

## Original Research Article

# Complementary feeding practices of children aged 6-23 months in rural area, Southern Benin : Challenges and Opportunities

ABSTRACT (ARIAL, BOLD, 11 FONT, LEFT ALIGNED, CAPS)

**Aims:** This study aims to provide in-depth knowledge of current infant feeding practices in order to create an evidence base and develop well-targeted strategies to reduce the prevalence of child malnutrition.

**Study design:** This was a descriptive cross-sectional survey.

**Place and Duration of Study:** This study was carried out in two rural districts, *Bopa* and *Houeyogbe*, in southern Benin from October to December 2013.

**Methodology:** A total of 1225 mother-infant pairs, aged 6-23 months were randomly selected in seventeen villages through exhaustive sampling. Socio-demographic data of participants were obtained through semi-structured interviews. Complementary feeding practices were assessed using recommended Infant and young child feeding (IYCF) indicators. Statistical analyses were performed with SPSS version 20. Statistical significance was set at  $P < 0.05$ .

**Results:** Overall, 20% had timely initiation of complementary feeding, whereas 61% and 17% had early and delayed initiation of complementary feeding, respectively. The mean age of introducing solid foods was  $4.9 \pm 2.3$  months. Prevalence of MDD, MMF and MAD was 60%, 71% and 46% respectively. There is no specific complementary foods (CFs) for children in Benin. Cereal porridges and extracts from family diets were two categories of complementary foods identified. Complementary food (CF) is characterized by unenriched porridges, mashed family diets and low consumption of fruits and eggs. Most of the children (70%) were fed vegetables consumed individually or mixed with other leaves. The most popular vegetables consumed by the children were *Corchorus olitorius* (48%), *Hibiscus esculentus* (22%), *Solanum macrocarpon* (18%).

**Conclusion:** Untimely initiation of complementary feeding was predominant. Complementary feeding practices in this area of Benin were suboptimal. The valorization of local biodiversity and traditional recipes was opportunity to improve quality of child's diet. Reinforcing the capacity building of stakeholders focused on child feeding may be a crucial step for child well-being.

**Keywords:** Complementary feeding, Child nutrition, Practices, Foods, Diversity, Benin

## ABBREVIATIONS

SDG, Sustainable Development Goal; CAN, Council for Food and Nutrition; IYCF, Infant and Young Child Feeding; WHO, World Health Organization; MDD, Minimum dietary diversity; MMF, Minimum meal frequency; MAD, Minimum acceptable diet; HFIAS, Household Food Insecurity Access Scale; LV, Leafy Vegetable; NUS, Neglected Used Species; CF, Complementary Food; CFs, Complementary Foods; exclusive breastfeeding, EBF.

## 1. INTRODUCTION

Appropriate infant feeding practices are fundamental to a child's growth, health and development during the first 2 years of life. Optimal nutrition in the first year of life is crucial in laying the foundation for good nutrition and health in later life [1]. Globally, 159 million children under five years are still affected by stunting with more than a third living in Africa. The number of stunted children was halved in Asia and

28 Latin America/Caribbean, whereas the burden in Africa increased by 24% between 1990 and 2012 [2].  
29 Undernutrition is responsible, directly or indirectly, for at least 35% of deaths in children less than five  
30 years of age [3]. In Africa, suboptimal infant feeding practices and poor nutrient density for key  
31 micronutrients are the major determinants that contribute to the high mortality among infants and young  
32 children [4,5]. Poverty, insufficient knowledge on infant feeding and cultural practices may affect the  
33 adequacy of the complementary diet [6]. In francophone West African countries, malnutrition remains a  
34 pertinent problem and mothers are not well educated on how to provide the correct nutrition for their  
35 babies [7]. This worrying situation occurs because of suboptimal complementary feeding practices as a  
36 result of inappropriate introduction of complementary foods (CFs), inadequate quantities and quality of  
37 diets coupled with inappropriate breastfeeding practices. In Benin, recent surveys show that only 15% of  
38 children achieved a minimum acceptable diet with 52% and 25% of children receiving the minimum meal  
39 frequency and the minimum dietary diversity, respectively [8].  
40 The Sustainable Development Goal (SDG) number 2 targets to end hunger, achieve food security,  
41 improve nutrition and promote sustainable agriculture by the year 2030 [9]. To reach this goal, successful  
42 infant feeding practices are crucial for preventing malnutrition. Apart from the creation of the National  
43 Council for Food and Nutrition (CAN), Benin has a national strategy for infant and young child feeding  
44 [10], but it remains little operational. Indeed, the strategy does not highlight proposals for actions related  
45 to nutrition capacity building at the level of the health pyramid, the role and responsibilities of  
46 stakeholders on the one hand and designing tools and communication strategy on the other hand is very  
47 important. Designing effective nutrition intervention programs requires good knowledge of current child  
48 feeding practices.  
49 To the best of our knowledge, few papers have described complementary feeding practices in Benin. This  
50 study aims to provide in-depth knowledge of current complementary feeding practices in order to create  
51 an evidence base and develop well targeted strategies to improve infant feeding practices.  
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## 54 2. MATERIALS AND METHODS

