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*Original Article*

# Food Supplementation Practices and Categorisation of Dishes Associated with Diets of Children Aged 6–36 Months in Rural areas of Man, Ivory Coast

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## ABSTRACT

**Background and Objectives:** Inappropriate infant feeding practices are a contributing factor to malnutrition in western Côte d'Ivoire. In this region of the country, 26% of children under 5 years-old are malnourished and 6% of these children are emaciated. This study was carried out in women in the city of Man to assess knowledge and practices regarding infant feeding.

**Materials and Methods:** A descriptive cross-sectional survey of 240 women was carried out to assess their knowledge and practices regarding infant feeding. The sampling frame for the study covered eight rural localities in Man, including Kassiapleu, Petit Gbepleu, Gbangbegouine-Yati, Kouitongouine 1, Kouitongouine 2, Gbouakpale, Zele and Guianle.

**Results:** A majority of the women (75.4 %) started taking supplements 6–12 m with only 49.5%, receiving medical supports. They thought that the ideal age to stop was 12–24 m. The most commonly used foods for supplementation were cereal porridge (88.5%), kokonde (45.4%) and placali (36.3%).

**Conclusions:** Inappropriate supplementation practices were observed in nearly half of the children.

**Keywords:** Dietary diversification, Children, Breast milk, Ivory Coast

## Introduction

During the first 6 m of a child's life, breast milk perfectly meets all the child's nutritional needs. Therefore, World Health Organization (WHO) and United Nations Children's Fund (UNICEF) Global Strategy on Infant and Young Child Feeding recommends exclusive breastfeeding for up to 6 m [1]. This prevents death of approximately 1.3 million children under the age of 5 years each year, which is a major problem in developing countries [2]. However, after 6 m of age, breast milk becomes insufficient in quality and quantity for infants, whose nutritional needs increase [3].

Feeding practices are key determinants of children's nutritional status, which affects their morbidity and mortality. In feeding practices, breastfeeding and the introduction of complementary foods are particularly important during the first two years of life [4]. Therefore, diets must progressively be diversified to help the infant make the transition from an exclusively milk-based diet to an adult diet [5]. The complementary feeding period is a period of high risk of deficiency. In several developing countries, infants and young children malnutrition and mortality are closely linked to often inappropriate complementary feeding practices [6]. Regarding importance of the quality of complementary feeding during this period, recommendations have been made based on the nutritional requirements of children at the age of introduction and for the development of nutritionally and healthily adequate infant formulae [7].

In Ivory Coast, studies into the socio-anthropological bases of malnutrition show that inappropriate feeding practices by mothers in the northwest of the country are at the root of malnutrition in children aged 0–5 y. In fact, people in these areas believe that certain local preparations in the form of maize porridge have nutritional and therapeutic qualities, on the pretext that they make children overweight [8]. In the regions of Ivory Coast, mothers' feeding practices are shaped by a system of thought characterised by ignorance, family beliefs, received ideas and other sociocultural factors [8]. The aim of this study was to assess knowledge and practices of women in the city

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of Man, Ivory Coast, regarding infant feeding. Moreover, maternal sociodemographic factors associated with complementary feeding practices in children aged 6–36 m in rural Man, Ivory Coast, was identified.

## Materials and Methods

### Fields of study

Man is a city with an area of 2.893 km$^2$, located in the west of Ivory Coast, 563.2 km from Abidjan and is the capital of the Tonkpi Region. It is located between 7°25'01" north latitude and 7°32'58" west longitude. Population of Man is estimated as 461.135 people, including 245.091 male and 216.044 female [9].

### Survey sites

The study was carried out in eight rural communities in the District of Man, including villages of Kassiapleu, Petit Gbepleu, Gbangbegouine-Yati, Kouitongouine 1, Kouitongouine 2, Groupale, Zele and Guianle.

