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Participatory cooking demonstrations for mothers improve feeding practices of young children in southern Benin

Carmelle Mizehoun-Adissoda [1], **Karimou Morou** [1], **Hortis Edjrokinto** [1], **Géraud S.R. Padonou** [2], **Joel R. Mahounou** [1], **Aubierge Flénon** [3], **Michael A. Wiafe** [4], **Elom K. Aglago** [5,6]

1 School of Nutrition and Dietetics, Faculty of Health Sciences, University of Abomey-Calavi (UAC), Cotonou, Benin. E-mail: carmelle.mizehoun@gmail.com / karimorou@hotmail.com / seiveedjrokinto@gmail.com / rivaldochristiphile@gmail.com
2 Department of Public Health. Faculty of Health Sciences. University of Abomey-Calavi (UAC), Cotonou, Benin. E-mail: geraudpad@yahoo.fr
3 Care International Benin. Togo, Cotonou, Benin. E-mail: aaubierge.flenon@care.org
4 Department of Nutritional Sciences, School of Allied Health Sciences, University for Development Studies, Tamale, Ghana. E-mail: mwiafeakenten@yahoo.ca
5 Laboratory of Food and Nutrition Biochemistry, Faculty of Sciences and Technologies, University of Kara, Kara, Togo. E-mail: aglagoelom@gmail.com
6 Department of Epidemiology and Biostatistics, Imperial College London, London, UK.

ABSTRACT

Background: Ensuring adequate nutrition for young children is crucial for their long-term health and development. **Aim:** This pilot interventional study aimed to assess feeding practices and the nutrient content of meals consumed by children aged 12 – 23 months during supervised cooking demonstrations (CDs). **Methods:** Thirty-seven mother-child dyads (including one set of twins) were recruited from 10 sites in Southern Benin. Mothers purchased ingredients from local markets and researchers documented cooking methods, recipes, and the weight of all consumed foods. Nutrient densities of prepared meal were estimated using the FAO/INFOODS database. A questionnaire was used to evaluate child feeding practices against World Health Organization (WHO) recommendations. **Results:** The average nutrient density per 100 kcal of the prepared meals was 2.17 ± 0.51 g for protein, 2.85 ± 0.92 mg for vitamin C, 0.79 ± 0.24 mg for iron, and 0.51 ± 0.09 mg for zinc. While protein and vitamin C content met recommendations, iron and zinc levels fell short. Notably, 53% of mothers adhered to the best practices for child feeding outlined by the WHO. However, there was potential for further meal diversification, especially for children who were not breastfed, or consuming fewer than four meals daily. **Conclusions:** This study suggests that while the CD-prepared meals provided adequate energy, they lacked essential micronutrients. These findings highlight the need for educational interventions targeted towards parents of young children to promote optimal feeding practices.

Keywords: Feeding practice, infant, cooking demonstration, complementary food, nutrient.

ARTICLE INFORMATION

Corresponding author: Carmelle Mizehoun-Adissoda. E-mail: carmelle.mizehoun@gmail.com / carmelle.mizehoun@uac.bj

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1 Introduction

Childhood malnutrition in all its forms remains a major public health concern worldwide. An estimated 165 million children under the age of five years are stunted, 49.5 million are emaciated and 40.1 million suffer from overweight [1]. According to the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), undernutrition is estimated to be the underlying cause of death for at least 45% of children under five years old [1]. This undernutrition translates to a heightened susceptibility to infections, impaired physical growth and development, reduces physical capabilities, and compromised cognitive development and intellectual capacity [2-4]. In Benin, the prevalence of stunting, acute malnutrition and underweight among children under five is concerning, with rates of 32%, 5% and 17% respectively [5]; malnutrition is estimated to account for 45% of all childhood deaths within this age group annually [5].

Undernutrition during early childhood can lead to permanent physical and cognitive impairments with these detriments becoming irreversible by the age of two [6]. A crucial window of opportunity exists, encompassing the period from preconception to two years of age. During this time, optimal nutrition is critical for both pregnant women and their children. Best practices for infant and young child feeding (IYCF) [7] are particularly important within this window. These best practices encompass: a. initiation of breastfeeding within one hour of birth; b. exclusive breastfeeding for the first six months of life; c. continued of breastfeeding for up to two years or beyond, alongside the introduction of adequate, safe, and age-appropriate complementary foods between 6 and 23 months [8,9].