### 55 2.1 Study area and population

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58 This cross-sectional study was carried out in two rural districts, *Bopa* and *Houeyogbe*, in Mono  
59 department, Southern of Benin. Mono department registered the highest food insecurity rate of the  
60 country (33%) compared to national level (12%) [11]. *Bopa* and *Houeyogbe* are characterized by a  
61 subequatorial and Sudano-Guinean climate respectively with four seasons: two rainy seasons and two  
62 alternating dry seasons. In *Bopa*, the vegetation consists of grasses, marshy grasslands and a mangrove  
63 stand along the "Aheme" lake. *Bopa* is more remote and more agriculture oriented, while *Houeyogbe* is  
64 closed to main towns. "Saxwe" is the predominant ethnic group in both areas.

### 65 2.2 Sampling technique

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67 An estimated theoretical sample size was 1183 children based on the following parameters: 95%  
68 confidence level, 1.96 two-tailed z-score and an estimated prevalence of stunting of 44.7%, the margin of  
69 error at 5%, the design effect of 1.4 and the rate of non-response at 10%[12]. Exhaustive sampling was  
70 performed. In the first stage, for each district, villages holding at least 70 children aged 6 to 23 months  
71 were listed from the latest national population census database. From these lists, proportionally to the  
72 number of children, 8 villages in *Bopa* and 9 villages in *Houeyogbe* were randomly selected. A total of  
73 1263 of households were selected. However, 38 of mothers with their infants left the area despite their  
74 commitment. Thus, the final sample size for the analysis was 1225 households and the non-response  
75 rate was 3%.

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## 2.3 Data collection

Data were collected from a cross-sectional survey conducted between October and December 2013. A pretested semi-structured questionnaire was used to collect socio-demographic and health information, as well as child, maternal and household characteristics. Locally recruited research assistance were trained and subsequently conducted interviews in local languages. Mothers or primary caregivers provided the details of feeding patterns (breastfeeding and complementary feeding practices).

### 2.3.1 Socio-economic surveys

The questionnaires used to collect data include three major types of information namely: the socioeconomic characteristics of households, the description of the complementary feeding practices and food consumption.

### 2.3.2 Complementary feeding and Household Food Insecurity indicators

To assess complementary feeding practices of infants and young children, three core infant and young child feeding (IYCF) indicators according World Health Organization (WHO) recommendations were used, namely minimum dietary diversity, minimum meal frequency and minimum acceptable diet. “Minimum dietary diversity” (MDD), refers to the proportion of children aged 6-23 months who ate from four or more of different food groups out of seven in a 24 h time period [13]. “Minimum meal frequency” (MMF) represents the proportion of breastfed and non-breastfed children aged 6-23 months who received solid, semi-solid or soft foods including milk feeds for non-breastfed children, at least the minimum number of times during the previous day. The minimum number of times was defined as two times for breastfed infants aged 6-8 months, three times for breastfed children aged 9-23 months and four times for non-breastfed children aged 6-23 months[13]; and “Minimum acceptable diet” (MAD): the proportion of children 6-23 months of age who received both minimum dietary diversity and minimum meal frequency [13].