### Survey on infant feeding practices

### Selection of respondents

Women were selected using technique of snowball sampling. This is a non-probabilistic sampling method; in which, a respondent is selected at random and a list of other women is then compiled. Totally, 240 women were interviewed, including 30 women per village. Inclusion criteria were as follows:

- Women living in the village at the time of the survey.
- Women with children aged 0–36 m and knowledge of infant feeding practices.
- Women with children over 36 m and knowledge of children feeding practices.

### Carrying out the survey

This study was a descriptive cross-sectional survey of 240 women, using questionnaires prepared using SPHINX Plus (V5) software. Sampling consisted of eight villages of Kassiapleu, Petit Gbepleu, Gbangbegouine-Yati, Kouitongouine 1, Kouitongouine 2, Gbouakpale, Zele and Guianle, all on the outskirts of the University of Man, Man, Ivory Coast. Data collection was carried out for a time period of approximately 1 m, 1–28 February, 2023, collecting information on sociodemographic characteristics, as well as mothers' nutritional practices and knowledge regarding the nutrition of their children.

### Assessment of the biochemical compounds

Various analyses were carried out, including dry matter, ash, total lipids [10], total carbohydrates [11], proteins [12] and energy [13].

### Statistical analysis

Two types of statistical analysis were used for data processing, including ANOVA variance analysis and Duncan's test for averaging. These analyses were carried out using SPSS software at 5% significance levels ($P \leq 0.05$).

## Results

### Sociodemographic characteristics of the women

Sociodemographic characteristics of the women are shown in Table 1. Most respondents were aged 15–74.5 years-old and married and 61.7% did not attend schools. Overall, 66.7% of the women were housewives and 70% belonged to Yacouba ethnicity.

**Table 1.** Sociodemographic characteristics of mothers in rural areas of Man, Ivory Coast

| Characteristics | Full sample (n=250) | % |
|---|---|---|
| **Marital status** | | |
| *Single* | 49 | 20.5 |
| *Married* | 178 | 74.5 |
| *Widowed* | 12 | 5.02 |
| *Total* | | 100 |
| **Age (year)** | | |
| *[15-30]* | 109 | 45.4 |
| *] 30- 45]* | 111 | 46.3 |
| *> 45* | 20 | 8.3 |
| *Total* | | 100 |
| **Level of study** | | |
| *No instruction* | 148 | 61.66 |
| *Primary* | 70 | 29.17 |
| *Secondary* | 22 | 9.17 |
| *Total* | | 100 |
| **Ethnic group** | | |
| *Yacouba* | 163 | 70 |
| *Ivoirian non Yacouba* | 54 | 23.2 |
| *ECOWAS* | 16 | 6.9 |
| *Total* | | 100 |
| **Profession** | | |
| *Housekeeper* | 160 | 66.66 |
| *Shopkeeper* | 57 | 23.75 |
| *Artisan* | 20 | 8.33 |
| *Civil servant* | 03 | 1.25 |
| *Total* | | 100 |

### Characteristics of dietary supplements

Results of the survey showed that a majority of women (75.4 %) started supplementation at 6 m of age. However, more than 21% started supplementation before 6 m of age (Figure 1A). Moreover, 84.6% of these women thought that their infant was ready to receive foods other than breast milk (Figure 1B). In most cases (49.2%) they did not receive advices from a qualified person, although some (37.5%) received information from health professionals (Table 2). After the first supplementation, a majority of women (61.2%) reported that they no longer changed their infants' diets, while 38.8% of them provided other types of foods (Figure 1C). A majority of women (63.9%) changed their babies' diets from age of 12 m, compared with women (31.1%) who changed their babies' diets from age of 6–12 m, as shown in Figure 1D.



