo and Lama Kpeda. 1) Pre-test in the field in around thirty households. 2) Taking into account the inadequacies and reformulating some questions in the questionnaire.
Investigation in Awandjelo	14/08 to 16/08/2023	Rural survey
Investigation in Lama	02/09 to 04/09/2023	Urban survey

2.10. Statistical Processing of Data

Data were entered and processed using the Excel 2013.

Firstly, using frequency tables, the different variables were evaluated by observing their proportions. In the second step, the associations between each independent variable identified (mother's socio-demographic status) and the coverage of the iron requirements of young children were determined.

To do this, the statistical test of chi2 (X^2) was used with a margin of error of 5% (γ). The chi2(X^2) is in fact a descriptive analysis method used to verify the association between two variables X and Y. However, most statistical software directly gives the value of the probability of the chi2 test (p) which is compared to the error threshold (γ). If the probability associated with the chi2 test (called the significance threshold) is less than the error threshold (γ), we can conclude that there is a relationship between the dependent variable and the independent variable concerned. Otherwise, there is no association.

Overall, this methodology made it possible to obtain the data for the present study according to the previously set objectives.

3. Results and Discussion

3.1. Results

3.1.1. Socio-Demographic Status of Children

(i). Age

The target population consisted of 479 children aged 6 to 59 months, including 236 in rural area and 243 in urban area. Depending on the age groups, there were 7.20% of children in rural area compared to 11.11% in urban area aged 6 to 11 months. Those whose age is between 12 and 23 months represented 28.82% in rural area compared to 23.87% in urban area and children aged 24 to 59 months represented 63.98% in rural area compared to 65.02% in urban area. The latter represent the highest proportion of this sample (Figure 1).

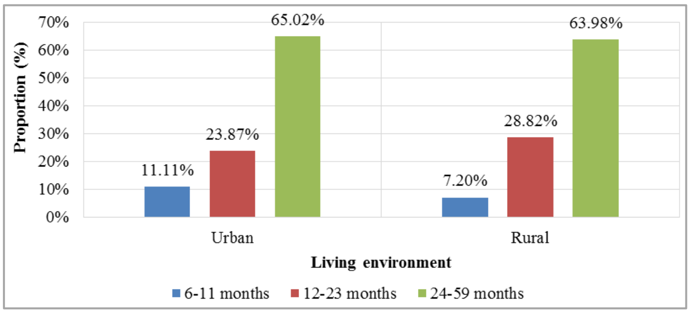


Figure 1. *Distribution of children by age group and living area.*

(ii). Sex

Among the children considered in the present study, 47.88% of children in rural area and 49.38% in urban area are male compared to 52.12% in urban area and 50.62% in rural area, female (Figure 2).

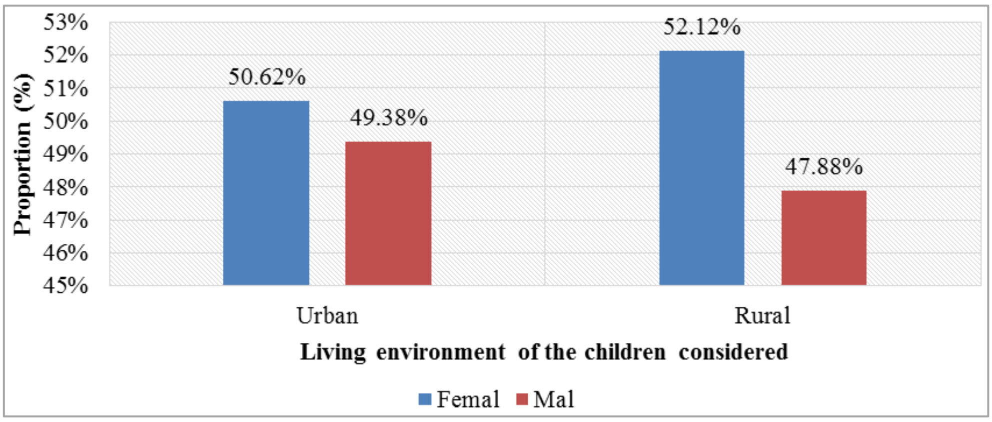


Figure 2*. Distribution of children by sex and living environment.*

3.1.2. Sociodemographic Status of Mothers

(i). Age

For operational reasons, mothers' age was grouped into three categories (Figure 3). The age of women at early childbearing (less than 18 years), women whose age is between 18 and 34 years and those who had births at advanced ages (35 years or more). It appears from this distribution that women aged under 18 represent 16.53% in rural area and 14.40% in urban area; those whose age is between 25 and 34 years old represent 81.36% in rural area and 83.13% in urban area and constitute the most represented group in this study. Women who had births at advanced ages were very poorly represented with 2.12% in rural area and 2.47% in urban area (Figure 3).