The household food insecurity indicator is an ordinal scale variable determined with the Household Food Insecurity Access Scale (HFIAS); method developed by Food and Nutrition Assistance Projects (FANTA) [14]. The construction of the HFIAS was based on the experience and expression of food insecurity (defined as lack of access). Nine brief HFIAS occurrence questions were asked with a recall period of four weeks (30 days). Four domains and several subdomains of food insecurity were: uncertainty (in the long term) and worry (in the short term) about food; inadequate quality (unhealthy foods and diets, limited variety); insufficient quantity (running out of food, not consuming enough, eating less, disrupted eating patterns); and social unacceptability (unacceptable means of acquiring food, eating foods that cause shame or embarrassment). The respondent was first asked an occurrence question – that is, whether the condition in the question happened at all in the past four weeks (yes or no). If the respondent answered “yes” to an occurrence question, a frequency-of-occurrence question was asked to determine whether the condition happened rarely (once or twice), sometimes (three to ten times) or often (more than ten times) in the past four weeks. Using HFIAS indicators, the collected data was analyzed, and at last each household was categorized according the following scale: food secure and mildly, moderately and severely food insecure. Then, all categories related to food insecurity were grouped in order to keep households under two main categories: food-secure and food-insecure [14-16].

## 2.4 Data analysis

Statistical analyses were performed with SPSS version 20. For categorical variables, frequencies and percentages were determined and represented in tables and figure. Chi-squared test was applied for comparison of categorical variables. For continuous variables, student’s t-test was used to make comparison of means. Statistical significance was set at  $P < 0.05$ .

### 3. RESULTS

#### 3.1 Socio-demographic, maternal and child characteristics

Socio-demographic characteristics of the study participants are presented in Table 1. Most of the mothers (67%) did not have formal education with the highest proportion observed in Bopa. The proportion of women who delivered at home is significantly higher in Bopa than Houeyogbe (24.2% vs 1.8%;  $P = .001$ ).

**Table 1 . Socio-demographics characteristic of the study participants**

| Characteristics                       | All<br>n (%) | Districts     |                    | <i>P</i> |
|---------------------------------------|--------------|---------------|--------------------|----------|
|                                       |              | Bopa<br>n (%) | Houeyogbe<br>n (%) |          |
| <b>Children</b>                       |              |               |                    |          |
| <i>Age of child (months)</i>          |              |               |                    | .188     |
| 6-11                                  | 460 (37.6)   | 222 (39.9)    | 238 (35.6)         |          |
| 12-17                                 | 402 (32.8)   | 183 (32.9)    | 219 (32.8)         |          |
| 18-23                                 | 363 (29.6)   | 152 (27.3)    | 211 (31.6)         |          |
| <i>Sex</i>                            |              |               |                    | .837     |
| Male                                  | 631 (51.7)   | 285 (51.3)    | 346 (52.1)         |          |
| Female                                | 588 (48.24)  | 270 (48.6)    | 318 (47.8)         |          |
| <b>Maternal</b>                       |              |               |                    |          |
| <i>Age of mothers (years)</i>         |              |               |                    | .136     |
| <20                                   | 60 (4.9)     | 20 (3.6)      | 40 (6)             |          |
| 20-34                                 | 930 (75.9)   | 432 (77.6)    | 498 (74.6)         |          |
| 35+                                   | 235 (19.2)   | 105 (18.9)    | 130 (19.5)         |          |
| <i>Maternal education</i>             |              |               |                    | .000***  |
| Did not attend school                 | 822 (67.1)   | 446 (80.1)    | 376 (56.3)         |          |
| Literate & Primary                    | 236 (19.3)   | 86 (15.4)     | 150 (22.5)         |          |
| Secondary & Above                     | 166 (13.6)   | 25 (4.5)      | 141 (21.1)         |          |
| <i>Place of delivery</i>              |              |               |                    | .000***  |
| Health institute                      | 1075 (87.8)  | 421 (75.6)    | 654 (97.9)         |          |
| Home                                  | 147 (12)     | 135 (24.2)    | 12 (1.8)           |          |
| <b>Household</b>                      |              |               |                    |          |
| <i>HFIAS Category</i>                 |              |               |                    | .018*    |
| Food secure                           | 242 (19.8)   | 128 (23)      | 114 (17.1)         |          |
| Food Insecure                         | 983 (80.2)   | 429 (77)      | 554 (82.9)         |          |
| <i>Nature of household (activity)</i> |              |               |                    | .001**   |
| Agriculture                           | 63.0 (768)   | 82.16 (456)   | 46.99 (46.99)      |          |
| No Agriculture                        | 37.0 (451)   | 17.84 (99)    | 53.01 (352)        |          |

HFIAS: Household Food Insecurity Access Scale

Chi-2 Test. Level of significance \*, \*\*, \*\*\* With  $\alpha=0.05$ .