In Benin, the most recent Demographic and Health Survey (2017 – 2018) by the Ministry of Plan and Development revealed that the quality of the diet provided to children is usually unsatisfactory [5]. The survey highlighted that, children aged 0 – 23 months were sub-optimally breastfed i.e., 46% of newborn babies were not breastfed within one hour after delivery and 58.5% of infants under six months age were not exclusively breastfed. Moreover, 85% of children aged 6-23 months were not fed according to IYCF best practices. These inadequate feeding practices are hypothesized to contribute significantly to the observed high prevalence of stunting (33.6%) among children aged 12 – 23 months [5]. Beyond breastfeeding practices, the diversification of children's diets upon weaning often falls short of recommended guidelines. Diets tend to be monotonous, with a heavy reliance on cereals and tubers [10]. Conversely, these diets often lack sufficient protein sources, vegetables, and fruits, particularly in rural communities. Paradoxically, several communities possess the capacity for local production of these food groups [10].

Several factors are identified as determinants of breastfeeding continuation and complementary feeding practices in Benin and other Sub-Saharan African contexts. These factors include maternal education level, employment status, access to mass media, level of empowerment and independence, place of residence, and access to healthcare facilities. [11-14]. Moreover, mothers' knowledge, attitudes, and practices, significantly influence infant feeding practices in Benin Examples include negative perceptions of colostrum, often fostered by influential figures within the mother's social circle (grandmothers, mothers-in-law, etc.), and the practice of force-feeding children [15]. To reduce malnutrition among children under five, various community interventions have been implemented. These interventions include: a. monitoring and promoting child growth; b. early detection of acute malnutrition; c. nutritional supplementation; d. improved healthcare system, and e. nutrition education. Previous research conducted across multiple countries suggests that educational interventions delivered to mothers can increase their knowledge of feeding practices, potentially leading to improved nutritional status in their children [16,17]. These interventions encompass a wide range of approaches, including: positive deviance approaches; family nutrition education; breastfeeding support initiatives; food and nutrition recommendations; social marketing; social change communication; and behavior change strategies. These interventions may utilize informative theoretical frameworks, experimental practices or a combination of approaches [18]. Cooking demonstrations (CDs) based on experimentation approaches represent a less-studied educational interventions. This is likely because they are frequently embedded within more comprehensive interventions [19-23]. These comprehensive interventions may include the use of photo materials, videos, regular home visits, or the introduction of new recipes for mothers to learn and appreciate.

This study hypothesized that maternal participation in community-based cooking demonstrations (CDs) would enhance their knowledge of dietary diversity. We further hypothesized that this improvement in knowledge could be assessed in real-time situations by analyzing the types of food mothers prepare and their children subsequently consume. To address these hypotheses, the study employed a two-part evaluation: (i) An initial assessment of the mothers' routine feeding practices; (ii) A subsequent evaluation of the nutritional content of foods prepared during lightly supervised CDs specifically designed for children aged 12 – 23 months.

2 Materials and Methods

2.1 Study framework

This pilot interventional study was conducted between August and September 2020 in Adjohoun, a municipality within the Ouémé Department of Southern Benin. Adjohoun is one of the eight administrative districts in the region, encompassing an area of approximately 308 square kilometers (km²). According to 2013 population estimates, Adjohoun has over 75,000 inhabitants, including an estimated 15,000 children under the age of five.

The study was implemented within the framework of the Collective Impact for Nutrition (CI4N) project (2018-2020). This community-based initiative, spearheaded by CARE International Benin/Togo [10], aimed to contribute to the reduction of childhood stunting through educational interventions targeted towards mothers. The project's theoretical foundation was Bandura's social cognitive theory [24] (Figure 1).

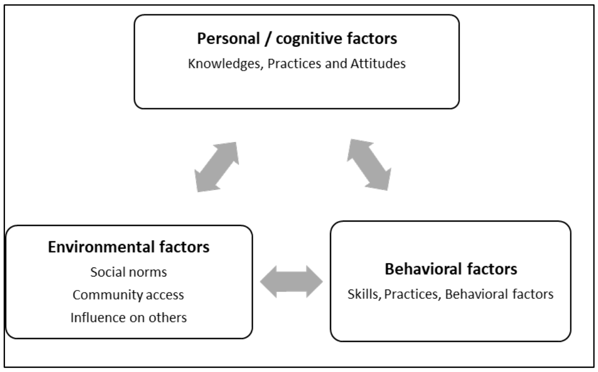

Figure 1. Social cognitive theory by Bandura

2.2 Study population and sampling

The study sample comprised mother-child dyads recruited through a convenience sampling approach. Inclusion criteria for mothers were: having a child aged 12 – 23 months, not being pregnant at the time of recruitment, and providing informed consent to participate in the study. Details regarding the recruitment procedure, steps involved, and data collected are further outlined in Figure 2.