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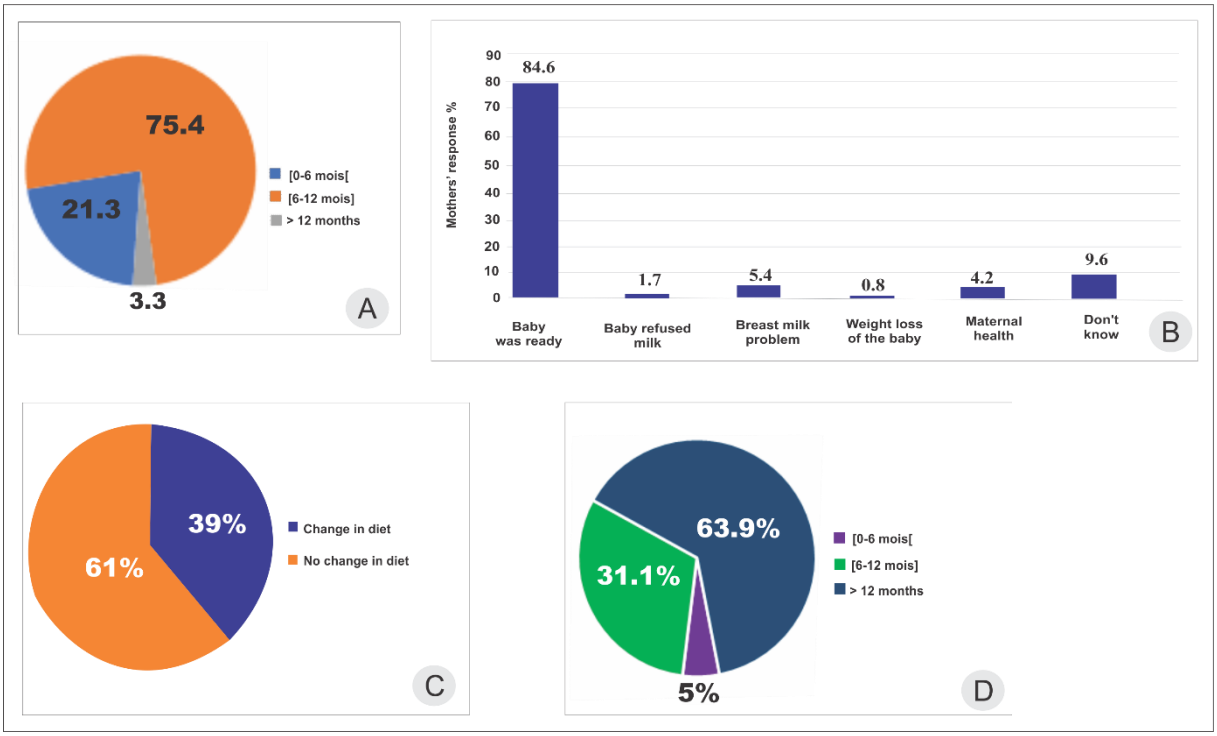


**Figure 1.** Characteristics of dietary supplements in rural areas of Man, Ivory Coast. A, Age of the introduction of local foods into diets; B, reasons for the supplementation of mothers; C, changes in the children's diets; and D, children's age for changes in their diets

**Table 2.** Distribution of women based on their sources of information on food supplements in rural areas of Man, Ivory Coast

| Source of information | Full sample (n = 240) | % |
|---|---|---|
| None | 118 | 49.2 |
| Mother | 19 | 7.9 |
| Mother-in-law | 09 | 3.8 |
| Husband | 03 | 1.3 |
| Health worker(s) | 90 | 37.5 |
| Total | | 100 |

### Identification of food supplements

Table 3 shows food supplements used in the diets of children aged 0–36 m. Nearly ten traditional foods in the children's diets were identified. In general, regardless of the age group, the major foods were cereal porridge (88.5%), kokonde (45.4%), placali (36.3%) and Cerelac (34.2%).

### Weaning practices for the infants

The survey detected that 75.4% of mothers weaned their children at the ages of 12–24 m. Mothers who were asked about the weaning provided two major reasons, including 'it was the ideal time' (69.6%) and 'the baby refused the milk' (21.2%) (Table 4). The most common food used during weaning was rice (97.9%), followed by cassava-based dishes such as placali (71.7%), kokonde (44.2%) and cassava foutou (36.7%) (Table 5).

### Method of the preparation of traditional dishes

#### Maize porridge (kpehibi bapou)

Flour used to prepare kpehibi bapou was prepared by grinding and sifting maize grains. This flour was toasted over a low heat and cooked in water to the desired consistency.