#### 3.2 Timing of initiation of complementary feeding

Figure 1 shows the distribution of children based on the time of introduction of complementary foods. Most of the children (78%) had the incorrect timely complementary feeding practice. The mean age of introducing solid foods was  $4.9 \pm 2.3$  months (data not shown).

**Comment [au1]:** This is not clear on the fig 1

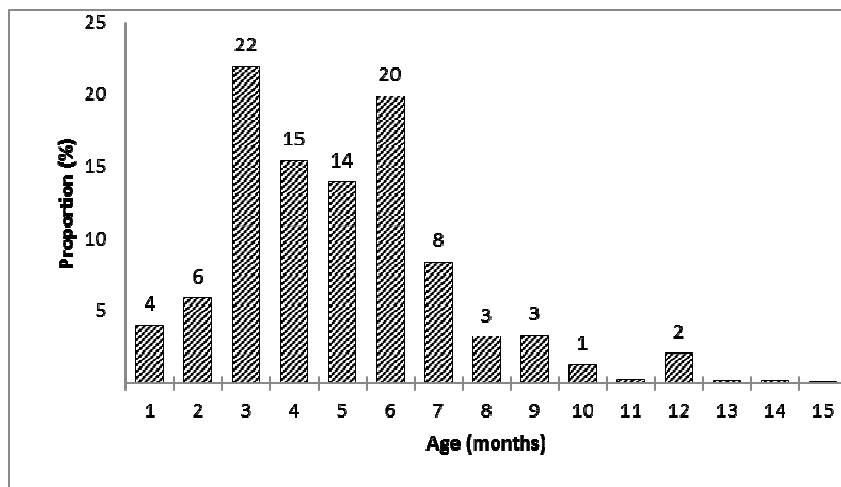


Figure 1: Age of introduction of the first complementary foods

### 3.3 Complementary feeding practices

#### 3.3.1 Consumption frequency of food groups and food items

The majority (82%) of children consumed maize paste followed by rice and red cowpea, whilst eggs and dairy products were rarely consumed (Table 2). Fruit consumption was almost absent in the diet. The use of diversity leafy vegetables was wide spread in both districts.