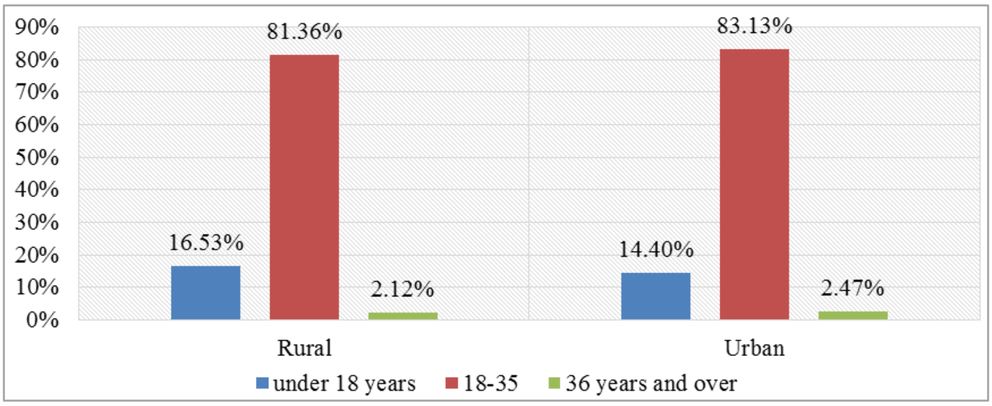


Figure 3*. Distribution of mothers according to age groups and living environment.*

(ii). Educational Level of Children's Mothers

Three modalities were chosen to illustrate this variable (Figure 4). Women with no level of school education (illiterate), those with a primary level of education and women who have reached a secondary level or higher.

The results obtained show that two mothers out of three (67.49%) have reached secondary level in urban area while in rural area; only (44.07%) have reached this level. The proportion of illiterates is also 6.17% in urban area compared to 26.27% in rural area.

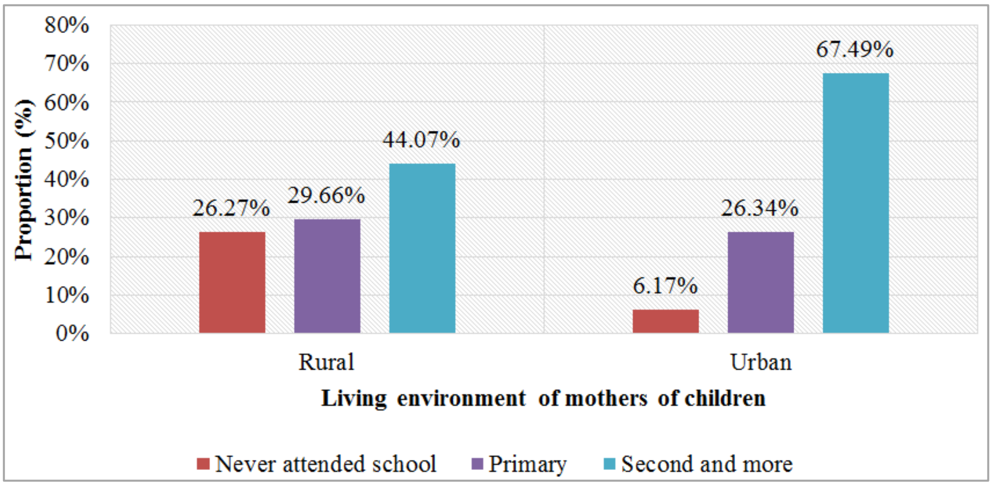


Figure 4. Distribution of mothers according to level of education and living environment.

(iii). Environment Before Married life

The area of residence is understood dichotomously by distinguishing women who live in urban area from their counterparts who live in rural area (Figure 5). The distribution of this variable shows that the majority of women surveyed in rural area (86. 86%) grew up in rural area and 88.07% in urban area also grew up in urban area.