#### Rice porridge (mlinbi bapou)

Flour used to prepare mlinbi bapou was prepared after the rice grains were husked and sifted. This rice flour was mixed with boiling water and cooked in water.

#### Placali

First, cassava tubers were peeled and washed. Then, a ferment from fresh cassava stored in jute bags for 2–3 d was added to the tubers and mixed. This mixture was ground well. The resulting paste was set to ferment for 12 h, then drained and wrung out. Drained paste was then diluted with water and the mixture filtered in a metal pot. After 5 min, the filtrate in the pot was heated on the stove and the mixture was stirred with a spatula until a light mush was achieved, which reached a homogeneous consistency after 10 min. After additional 10 min, the cooked filtrate formed as a gelatinous mass and placali was served, packaged and preserved.



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**Table 3.** Food supplements in diets of children in rural areas of Man, Ivory Coast, based on the age of the children

| Local dishes | Full sample (n=240) | % |
|---|---|---|
| **[0-6 month [** | | |
| *Maize porridge (Kpêhibi bâpou)* | 37 | 15.4 |
| *Rice porridge (Mlinbi bâpou)* | 12 | 5 |
| *Cérélac (infant cereal)* | 15 | 6.3 |
| *Tôh* | 12 | 5 |
| *Placali* | 3 | 1.3 |
| *Foutou cassava* | 3 | 1.3 |
| *Vermicelli* | 8 | 3.3 |
| *Rice* | 17 | 8.3 |
| **[6-12 month [** | | |
| *Maize porridge (Kpêhibi bâpou)* | 120 | 50 |
| *Rice porridge (Mlinbi bâpou)* | 38 | 15.8 |
| *Millet porridge* | 8 | 3.3 |
| *Cérélac (infant cereal)* | 67 | 27.9 |
| *Mashed potatoes (potato and potato)* | 20 | 7.5 |
| *Kokondé* | 29 | 20 |
| *Placali* | 31 | 12.9 |
| *Foutou* | 13 | 5.4 |
| *Vermicelli* | 48 | 20 |
| *Boiled yam* | 3 | 1.3 |
| *Attieke* | 5 | 2.1 |
| *Rice* | 44 | 37.1 |
| **12 month and more** | | |
| *Maize porridge (Kpêhibi bâpou)* | 3 | 1.3 |
| *Kokondé* | 49 | 20.4 |
| *Placali* | 53 | 22.1 |
| *Foutou* | 14 | 5.8 |
| *Vermicelli* | 6 | 2.5 |
| *Attieke* | 3 | 1.3 |
| *Rice* | 124 | 51.7 |

**Table 4.** Distribution of mothers based on the reasons for weaning their children in rural areas of Man, Ivory Coast

| Reason for weaning | Full sample (n=240) | % |
|---|---|---|
| Baby refuses mother's milk | 51 | 21.2 |
| Mother's unavailability | 12 | 5 |
| Advice from the husband | 10 | 4.2 |
| The perfect time | 160 | 66.6 |
| Don't know | 7 | 2.9 |
| *Total* | | 100 |

**Table 5.** Distribution of foods for weaning children in rural areas of Man, Ivory Coast

| Dishes | Full sample (n=240) | % |
|---|---|---|
| Kokondé | 106 | 44.2 |
| Placali | 172 | 71.7 |
| Foutou cassava. | 88 | 36.7 |
| Foutou banana | 21 | 8.8 |
| Foutou yam | 8 | 3.3 |
| Vermicelli | 25 | 10.4 |
| Attieke | 19 | 7.9 |
| Rice | 235 | 97.9 |

**To (kokonde)**

To of cassava, known locally as kokonde, is a dish prepared from cassava flour. Cassava pods were washed, dried and ground to achieve the flour. Nearly 4/5 of the water were heated to boiling. While boiling, 2/5 of the boiling water were removed from the pot and stored using container. The sieved cassava flour was gradually added to the boiling water, stirring with a spatula until a light porridge with an even consistency was achieved. After 10 min of cooking, 1/5 of the water was added to the light porridge and the mixture was vigorously stirred for nearly 15 min until thickening.