167 Table 2: Proportion of children that consumed food groups and food items/recipes by districts

| Food group and food items/recipes                         | All (n=1225)       | Bopa<br>(n=557)   | Houeyogbe<br>(n=668) | P            |
|-----------------------------------------------------------|--------------------|-------------------|----------------------|--------------|
|                                                           | n (%)              | n (%)             | n (%)                |              |
| <b>Grains, roots and tubers</b>                           | <b>1215 (99.2)</b> | <b>552 (45.1)</b> | <b>663 (54.1)</b>    |              |
| Porridges of maize                                        | 682 (55.7)         | 290 (42.5)        | 392 (57.5)           |              |
| Maize paste                                               | 1003 (81.9)        | 474 (38.7)        | 529 (43.2)           |              |
| Rice                                                      | 321 (26.2)         | 156 (12.7)        | 165 (13.5)           |              |
| Wheat (Pasta)                                             | 126 (10.3)         | 52 (4.2)          | 74 (6)               |              |
| Cassava                                                   | 199 (16.2)         | 85 (6.9)          | 114 (9.3)            |              |
| Sweet potato                                              | 32 (2.6)           | 10 (0.8)          | 22 (1.8)             |              |
| <b>Legumes and nuts</b>                                   | <b>616 (50.3)</b>  | <b>334 (27.3)</b> | <b>282 (23)</b>      | <b>.001</b>  |
| White cowpea                                              | 38 (3.1)           | 13 (1.1)          | 25 (2)               |              |
| Red cowpea                                                | 245 (20)           | 148 (12.1)        | 97 (7.9)             |              |
| Soya cheese                                               | 32 (2.6)           | 11 (0.9)          | 21 (1.7)             |              |
| <b>Dairy products</b>                                     | <b>33 (2.7)</b>    | <b>5 (0.4)</b>    | <b>28 (2.3)</b>      | <b>.0001</b> |
| Dairy products                                            | 33 (2.7)           | 5 (0.4)           | 28 (2.3)             |              |
| <b>Flesh foods</b>                                        | <b>929 (75.8)</b>  | <b>412 (33.6)</b> | <b>517 (42.2)</b>    | <b>.180</b>  |
| Fermented fish « Lanhouin » (Saxwe)                       | 358 (29.2)         | 88 (7.2)          | 270 (22)             |              |
| Dried fish (small)                                        | 330 (26.9)         | 146 (11.9)        | 184 (15)             |              |
| Fresh fish ; « Chinch » (French) « sylvie » (Saxwe, fon)  | 669 (56.4)         | 2525 (20.6)       | 439 (35.8)           |              |
| Fresh fish; "Tilapia" (French); "Akpavi"(Saxwe, Fon)      | 205 (10.7)         | 96 (7.8)          | 109 (8.9)            |              |
| <b>Meat of hen</b>                                        | <b>6 (0.5)</b>     | <b>2 (0.2)</b>    | <b>4 (0.3)</b>       |              |
| <b>Eggs</b>                                               | <b>26 (2.1)</b>    | <b>7 (0.6)</b>    | <b>19 (1.6)</b>      | <b>.72</b>   |
| Eggs of hen                                               | 26 (2.1)           | 7 (0.6)           | 19 (1.6)             |              |
| <b>Vitamin A-rich fruits and vegetables</b>               | <b>494 (40.3)</b>  | <b>266 (21.7)</b> | <b>228 (18.6)</b>    | <b>.001</b>  |
| Tomato                                                    | 460 (67.6)         | 134 (30.3)        | 482 (39.3)           |              |
| Pepper (Red)                                              | 829 (67.7)         | 421 (34.4)        | 408 (33.8)           |              |
| <b>Leafy vegetable (LV)</b>                               |                    |                   |                      |              |
| Corchorus olerius ; « Crincrin » (French), "Ninwi"(Saxwe) | 593 (48.5)         | 294 (49.6)        | 299 (50.4)           |              |
| Solanum macrocarpon                                       | 217 (17.7)         | 136 (11.1)        | 81 (6.6)             |              |
| Vernonia amygdalina                                       | 70 (5.7)           | 37 (3)            | 33 (2.7)             |              |
| Moringa leaves ; LV of Moringa oleifera (Moringa)         | 37 (3)             | 19 (1.6)          | 18 (1.5)             |              |
| Cowpea leaves; LV of Vigna unguiculata                    | 30 (2.4)           | 19 (1.6)          | 11 (0.9)             |              |
| Cassava leaves ; LV of Manihot esculenta                  | 12 (1)             | 7 (0.6)           | 5 (0.4)              |              |
| LV_ Talinum triangulare ; « Glaceman » (Fon)              |                    |                   |                      |              |

|                                                                         |                    |                   |                   |             |
|-------------------------------------------------------------------------|--------------------|-------------------|-------------------|-------------|
| <b>Fruit</b>                                                            |                    |                   |                   |             |
| Orange                                                                  | 44 (3.6)           | 3 (0.2)           | 41 (3.3)          |             |
| Banana                                                                  | 17 (1.4)           | 6 (0.5)           | 11 (0.9)          |             |
| <b>Others fruits and vegetables</b>                                     | <b>874 (71.3)</b>  | <b>379 (30.9)</b> | <b>495 (40.4)</b> | <b>.012</b> |
| <i>Okra ; Hibiscus esculentus ; « Gombo » ; « Fevi » (Saxwe)</i>        | 269 (22)           | 129 (10.5)        | 140 (11.4)        |             |
| Onion                                                                   | 853 (69.6)         | 371 (30.3)        | 482 (39.3)        |             |
| Pepper (Green)                                                          | 715 (58.4)         | 287 (23.4)        | 426 (34.9)        |             |
| <b>Mixed recipes</b>                                                    | <b>10 (0.8)</b>    | <b>7 (0.6)</b>    | <b>3 (0.2)</b>    | <b>-</b>    |
| Mixed of rice and cowpea; « <i>Atassi</i> » (Saxwe, Fon)                | 46 (3.8)           | 16 (1.3)          | 30 (2.4)          |             |
| Mixed of Palm nut sauce, cowpea and maize flour; "Aitoutou"             | 2 (0.2)            | 2 (0.2)           | 0                 |             |
| Mixed of red cowpea and banana ( <i>Yotchio djangan</i> )               | 1 (0.1)            | 1 (0.1)           | 0                 |             |
| <b>Spices and condiments</b>                                            | <b>1018 (83.1)</b> | <b>468 (38.2)</b> | <b>550 (44.9)</b> | <b>.445</b> |
| Garlic                                                                  | 662 (54)           | 282 (42.6)        | 380 (35)          |             |
| Cube ; « Bouillon » (French)                                            | 975 (78.1)         | 439 (35.8)        | 518 (42.3)        |             |
| <b>Sugars</b>                                                           | <b>555 (45.3)</b>  | <b>182 (14.9)</b> | <b>373 (30.4)</b> | <b>.000</b> |
| Sugars                                                                  | 555 (45.3)         | 182 (14.9)        | 373 (30.4)        |             |
| Honey                                                                   | 5 (0.4)            | 0                 | 5 (0.4)           |             |
| <b>Miscellaneous ( NUS<sup>3</sup>)</b>                                 |                    |                   |                   |             |
| LV_ <i>Cleome rutidosperma</i> ; « <i>Akaya, Sanvo</i> » (Saxwe)        | 1 (0.1)            | 1 (0.1)           | 0                 |             |
| LV_ <i>Telfairia occidentalis</i> ; « <i>Lokoman</i> » (Saxwe)          | 1 (0.1)            | 0                 | 1 (0.1)           |             |
| LV_ <i>Ipomea aquatica</i> ; « <i>Toyoe</i> » (Saxwe)                   | 2 (0.2)            | 1 (0.1)           | 1 (0.1)           |             |
| LV_ <i>Launaea traxacifolia</i> ; « <i>Wonto</i> » (Saxwe)              | 6 (0.5)            | 4 (0.3)           | 2 (0.2)           |             |
| LV_ <i>Vitex doniana</i> ; <i>Prunier des savanes</i> « <i>Fonman</i> » | 1 (0.1)            | 1 (0.1)           | 0                 |             |