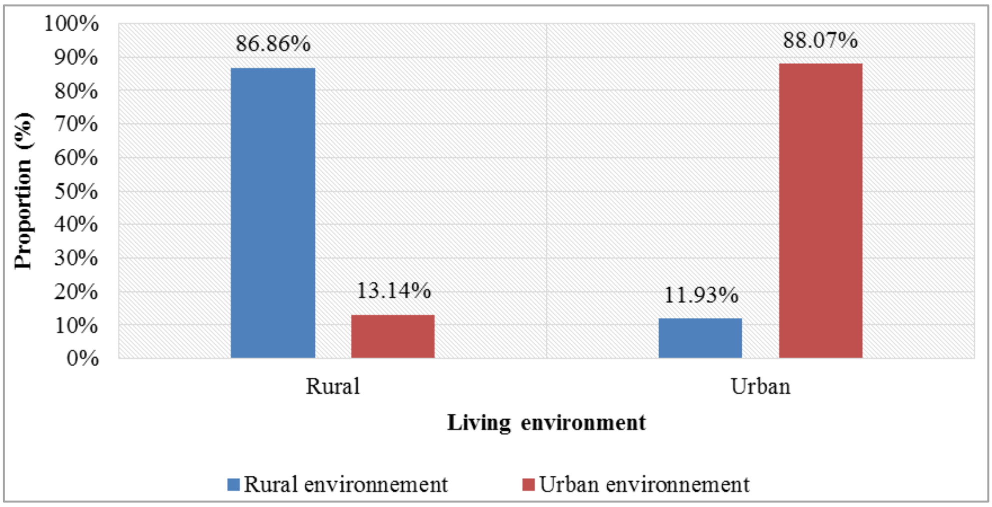


Figure 5. Distribution of mothers according to living environment before married life.

(iv). Socio-Professional Category

The socio-professional category of the mother was grouped into three categories (Figure 6). Women who do not carry out any activity (unemployed), those who work in the agricultural sector (farmers) and those who carry out a lucrative activity in the public sector (public administration) or who carry out small income-generating jobs (sales/ industry). From this distribution, it appears that almost half of the mothers (43.3%) are farmers in rural area while more than half of the mothers in urban area are unemployed (52%).

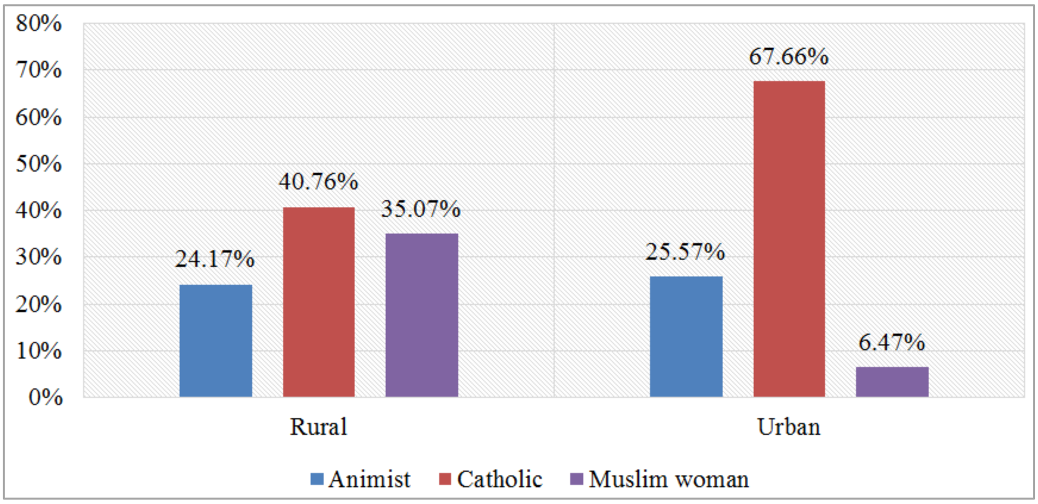


Figure 6. Distribution of mothers according to socio-professional category and living environment.

(v). Religion

The data relating to the mother's religion were classified into three categories (Figure 7). Women belonging to the Christian religion (Catholic and Protestant), Muslim women and those who are neither Christian nor Muslim (traditional/animist/atheist). From this grouping, it appears that the majority of women 67.66% in urban area and 40.76% in rural area belong to the Christian religion. Muslim women represent 6.47% in urban area and 35.07% in rural area. Women not belonging to any religion represented 25.57% in urban area and 24.17% in rural area.