**Physicochemical and nutritional characterisation of the local dishes**

**Cereal porridges**

Physicochemical compositions of the maize (kpehibi bapou) and rice (mlinbi bapou) slurries are shown in Table 6. The ash content was low, 1 ±0.3 $g.kg^{-1}$ for kpehibi bapou and 2 ±2 $g.kg^{-1}$ for mlinbi bapou. Although dry matter content and pH of the two slurries were nearly similar, those of kpehibi bapou were relatively higher.

**Placali and kokonde**

Physicochemical compositions of placali and kokonde are shown in Table 6. The ash content was low, 79 ±2.4 $g.kg^{-1}$ for placali and 88.4 ±0.2 $g.kg^{-1}$ for kokonde. Although placali included the lowest ash content, it included the highest dry matter content (204.2 ±2.9 $g.kg^{-1}$).

**Sludge nutritional parameters**

**Cereal porridges**

Macronutrient contents and energy values of the porridges are listed in Table 6. Data showed that kpehibi bapou and mlinbi bapou included high carbohydrate contents of 854 ±5.6 and 814 ±5.4 $g.kg^{-1}$, respectively. The protein content of mlinbi bapou (128 ±5 $g.kg^{-1}$) was almost double that of kpehibi bapou (88 ±3.8 $g.kg^{-1}$). For lipids, kpehibi bapou included the relatively highest content (62 ±2.6 $g.kg^{-1}$), compared to mlinbi bapou (54 ±4 $g.kg^{-1}$). These macroelements provide these two dishes with high and almost identical energy values.



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**Table 6.** Physicochemical and nutritional compositions of foods used in the diets of children in rural areas of Man, Ivory Coast

| **Local dishes** | Maize porridge | Rice porridge | Placali | *Kokondé* |
|---|---|---|---|---|
| pH | 5.5 ± 0.2 [a] | 6.7 ± 0.3 [a] | 4.4 ± 0.1 [a] | 5.3 ± 0.1 [a] |
| Dry matter ($g.kg^{-1}$) | 171.1 ± 6.2 [a] | 145.5 ± 5.1 [a] | 204.2 ± 2.9 [a] | 191.8 ± 1.4 [a] |
| Ash ($g.kg^{-1}$) | 1 ± 0.3 [a] | 2 ± 2 [a] | 79 ± 2.4 [b] | 88.4 ± 0.2 [b] |
| Carbohydrates ($g.kg^{-1}$) | 854 ± 5.6 [a] | 814 ± 5.4 [a] | 616 ± 7.2 [b] | 603 ± 2.5 [b] |
| Protein ($g.kg^{-1}$) | 88 ± 3.8 [a] | 128 ± 5 [a] | 257 ± 5.7 [b] | 276 ± 2.3 [b] |
| fat ($g.kg^{-1}$) | 62 ± 2.6 [a] | 54 ± 4 [a] | 48 ± 3.3 [a] | 40 ± 0.9 [a] |
| Energy value ($Kcal.kg^{-1}$) | 4302 ± 3.4 [a] | 4284 ± 3.5 [a] | 3930 ± 10 [b] | 3858 ± 6.6 [b] |

*Means followed by the same letter in the same row are not significantly different at P = 0.05.*

**Placali and kokonde**

Macronutrient contents and energy values of the dishes are shown in Table 6. Data showed that these two dishes were rich in carbohydrates (616 ±7.2 and 603 ±2.5 $g.kg^{-1}$, respectively). For proteins, kokonde (276 ±2.3 $g.kg^{-1}$) was richer than placali (257 ±5.7 $g.kg^{-1}$). For lipids, placali included the highest relative content (48 ±3.3 $g.kg^{-1}$), compared to kokonde (40 ±0.9 $g.kg^{-1}$). These macroelements provided these two dishes with high-energy values. Placali included more energy (3930 ±10 $kcal.kg^{-1}$) than that kokonde did (3858 ±6.6 $kcal.kg^{-1}$).