168 <sup>1</sup> Only food items consumed by at least 1% of children are reported excepted neglected used species (NUS) wild edible products, flesh foods less consumed and local recipes  
169 observed with potential nutritional value.  
170 <sup>2</sup> LV: Leafy Vegetable; <sup>3</sup> NUS: Neglected Used Species

### 3.3.2 Food consumption pattern

Two categories of CFs were provided to children: Cereal porridges and extracts from family diets. No specific CF were given to infants and young children. Complementary feeding was mostly initiated using locally prepared maize porridges ("Koko" or "Godo" in Saxwe, local language). Only 15% of children received enriched porridges. Besides porridges, extracts of family diets were often made up of staple foods and traditional sauces or mixed recipes (mixture of cereals and/or legumes with crushed condiments/spices). Cultivated leafy vegetables (eg. *Corchorus olitorius*, *Solanum macrocarpon*, *Moringa oleifera*) and Neglected Used Species (NUS) ones (eg. *Cleome rutidosperma*, *Launaea traxacifolia*, *Ipomea aquatic*) were consumed individually or mixed with other leaves as described in Table 2. *Corchorus olitorius* commonly called "Ninwi" (Saxwe) or "Crincrin" (French) remains the most leafy vegetable frequently consumed by infant and young children.

### 3.3.3 Complementary feeding indicators

Prevalence of MDD, MMF and MAD was 60%, 71% and 46% respectively (Table 3). The proportion of children who achieved MDD was significantly higher in Bopa than Houeyogbe among children in the two age categories: (48.6% vs 38.7%;  $P = .038$ ) for 6-11 months. About 40% of mothers started earlier complementary feeding following the advice from parents and healthcare workers.