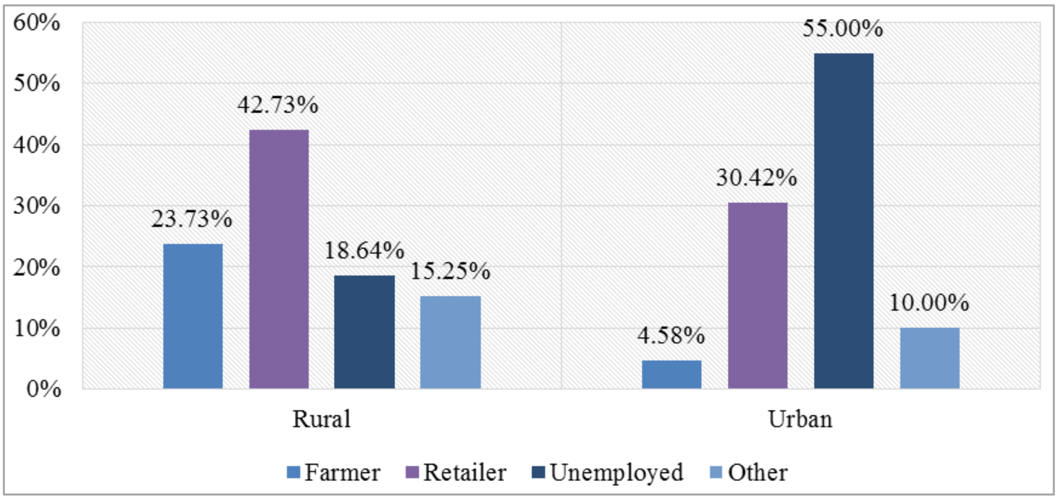
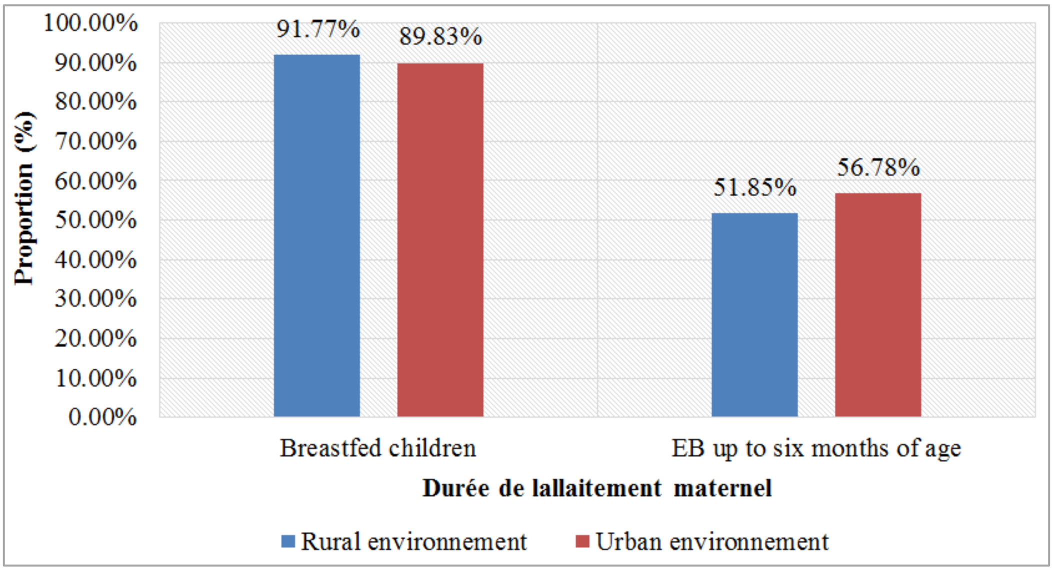


Figure 7. Distribution of mothers according to religion practiced and living environment.

(vi). Breastfeeding Practice

This variable was grouped into two modalities, considering women who breastfeed their children and those who practice exclusive breastfeeding (EB) up to six months of their child's age (Figure 8). It appears from this distribution that women in rural and urban areas breastfeed their children. Children who are not breastfed are those who have lost their mother or whose mother suffers from a condition that does not allow her to do so. On the other hand, only 56.78% of women in urban area and 51.85% of women in rural area practice exclusive breastfeeding (EB) until six months of their child's age.