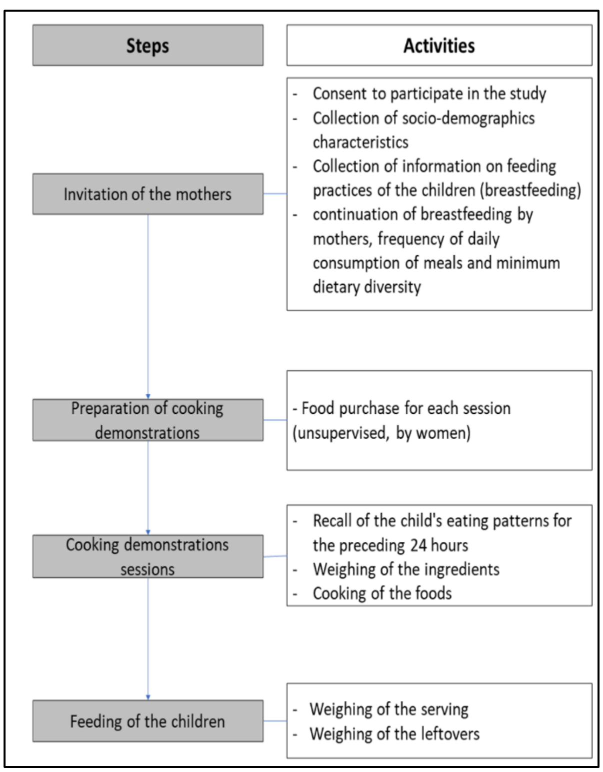

Figure 2. Steps and intervention' protocol

2.3 Data collection

Data were collected from mothers using a standardized questionnaire designed to assess sociodemographic characteristics and their child feeding practices. The questionnaire captured information on the mother's age, educational attainment, marital status, monthly income, and participation in a savings and credit group. Information regarding the child included age, sex, breastfeeding status, and complementary feeding practices were also collected. Additionally, a 24 – hour dietary recall was conducted to estimate the children's meal frequencies and the main food groups consumed on the day preceding the supervised cooking demonstration (CD) session.

2.4 Sessions of cooking demonstration

Prior to each CD session, mothers procured the necessary ingredients for meal preparation either from local markets or their homes. Each CD session accommodated three to four participants and was conducted at the residence of the village chief. On rare occasions, a participant's home centrally located to most participants might be used. The facilitator for each CD session commenced by eliciting the participants' knowledge, attitudes, and practices regarding a local recipe. Following this, the facilitator explained methods for improving the recipe's nutritional value. The actual cooking process then commenced under the facilitator's supervision.

A calibrated kitchen scale with a 5 kg load capacity and ±1 g accuracy was employed to weigh both the individual ingredients used in each meal and the final prepared meal quantity. Additionally, a SECA-type electronic scale with a 150 kg capacity and ±100 g accuracy was utilized for this purpose. To determine the actual amount consumed by each child, the served meal and any remaining leftovers were weighed. The consumed portion was then calculated by subtracting the leftover amount from the served amount. CDs were conducted during lunch hours, and mothers were instructed to feed their children in their customary feeding environment.

2.5 Assessment of maternal feeding practices

Maternal feeding practices were assessed using a three-components based system based on WHO/UNICEF recommendations [25,26]. These components included:

- **Continuation of Breastfeeding:** Mothers received one point if they were still breastfeeding their children.
- **Meal Frequency:** One point was awarded if the reported daily meal consumption met the recommended frequency. This meant at least three meals per day for

breastfed children and at least four meals per day for non-breastfed children.

- **Minimum Dietary Diversity:** Children received one point if their 24-hour dietary recall indicated consumption of foods from at least five out of the following eight food groups on the day preceding the survey:
    - Breast milk
    - Cereals, roots, tubers, and plantains
    - Legumes, nuts, and seeds
    - Dairy products
    - Meat, poultry, offal, and fish
    - Eggs
    - Fruits and vegetables rich in vitamin A
    - Other fruits and vegetables [27].

The overall score for each mother's feeding practices was obtained by summing the individual component scores. A score of three was considered indicative of optimal feeding practices.