**Table 3 Complementary feeding indicators and related feeding practices of primary caregivers**

| Characteristics                                    | All n (%)   | Districts  |                 | P       |
|----------------------------------------------------|-------------|------------|-----------------|---------|
|                                                    |             | Bopa n (%) | Houeyogbe n (%) |         |
| <i>Complementary feeding indicators</i>            |             |            |                 |         |
| MDD                                                |             |            |                 |         |
| 6-11 mo                                            | 200 (43.5)  | 108 (48.6) | 92(38.7)        | .038*   |
| 12-17 moi                                          | 271 (67.4)  | 135 (73.8) | 136 (62.1)      | .014*   |
| 18-23 mo                                           | 267 (73.6)  | 108 (71.1) | 159 (75.4)      | .399    |
| 6-23 mo                                            | 738 (60.2)  | 351 (63)   | 387 (57.9)      | .079    |
| MMF                                                |             |            |                 |         |
| 6-11 mo                                            | 329(71.5)   | 148 (66.7) | 181 (76.1)      | .030*   |
| 12-17 mo                                           | 261 (64.9)  | 114 (62.3) | 147 (67.1)      | .345    |
| 18-23 mo                                           | 279 (76.9)  | 110 (72.4) | 169 (80.1)      | .101    |
| 6-23 mo                                            | 869 (70.9)  | 372 (66.8) | 497 (74.4)      | .004**  |
| MAD                                                |             |            |                 |         |
| 6-11 mo                                            | 154 (33.5)  | 77 (34.7)  | 77 (32.4)       | .622    |
| 12-17 mo                                           | 199 (49.5)  | 92 (50.3)  | 107 (48.9)      | .841    |
| 18-23 mo                                           | 214 (59)    | 81 (53.3)  | 133 (63.0)      | .067    |
| 6-23 mo                                            | 567 ( 46.3) | 250 (44.9) | 317 (47.5)      | .388    |
| <i>Reasons for starting CF</i>                     |             |            |                 |         |
| Breast milk was not sufficient                     | 400 (31.9)  | 196 (34.4) | 204 (29.8))     | .001*** |
| Parents/hospital advices                           | 496 (39.6)  | 183 (32.2) | 313 (45.8)      | .001*** |
| Always crying                                      | 249 (19.8)  | 111 (19.5) | 138 (20.1)      | .411    |
| <i>First CF provided to children</i>               |             |            |                 |         |
| Simple porridges                                   | 1010 (80.5) | 479 (84)   | 531 (77.5)      | .008**  |
| Enriched porridges                                 | 188 (15)    | 62 (10.9)  | 126 (18.4)      |         |
| Others foods                                       | 50 (4)      | 25 (4.4)   | 25 (3.6)        |         |
| <i>Hand washing with soap before feeding child</i> |             |            |                 | .01**   |

|                               |            |            |            |         |
|-------------------------------|------------|------------|------------|---------|
| Yes                           | 660 (52.3) | 252 (44)   | 408 (59.1) |         |
| No                            | 603 (47.7) | 321 (56)   | 282 (40.9) |         |
| <i>How CF is fed to child</i> |            |            |            |         |
| Hands                         | 794 (63.3) | 361 (63.3) | 433 (63.2) | .506    |
| Spoon                         | 248 (19.8) | 79 (9.5)   | 169 (24.7) | .001*** |
| Cup                           | 179 (14.3) | 54 (9.5)   | 125 (18.2) | .001*** |
| Bottle                        | 19 (1.5)   | 4 (0.7)    | 15 (2.2)   | .025*   |

mo: month; CF: Complementary foods; MDD: Minimum Dietary Diversity; MMF: Minimum Meal Frequency; MAD: Minimum Acceptable Diet  
Chi-2 Test. Level of significance \*, \*\*, \*\*\* With  $\alpha=0.05$ .

#### 4. DISCUSSION

Complementary foods were provided early or too late to more than halve of the children with the mean age for introducing CF estimated at 4.9 months. Untimely introduction of CF appeared as a concern within the study area. Similar findings were observed in Tanzania and India where age of introduction was estimated at 3.30 months and 3-5 months, respectively [17,18]. Counseling from parents and healthcare workers and mothers' perceptions were important factors influencing the beginning of complementary feeding. A study in Nigeria found that some mothers started complementary feeding early as a result of instructions given in the hospital [19]. Consequently, exclusive breastfeeding (EBF) rate decreases with the precocious introduction of CFs. This incorrect timing of introduction of CF for children exposes them to the risk of nutrient deficiencies and deterioration of the immune system. A study conducted by Kramer *et al* [20] demonstrated that early introduction of CF has negative effects on child health with increased risk of diarrhoea, respiratory illness and malnutrition.

In terms of types of complementary foods fed the infants, no specific CF were given to IYC. Cereal porridges and extracts from family diets were the two main CFs consumed by children. However, a study conducted by Sawadogo *et al* [21] revealed that three categories of CF including special dish were identified in Burkina Faso [21]. Concerning porridges, the majority of children were given maize-porridge and only few (15%) received enriched ones. Indeed, enriched porridges basically consists of cereals (maize, millet, sorghum, wheat-pasta) mixed with roasted legumes (soya, groundnut) and small smoked fish. Then, in 1L boiling water, 200 g of enriched flours previously diluted in water, was added and cooked for about 15 min. Sugar and sometimes milk were added and served to child throughout the day. Moreover no support from government to facilitate access to raw materials apart from maize seeds given to farmers for promotion of value-chain. Also, enriched flours needs more time and financial resource for the supply of raw materials. Lack of timing of mothers and low availability or accessibility of ingredients to prepare enriched flour are relevant limiting factors according respondents.