EB: Exclusive Breastfeeding

Figure 8. *Distribution according Breastfeeding practice.*

3.1.3. Coverage Rate of Iron Requirements in Young Children

Coverage of recommended daily intakes (RDA) of iron is inadequate in the two locations surveyed. All areas combined, 62.42% of children have iron intakes below 100% of the RDA.

However, the coverage of iron requirements in the two study areas is not significantly different *($p > 0.05$)* (Table 2).

Table 2. *Coverage of iron requirements according to living environment.*

Child's living environment	Proportion of children not having full coverage of their iron requirements (n)	Proportion of children with full coverage of their iron requirements (n)	Total (n)
Rural	66.58% (155)	34.32% (81)	100%(236)
Urban	59.26 %(144)	40.74 % (99)	100%(243)
All environments considered	62.42 % (299)	37.58 % (180)	100%(479)
P-value (Rural vs Urban)	0.349 (p > 0.05)		

n = number of children for the factor considered

3.1.4. Variation in Coverage of Children's Iron Requirements According to Their Characteristics

According to the data in table 3, it appears that the correlation between the age of children and coverage of iron requirements is significant *($p < 0.05$)*. Across both study locations, coverage is low (2.27%) among children aged 6 to 11 months.

Table 3. *Coverage of iron requirements according to age groups.*

Age of child (months)	Proportion of children not having total coverage of their iron requirements (n)	Proportion of children with total coverage of their iron requirements (n)	Total (n)
6-11	97.73% (43)	2.27% (1)	100% (126)
12-23	77.78% (98)	22.22% (28)	100% (309)
24-59	51.13% (158)	48.87% (151)	100% (44)

Age of child (months)	Proportion of children not having total coverage of their iron requirements (n)	Proportion of children with total coverage of their iron requirements (n)	Total (n)
All ages considered	62.42% (299)	37.58% (180)	100% (479)
P-value (Rural vs Urban)	3,364.10 -12 (p < 0.05)		

n = number of children for the factor considered

The correlation between the sex of the child and the coverage of iron requirements was not significant in the present study *($p > 0.05$)*. Table 4 shows that, for the coverage of iron requirements, there is no significant difference between the two sexes with 35.62% among boys and 39.34% among girls. The coverage rates were then almost identical.

Table 4. *Coverage of iron requirements according to the sex of the child.*

Gender of child	Proportion of children not having total coverage of their iron requirements (n)	Proportion of children with total coverage of their iron requirements (n)	Total (n)
Female	60.57% (149)	39.34% (97)	100% (236)
Male	64.38% (150)	35.62% (83)	100% (243)
All sexes considered	62.42% (299)	37.58% (180)	100% (479)
P-value (Rural vs Urban)	P-value = 0.39 (p > 0.05)		

n = number of children for the factor considered

3.1.5. Variation in Coverage of Children's Iron Requirements According to the Socio-Demographic Characteristics of the Mother

(i). Influence of Age

According to the data in table 5, the association between maternal age and coverage of iron requirements in children in this study was not significant *($p > 0.05$)*.

Table 5. *Coverage of children's iron requirements according to mother's age.*

Age of mother (years)	Proportion of children not having total coverage of their iron requirements (n)	Proportion of children with total coverage of their iron requirements (n)	Total (n)
18-35	63.81% (238)	36.19% (135)	100% (373)
More than 35	57.55% (61)	42.45% (45)	100% (106)
All ages considered	62.42% (299)	37.58% (180)	100% (479)
P-value (Rural vs Urban)	0.269 (p > 0.05)		

n = number of children for the factor considered

(ii). Influence of the Mother's Educational level

The mother's educational level is significantly correlated with meeting iron requirements in young children *($p < 0.05$)*. The results (Table 6) indicate that children born to women who have reached a secondary level of education or higher represent the highest proportion (40.16%) of children with total coverage of iron requirements.

Table 6. *Coverage of iron requirements according to the mother's level of education.*

Level of School education	Proportion of children not having total coverage of their iron requirements (n)	Proportion of children with total coverage of their iron requirements (n)	Total (n)
None	61.54% (8)	38.46% (5)	100% (13)
Primary	74.12% (63)	25.88% (22)	100% (85)
Secondary and above	59.84% (228)	40.16% (153)	100% (381)
All levels combined	62.42% (299)	37.58% (180)	100% (479)
P-value (Rural vs Urban)	0.049 (p < 0.05)		

n = number of children for the factor considered

(iii). Influence of the Mother's Living Environment Before Her Married life

The mother's living environment before marital life is not significantly associated with meeting iron requirements in children *($p > 0.05$)* (Table 7).