2.6 Estimation of meal nutrient content

The FAO-recommended mixed method was employed to estimate the energy and energy values per 100g of edible portion for each meal prepared during the CDs [28]. This involved applying yield and retention factors to the energy and nutrient values of the raw ingredients from the West African Food Composition Table version 2019 [28]. The yield factor is the percentage change in the weight of food and/or recipe due to cooking. It was calculated from the weight of the ingredients before cooking and the weight of the recipe after cooking. The retention factor is the percentage retention of nutrients, specifically vitamins and minerals, in foods and/or recipes after cooking. The retention factors used in our study were those proposed by Bognár [29]. These retention factors adjust the composition of nutrients in the food according to the cooking methods.

2.7 Energy densities and nutrient intakes

The energy and nutritional values of the meals were calculated using the Nutrisurvey 2007 software (EBISpro, Germany; RRID:SCR_022655). Nutrient contents (protein, vitamin C, iron, and zinc) per 100 kcal of each meal (nutrient densities) were also estimated. The nutritional adequacy of the prepared meals was then assessed in regard to the WHO recommendations on the nutrient densities of complementary foods [30].

2.8 Statistical analysis

Data was acquired on Tablet using KoboCollect version 2020 (Kobo Inc, Cambridge MA, US) an Android-built tool used for primary data collection in humanitarian emergencies software and was entered into Microsoft Excel (Microsoft Office, Redmond, WA, US). The analysis was performed using R version 4.1.2 (R Project for Statistical Computing, RRID: SCR_001905). Descriptive statistics such as frequencies, means and standard deviations were reported. The association between the energy density of complementary food according to meal frequency was investigated using the Mann-Whitney non-parametric test. Two-tailed p-values of < 0.05 were considered statistically significant.

2.9 Ethical consideration

Administrative and ethical authorizations for data collection were obtained from the local authorities of Adjohoun, research protocol evaluation committee of faculty of health sciences and the leaders of the NGO Care Benin-Togo. Informed verbal consent of mother was obtained prior to the investigation. All data were collected anonymously and processed confidentially.

3 Results

3.1 Characteristics of the mothers and the children

A sample of 37 mothers and 38 children aged 12 – 23 months, was recruited from 10 cooking demonstration (CD) sites (numbered 1-10) in the study area. One mother reported having twins. The majority of mothers (81.1%) identified as belonging to the Wémè ethnic group. Marital status data revealed that 97.3% of the mothers were married. With regard to occupational background, the primary occupation reported by mothers was petty trade (56.7%). In terms of educational attainment, 54.1% of the mothers reported having no formal education. Income data indicated that all mothers (100%) earned below the minimum wage in Benin, with earnings falling below 40,000 XOF (approximately 65 USD). (Table 1).

Breastfeeding prevalence exhibited an inverse association with age. A total of 68.4% of children were breastfed on the day preceding the cooking demonstration (CD) sessions. This rate was significantly higher (89.5%) among children aged 12 – 17 months compared to those aged 18 – 23 months (47.5%) (Table 1). Dietary patterns revealed that most children (86.8%) consumed four meals per day, and a substantial proportion (84.2%) demonstrated acceptable food diversity. However, nearly half (47.4%) of the children were classified as not optimally fed. This classification was based on the combined factors of discontinued breastfeeding, a lower number of meals consumed, and a lack of dietary diversification (as detailed in Table 1).

A more granular examination of the primary food groups consumed by children the day before the CD sessions (Figure 3) revealed a dietary pattern predominantly comprised of staples (cereals, roots, and tubers) and/or legumes, nuts, and seeds. Notably, animal products, fruits, and vegetables were not consistently incorporated into the children's diets. Additionally, none of the children reported consuming dairy products or eggs.

Table 1. Selected characteristics of the mothers and the children

		N	%
Mothers (n=37)			
Age range, years			
-	19- 24	8	21.6
-	25-34	27	73
-	35-40	2	5.4
Marital status			
-	Married	36	97.3
-	Single	1	2.7
Highest attained education			
-	No formal education	20	54.1
-	Primary school	8	21.6
-	Secondary school	9	24.3
Ethnic group			
-	Wémè	30	81.1
-	Yoruba	2	5.4
-	Other	5	13.5
Occupation			
-	Petty trader	21	56.7
-	Farmer	7	18.9
-	Artisan	7	18.9
-	Civil servant	2	5.5
Monthly income*			
-	Below minimum wage	37	100
-	Above minimum wage	0	0
Membership of a saving or credit association			
-	Yes	26	70.3
-	No	11	29.7
Children (n=38)			
Age range, months			
-	12-17	19	50
-	18-23	19	50
Continued to be breastfed†			
-	Yes, all ages	26	68.4
-	Yes, aged 12-17 months	17	89.5
-	Yes, aged 18-23 months	9	47.5
Number of meals, per day			
-	3 meals	5	13.2
-	4 meals	33	86.8
Diversified food‡			
-	Yes	32	84.2
-	No	6	15.8
Optimally fed§			
-	Yes	20	52.6
-	No	18	47.4