## Discussion

Survey of infant feeding practices in rural Man revealed findings that highlighted the importance of promoting local dishes to improve the management of infant malnutrition in this region. From a sociodemographic point of view, survey showed that 74.5% of women were married and 66.7% were housewives with a high illiteracy rate (61.7%). These results were similar to those of Diallo, 2020 [14], who detected that 97% of the women were married and 61% did not attended school in her study on mothers' knowledge, attitudes and practices regarding the feeding of children aged 0–23 m and their nutritional status. A similar study by Diawara (2015) [15] detected that 96.2% of mothers were married, 92.9% were housewives and 65.3% did not attend schools. The high rate of women not attending school could be the result of several factors that reflect the rural reality; where, women generally have a few opportunities, under the effects of certain cultural practices.

Regarding the rate of supplementation of infant foods, age of starting foods was estimated at a rate of 75.4% at 6–12 m old. In the highlighted reasons, 84.6% of mothers thought that the baby was ready. These findings were similar to those of Gueye, 2012 [16], who detected that the age range was 6 m and above in 55.8% of cases. In addition, Mavuta et al. (2018) [17] detected that 92.42% of women started feeding of complementary foods for their children from the age of 6 m. The current values were similar to WHO standards [1], which recommend that complementary foods should only be added into young children's diets from the age of 6 m. In addition, the women did not receive any professional supports (49.5%) in managing infant feeding. This finding was in contrast to that of Traore et al. (2009) [18], who detected that 61.8% of mothers received advices from a health worker. This might reflect adherence to customary practices, which often contradict WHO recommendations and lack of information on appropriate feeding practices in early childhood. This information could be provided by a health worker, whose role is to explain how to introduce the first foods other than breast milk and to teach certain behaviours for the best development of the children.

Regardless of age group, the most commonly eaten dishes were cereal porridge (88.5%), kokonde (45.4%), placali (36.3%) and Cerelac (34.2 %). The current results could be explained by the fact that cereals are generally grown as staple crops in almost all regions of Ivory Coast. This is similar with the recommendations of the WHO (2003) [1], which advocates the introduction of semi-solid foods from 6 m of age for good feeding practices. In fact, the early introduction of foods (before 6 m) encourages competition with breast milk [19]; when, the babies' physiology does not allow them taking full advantages of these foods.

Regarding the age of weaning, a majority of mothers (75.4%) thought that the ideal age time for weaning was 12–24 m. In fact, all children should exclusively be breastfed from birth, at least for the first two years of life. For this reason, WHO (2003) [1] has recommended that children should exclusively be breastfed until 6 m of age until 2 y of age. Breastfeeding beyond 6 m is extremely important because it provides the children with micronutrients, vitamins and polyunsaturated fatty acids



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(PUFA), which are detected at lower concentrations in cereal-based infant formulae [20]. In addition, 38.8% of mothers changed the foods they fed their children from the age of 12 m by introducing solid foods (family dishes) such as rice, placali, foutou manioc and toh. These results differed from those of Diadie in rural areas of Niger (2013) [21] on infant feeding practices, where introduction of family dishes was observed majorly in certain ethnic groups **(**Haoussa) before 6 m (53.2%) and 7 m (35.26%), respectively.