Table 7. *Coverage of iron requirements according to the mother's living environment before her married life.*

Living environment	Proportion of children not having total coverage of their iron requirements (n)	Proportion of children with total coverage of their iron requirements (n)	Total (n)
Rural	63.67% (149)	36.33% (85)	100% (234)
Urban	61.22% (150)	38.78% (95)	100% (245)
All environments considered	62.42% (299)	37.58% (180)	100% (479)
P-value (Rural vs Urban)	0.58 (p > 0.05)		

n = number of children for the factor considered

(iv). Influence of Socio-Professional Category

The mother's activity is significantly correlated with the coverage of needs in young children *($p < 0.05$).* The results (Table 8) show that, even if overall, more than 50% of children are unable to meet their iron requirements, the largest proportion of children who meet their iron requirements is observed in level of those from civil servant mothers with 42.03%. The children of unemployed mothers who cover their iron requirements represent only 8.33%.

Table 8. *Coverage of iron requirements according to the mother's profession.*

Mothers' activities	Proportion of children not having total coverage of their iron requirements (n)	Proportion of children with total coverage of their iron requirements (n)	Total (n)
Farmer/trader/artisan	62.31% (248)	37.69% (150)	100% (398)
Official	57.97% (40)	42.03% (29)	100% (69)
Unemployed	91.67% (11)	8.33% (1)	100% (12)
Any professional situation considered	62.42% (299)	37.58% (180)	100% (479)
P-value (Rural vs Urban)	0.084 (P < 0.05)		

n = number of children for the factor considered

(v). Influence of Religion

In light of the data obtained (Table 9), it appears that religious affiliation is not significantly associated with meeting iron requirements in young children *($p > 0.05$)*. The mother's religion therefore does not influence the consumption of foods rich in iron.

Table 9. *Coverage of iron requirements according to the mother's religion.*

Mother's religion	Proportion of children not having total coverage of their iron requirements (n)	Proportion of children with total coverage of their iron requirements (n)	Total (n)
Animist	66.99% (69)	33.01% (34)	100% (103)
Christianity	60.90% (176)	39.10% (113)	100% (289)
Muslim	62.07% (54)	37.93% (33)	100% (87)
Any religion considered	62.48% (299)	37.58% (180)	100% (479)
P-value (Rural vs Urban)	0.547 (p > 0.05)		

n = number of children for the factor considered

3.1.6. Iron- Rich Foods

The questionnaire covered the consumption of any type of meat or fish, in any form, as well as leafy vegetables, cereals and legumes. The proportions of children having consumed animal or plant products rich in iron at least once during the week preceding the survey in the two areas considered were presented in Figure 9. It appears that a majority of approximately 93% of children ate fish at least once, including 75.5% one or more times during the week. Only 75.3% would have consumed meat at least once, including 22% one or more times. Baobab leaves are consumed by the majority of children in the two localities considered in this study (88.3%).