*40,000 XOF monthly (≈65 USD)
†Percentage was calculated separately for each age range
‡Assessed with the food consumed the preceding day of recruitment, if the children had consumed on the day before the survey, foods belonging to at least 5 groups out of 8 distinct food groups (breast milk; cereals, roots, tubers, and plantain bananas; legumes, nuts, and seeds; dairy products; meat, poultry, offal and fish; eggs; fruits and vegetables rich in vitamin A; other fruits and vegetables
§A child is optimally fed when they are continued to be breastfed, had at least 3 meals per day, and have a diversified diet.

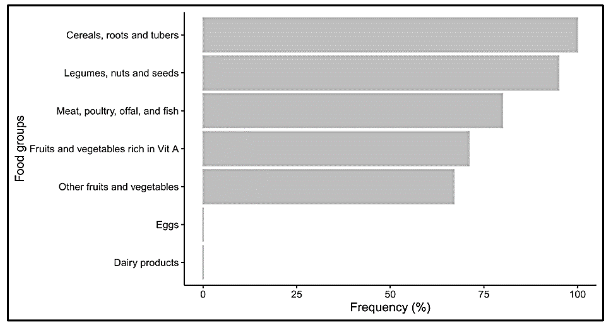

Figure 3. Main food groups consumed by the children the day before the cooking demonstrations (n = 38)

3.2 Meals prepared during cooking demonstrations and nutrient content

Standardized meals were prepared at all 10 CD sites throughout the data collection period. The staple food component of these meals exhibited limited diversity, primarily consisting of a local dish called "Atassi" (rice and beans) (Table 2). However, additional ingredients were incorporated to enhance nutritional content. These included animal-source foods (fish, chicken, rabbit meat, quail eggs) serving as valuable sources of high-biological-value protein, iron, and zinc. Moringa leaves, tomatoes, onions, garlic, chili peppers, bay leaves, shrimp, ginger, and cooking salt further enriched the meals. Notably, Lucky Iron Fish [31], a reusable cooking tool designed for iron supplementation, was also employed during food preparation. Qualitative variations between the 10 dishes were observed primarily in the types of animal protein and plant-based lipids used (Table 2). For instance, palm nut soup was utilized in meals served at sites 1, 2, 3, 5, 7, 9, and 10, while red palm nut oil was employed at sites 4, 6, and 8. Additionally, the quantities of ingredients and the final portion sizes exhibited variability across the CD sites. The nutrient content (protein, vitamin C, iron, and zinc) per 100 kcal of the prepared meals is presented in Table 2. Compared to World Health Organization (WHO) recommendations, the majority of meals achieved adequate protein and vitamin C density, with the exception of meal 8. However, iron and zinc densities fell below recommended levels in most meals, with only meals 7 and 9 exceeding iron requirements and meals 6 and 9 surpassing zinc requirements. When averaged across all meals, protein and vitamin C content reached adequacy, while iron and zinc content remained lower.

Table 2. Nutrient densities of food prepared during the 10-cooking demonstration sessions

Meals	Ingredients *	Nutrient density, per 100 kcal†			
		Protein (g)	Vitamin C (mg)	Iron (mg)	Zinc (mg)
Meal 1	Rice and beans, palm nut soup, chicken meat	2.3	3.3	0.9 #	0.5 #
Meal 2	Rice and beans, palm nut soup, chicken meat	1.7	3.8	0.7 #	0.4 #
Meal 3	Rice and beans, palm nut soup, fish	1.5	2.9	0.9 #	0.5 #
Meal 4	Rice and beans, palm nut soup, quail egg	2.3	3.9	0.5 #	0.5 #
Meal 5	Rice and beans, palm nut soup, chicken meat	2.0	3.2	0.8 #	0.4 #
Meal 6	Rice and beans, red palm oil, snails	3.1	3.5	0.6 #	0.7
Meal 7	Rice and beans, palm nut soup, fish	1.9	1.7	1.1	0.5 #
Meal 8	Rice and beans, red palm oil, chicken meat	1.8	1.4†	0.4 #	0.5 #
Meal 9	Rice and beans, palm nut soup, rabbit meat	2.9	1.7	1.1	0.6
Meal 10	Rice and beans, red palm oil, chicken meat	2.2	3.1	0.9 #	0.5 #
Average mean ± SD		2.17 ± 0.51	2.85 ± 0.92	0.79 ± 0.24 #	0.51 ± 0.09 #