The low dry matter content (171.1 ±6.2 and 145.5 ±5.1 $g.kg^{-1}$) of the porridges did not meet the WHO recommended standard of 300 $g.kg^{-1}$ dry matter in infant porridges. However, the present values were higher than those (78 and 104 $g.kg^{-1}$) achieved by Hassane in 2006 [22] for fermented millet porridges in Burkina Faso. Indeed, the lesser the dry matter content, the more fluid in the porridge and hence the less energy of the food. Therefore, such porridges could lead to protein-energy deficiencies, potentially resulting in weight loss [23]. Regarding the nutritional value of these porridges, the carbohydrate content of 854 ±5.6 and 814 ±5.4 $g.kg^{-1}$, respectively for corn porridge (kpehibi bapou) and rice porridge (mlinbi bapou), exceeded the WHO/FAO recommendation of 68% for infants aged 6–12 m in porridges. The present results were similar to those of Carole et al. (2022) [24], who detected a carbohydrate content of 801.4 $g.kg^{-1}$ for millet porridge, 850.8 $g.kg^{-1}$ for kokobaka porridge and 795 $g.kg^{-1}$ for anagobaka porridge. This could be justified by the fact that rice and corn are starch-rich foods and by the large daily production quantities of porridges. This high carbohydrate content could lead to obesity, digestive disorders, pain and constipation in the children.

The protein (88 ±3.8 and 128 ±5 $g.kg^{-1}$) and lipid (62 ±2.6 and 54 ±4 $g.kg^{-1}$) contents of these porridges were lower than the WHO recommendations of 150 $g.kg^{-1}$ protein and 8% lipids in infant nutrition. The current results were differnt from those of Kouassi (2015) [23], who detected protein contents ranging 135–158 $g.kg^{-1}$ in porridges prepared from a mixture of sprouted corns and sorghums. Protein deficiency in the porridges could inhibit the children's growth. Additionally, lipids play an important role in satiety and weight gain. Foods low in lipids and energy promote weight loss.

The carbohydrate contents ranged 603 ±2.5 $g.kg^{-1}$ for kokonde to 616 ±7.2 $g.kg^{-1}$ for placali. These results were similar to those of Tchoko et al. (2011) [25], who achieved carbohydrate contents ranging 610–630 $g.kg^{-1}$ in cassava-based weaning flours. Since placali and kokonde are complementary foods, their carbohydrate contents meet the standard. Carbohydrates play an essentially energetic role and provide the body with the necessary energy. As for lipids, these various foods include relatively low contents ranging 48 ±3.3 $g.kg^{-1}$ (placali) to 40 ±0.9 $g.kg^{-1}$ (kokonde). These results were higher than those of Yeboue (2017) and Zoumenou (1994) [26, 27], who reported lipid contents of 0.91 and 0.4% for placali and kokonde, respectively. This lipid deficiency could lead to weight loss in children [28].

The protein contents varied 257 ±5.7 $g.kg^{-1}$ (placali) and 276 ±2.3 $g.kg^{-1}$ (kokonde). These results differed from those by Yeboue in 2017 [26], who detected protein contents of 10.9 $g.kg^{-1}$ (placali) and 15.3 $g.kg^{-1}$ (attieke). According to Diallo et al. (2013) [29], cassava is a protein-poor food. Therefore, these protein contents might be resulted from the use of frogs, protein-rich foods, based on the studies of Barros et al. (2008) [30]. These foods, frequently consumed by the populations of Man, are introduced into various accompanying sauces. These animal and plant resources could be used to address protein-energy nutritional deficiencies in children.

The energy value of cereal porridges (4302 ±3.4 $kcal.d^{-1}$) was higher than that of kokonde and placali, which were 3858 ±6.6 and 3930 ±10 $kcal.d^{-1}$, respectively. These results were similar to those of Tchoko et al. in 2011 [25], who reported values ranging 3900–3940 $kcal.kg^{-1}$ of cassava-based weaning flours. However, the present results were lower than those of WHO that recommends a total energy intake of 5500 and 12000 $kcal.kg^{-1}$ for children aged 6–36 m.

**Conclusion**

This study provides important data on dietary diversification in children aged 6–36 m in rural areas of Man, Ivory Coast, to enhance values of the local foods. Supplementation practices were inappropriate in nearly half of the children because food introduction occurred before the recommended age of 6 m. The age; at which, foods were introduced increased 6–12 m and the most commonly consumed foods included cereal-based porridges. Strategies aimed at improving maternal dietary behaviours are therefore needed to improve children's nutrition in rural areas of Man, Ivory Coast.

**Conflict of interest**

The authors declare no conflict of interest.

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