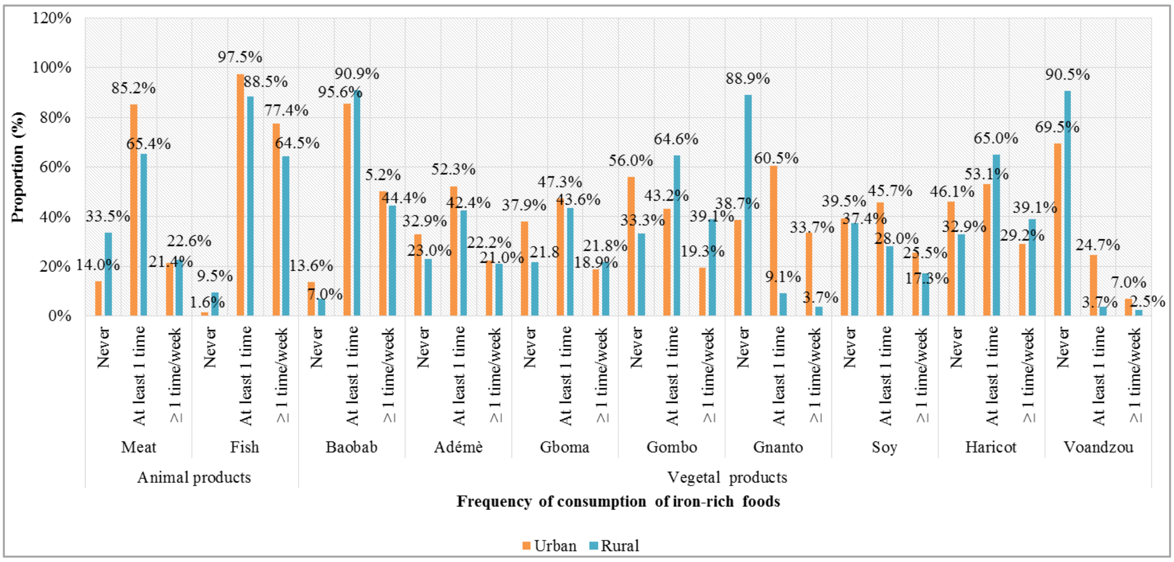


Figure 9. *Distribution of children according to frequency of consumption of iron-rich foods per week.*

A slightly more detailed analysis of the data reveals certain disparities depending on the survey locations (Figure 9). It appears that 85.2% of children ate meat at least once a week in urban area compared to 65.4% of children in rural area. Fish was consumed at least once a week by 97.5% of children in Lama (urban area) and 88.5% of children in Awandjelo (rural area). Three out of four children consumed fish more than once a week in both locations. In the two locations surveyed, only 10.3% of children did not consume baobab leaves. The highest proportion (90.9%) of children who consumed baobab leaves at least once a week was recorded in Awandjelo.

3.2. Discussions

3.2.1. Coverage Rate of Iron Requirements in Young Children

The survey on the food consumption of young children carried out in the two environments as part of this study revealed insufficient iron intakes in children aged 6 to 59 months. The results of the survey show that the diet of the children in question is monotonous, based on repetitive meals prepared from the same cereals or tubers, as generally observed in the case of developing countries such as Togo. This monotony thus predisposes the child to multiple mineral and vitamin deficiencies [16].

Insufficient iron intake, reflected by the high proportions of children whose intakes fail to cover not only 100% but even less, 50% of the RDA from their diet, is undoubtedly one of the factors explaining, beyond our two study environments, why many Togolese children suffer from iron deficiency. The prevalence of anemia appears to be a public health problem in Togo [17] affecting more than three quarters of children [7]. The low bioavailability of iron from the diet of young children combines with these low intakes to contribute to the severely deficient iron status of these young children.

In terms of age, the results indicate that it is in the age group of 12 to 23 months that children are most vulnerable. These results are not surprising, because the needs of the child during the first year of life are important. Reserves are sufficient for the first four to six months of life. However, after six months, these reserves are gradually depleted [8]. An exogenous iron intake then becomes essential. Taking into account the nature of the foods consumed, we can say that iron deficiency essentially comes from the lack of easily assimilated iron in the food supplements of young children to cover the needs linked to growth.

3.2.2. Influence of the Socio-Demographic Status of the Mother on Iron Deficiency in Children

The analysis of the data through correlation tests between the socio-demographic status of the mother and the coverage of the iron requirements of her children revealed that the age of the mother, the environment in which she grew up and her religious affiliation n were not significantly associated with the consumption of iron-rich foods in young children. On the other hand, the level of school education and socio-professional category were significantly correlated with the consumption of iron-rich foods in young children.

According to the data obtained, children born to mothers with a secondary education have good coverage of iron requirements. The more educated a mother is, the less her children suffer from nutritional deficiencies. These mothers are in fact more able to adopt healthy weaning practices and avoid inappropriate eating habits. They can also benefit from a higher social status and promote good domestic and food hygiene [18].

As the primary caregivers for family nutrition and health, women are responsible for the quality of food and care provided to their children. Having a secondary or higher education level gives them a greater capacity to provide better quality nutrition, essential for the growth of their offspring. This result confirms the studies of Alaimo et al. (2001) [19] where 78.5% of children born to mothers who had reached secondary school or above had a quality diet compared to 21.5% in the case of those who had a lower level. Indeed, women's education improves their knowledge of hygiene and nutritional practices [20].