With regards to family dishes, children's diet were composed of staple foods (cereals, roots, legume) accompanied by sauces. This finding is similar to studies carried out in southern-Benin describing that the CFs comprise porridges, snacks and family dishes [22]. Concerning sauces, about half of the children consumed leafy vegetable (LV) sauce, mainly *Chorchorus olitorius* often prepared with red palm oil or palm nut. Indeed, traditional vegetables are an essential source of vitamins, micronutrients and protein and, thus, a valuable component to attain nutritional security[23,24]. In addition, the sauces were considered as an important source of vitamin A for young Beninese children[25]. Therefore, the consumption of leafy vegetable sauces is a good dietary habit which contributes to improve dietary diversity. The high rate of MDD (60%) in the studied population compared to the national prevalence of 25% was likely related to the predominant consumption of a diversity of LV. In addition, the high prevalence of MDD among Bopa's children under one year was likely related to the frequency of LV provided that is higher than Houeyogbe. Inversely, the consumption of fruits almost absent in the children's diet is one of the weaknesses registered. Currently, similar trend was found in India where fruits were also missen in the diet of children [18]. The promotion of fruit consumption appears capital to improving the quality of diet of children.

Even if plant-based foods were used to feed children, it would be better to also add the use of animal products (potential sources of vitamins and micronutrients) in order to increase the bioavailability of

micronutrients and avoid monotonous diet. This may contribute to diversified diet, because all essential nutrients such as high biological value proteins, vitamins C, E, B6, B12, calcium, iron, zinc, magnesium and selenium essential for growth and development cannot not be obtained with the consumption of only leafy vegetable.

Social environment should also be integrated in nutritional interventions by targeting mothers. Collaterals such as grandmothers and aunts, vectors of dietary habits, should also be addressed. Capacity building of healthcare workers focusing on child nutrition and behavior change communication appears fundamental to provide appropriate counseling. But, for nutrition education to be effective in changing behavior, it is critical to accompany this with environmental changes [26]. This involves promoting self-consumption of agricultural and animal products. For example, the consumption of fruits, eggs, meats, cheese, etc. could be encouraged to improve the quality of diet and the valorization of local resources.

## 5. LIMITATIONS OF STUDY

Due to the cross-sectional design utilized in this study, the possibility of recall bias could exist. The answers given depends on the memory of respondents. However, the 24-hours recall used is a validated method. Again, the survey was conducted after the short rainy season which corresponds to the period of medium food availability. The study did not take into account the seasonal variation that could influence the availability and accessibility of households to local food resources. It would therefore be interesting to carry out another study during dry season characterized by food shortage.

## 6. CONCLUSION

The findings of this study provide in-depth knowledge on feeding practices and potential constraints to the adoption of optimal feeding practices. Breastfeeding was widely practiced but exclusive breastfeeding (EBF) until 6 months was very poor. Too early or late introduction of CF remains a crucial concern that hampered optimal infant feeding practices. Porridges and family dishes were the main CF provided to children. The local biodiversity, fruit and the diversity of traditional potentially nutritious food recipes should be integrated to the national strategy for infant and young child feeding to facilitate the implementation of food security and nutritional programs. Beliefs, local perceptions and insufficient capacity building of healthcare workers may be the potential bottlenecks to behavior change for adoption of adequate infant feeding practices. Taking into account local perceptions appears fundamental to formulate key messages in order to ensure sustainable behavior change. Moreover, reinforce capacity building of healthcare workers focusing on child nutrition appears important to provide adequate counseling on issues regarding child care, including infant feeding practices during antenatal and postnatal visits. Nutritional education at community level targeting mothers and collaterals is an important strategy that contributes to the effectiveness of nutrition interventions programs in order to improve child well-being. For improving child nutrition, Government interventions should focused on nutritional education for families and training of health professionals in one hand, and promoting value chain in order to increase food access and availability in other hand.

**Comment [au2]:** I did not see this in any part of your work

## **ETHICAL APPROVAL**

Ethical approval was obtained from the Benin National Ethics Committee for Scientific Research (N°45/MS/DC/SGM/DFR/CNERS/SA). Thus study only involved parents of children who show complete willingness to participate based on attestation to the informed consent provided.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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