In developing countries and particularly in Togo, ignorance of the specific needs of children, traditional beliefs and practices, often push mothers to give their offspring foods that are poor in quantity and nutritional quality. The mother's level of school education can thus effectively contribute to resolving this problem. Indeed, most illiterate mothers do not know the concepts of nutritional balance and the nutrients necessary for their children. In addition, these mothers sometimes live in precarious conditions characterized by food insecurity (where food may be available but limited and not diversified) and by sometimes unsanitary housing conditions [21].

Regardless of the socio-professional category of the mother, the proportion of children with good iron coverage is less than 50%. This indicates either the unavailability or inaccessibility of alternative iron-rich foods, likely linked to women's economic situation. This confirms the studies of Alaimo et al. (2001) [19] and Séguin et al. (2003) [22] where 63.02% of children with sufficient household income have good health, while in low-income households, children (36.97%) have chronic health problems or have been hospitalized since birth. Women who work in the fields generally do not have enough time to take care of their children. They sometimes entrust the care of their children either to their younger brothers or to other family members who often have no knowledge of food hygiene and who have difficulty ensuring adequate nutrition and care for their children. In addition, they sometimes take their children to the fields, despite the risks involved. Conversely, unemployed women may be more attentive, spending more time preparing alternative foods and distributing them adequately throughout the day [23]. Furthermore, women who work in the public sector or in small income-generating jobs have financial resources and can therefore access the best choice of iron-rich foods [24].

The duration of breastfeeding plays a crucial role in the nutritional status of young children. From birth until the age of six months, breast milk alone is sufficient to cover the infant's needs. This is why the WHO and UNICEF (2001) [25] recommend that children be exclusively breastfed until six months of age. Due to its nutritional value, its anti-infectious properties, its hygienic qualities and its psycho-affective aspects, breastfeeding is the optimal food for young children [26]. It contains a full range of essential nutrients including sufficient iron for good growth at least for the first six months. However, additional iron intake is necessary after this age

[17]. However, although breast milk has an iron content that is not sufficient for a child over 6 months, it is better absorbed (50%) than that of fresh cow's milk. After six months of age, replacement foods should be introduced and diversified to meet physiological needs. Ideally, we should seek to consume products rich in haem iron (meat, fish, poultry) and fruits rich in vitamin C in order to facilitate the absorption of iron of plant origin. However, these products are often expensive and inaccessible to certain segments of the population [17]. Complementary foods commonly served to children consist of cereals, which are not only poor sources of iron, but also contain substances that inhibit its absorption. Prolonged exclusive breastfeeding has, as a corollary, a reduction in dietary iron intake. To this end, the late addition of food can trigger the deficiency process to the extent that the child's needs are not covered and accentuate his vulnerability [27].

Furthermore, breastfeeding is a determining factor for the health of young children and must be constantly adapted to rapidly changing needs. Studies carried out in different regions of Africa have shown that the poor quality of complementary foods largely explains the relatively high prevalence of nutritional deficiencies [28] However, well-prepared food, stored in good conditions and given to children from six months of age, increases their capacity to resist infections by strengthening their immune system. The nutritional poverty of substitute foods combined with the unsanitary conditions of their preparation means that, generally, weaning corresponds to the beginning of the child's period of vulnerability [26].

4. Conclusion

The aim of this study was to evaluate the coverage of the iron requirements of young children aged 6 to 59 months from foods consumed in urban and rural areas in the Kozah prefecture (Kara). The results revealed the low iron intake in the diet of these children, even in the urban area considered, where better results could be expected thanks to greater accessibility to a diversified diet. However, several foods rich in iron have been identified in the localities studied which if they are well prepared and stored in good hygienic conditions, can ensure good coverage of the recommended daily iron intake.

The conclusion reached by this study is perhaps not new, but it provides additional and precise details concerning the characteristics on which we could act to significantly reduce the risk of exposure of the children considered to micronutrient deficiencies such as iron.

The nutritional education of women must therefore be promoted, for better health and harmonious growth of their offspring. This contributes significantly to behavior change. Mothers will thus be equipped with the knowledge enabling them to effectively combat nutritional imbalances in young children. This knowledge is likely to encourage the abandonment of food taboos and inappropriate practices in favor of a balanced diet. Diversifying alternative foods also remains an effective strategy for preventing iron deficiency in young children. For this, nutritional education is fundamental and represents the key to the success of any nutritional intervention program that aims to be relevant and impactful.

Conflicts of Interest

The authors declare no conflicts of interest.

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