*Rice and beans are a dish locally called "atassi"

Values below WHO recommended average dietary density of complementary foods (per 100 kcal) which are 0.9 g, 1.5 mg, 1 mg, and 0.6 mg for protein, vitamin C, iron, and zinc intakes, respectively.

Table 3. Energy densities (kcal/g) of meals consumed by children based on frequency of consumption

	Breastfed		Non-breastfed	
	3 meals	4 meals	3 meals	4 meals
N children	5	21	1	11
Energy density, mean ±SD	1.9 ± 1.1	2.2 ± 0.9	2.4 ± 0.0	2.5 ± 0.7
WHO recommendation	0.75-0.99	0.56-0.75	1.08	0.81
p-value*		0.4	-	

*Mann-Whitney test

Table 4. Energy and nutrient intakes from meals consumed by the children

Nutrients	Mean± SD	Percentage of RDA*
Energy (kcal)	280.4 ± 222.5	-
Protein (g)	6.4 ± 3.8	59
Lipid (g)	15.6 ± 12.8	-
Carbohydrate (g)	28.7 ± 23.5	-
Vitamin C (mg)	8.2 ± 6.8	27
Iron (mg)	2.2 ± 2.1	38
Zinc (mg)	0.9 ± 0.6	22

IQR, interquartile range; RDA, recommended dietary allowance. *RDA were 10.9 g for protein, 30 mg for vitamin C, 5.8 mg for iron, and 4.1 for zinc

3.3 Energy densities of the meals consumed by children and nutrient coverage

Table 3 displays the average energy densities of meals consumed by breastfed and non-breastfed children. Notably, energy densities exceeded recommended values in both groups, regardless of daily meal frequency. Furthermore, no statistically significant association was observed between energy density and meal frequency (p = 0.4).

Mean intakes of protein, lipids, and carbohydrates consumed by children during the CD sessions are presented in Table 4. Children consumed an average of 6.4 ± 3.8 g of protein, 15.6 ± 12.8 g of lipids, and 28.7 ± 23.5 g of carbohydrates. These macronutrients contributed to total energy intake as follows: 9.1% from protein, 50.1% from lipids, and 40.9% from carbohydrates. Protein intake at CDs reached approximately 60% of the recommended daily allowance for children. However, the contribution of lipids to energy intake was concerning, exceeding the maximum recommended level (17 – 42%) for complementary foods established by the World Health Organization (WHO). Mean intakes of micronutrients, including vitamin C, iron, and zinc, were 8.2 ± 6.8 mg, 2.2 ± 2.1 mg, and 0.9 ± 0.6 mg, respectively. These intakes corresponded to 21.9%, 27.3%, and 37.9% of children's recommended daily intakes for vitamin C, iron, and zinc, respectively.

4 Discussion

This study assessed the feeding practices of mothers with children aged 12 – 23 months and analyzed the energy and nutrient content of meals prepared during cooking demonstration (CD) sessions. We observed that 52.6% of the children adhered to optimal feeding practices. While meals demonstrated adequate protein and Vitamin C content, iron and zinc intake fell short. Protein intake from meals reached approximately 60% of recommended daily allowances, while fat contributed excessively to overall energy intake.

Optimal infant and young child feeding practices included continued breastfeeding, minimum food diversity and acceptable daily meal frequency [32]. Our findings regarding continued breastfeeding in 68.4% of the children align with previous reports from Benin such as Greffeuille et al. [33] who reported a 68.8% breastfeeding rate among children aged 12 – 23 months. Stratifying the data by age group revealed that 89.5% of children aged 12 – 17 months continued breastfeeding, while the rate dropped below 50% for those aged 18 – 23 months. This suggests a concerning trend of early breastfeeding cessation. In such scenarios, the recommended number of daily meals should increase to at least four, accompanied by diversification of post-weaning foods. Our observation that 86.8% of the children received four daily meals is encouraging, suggesting success in previous CI4N project initiatives targeting meal frequency. Nevertheless, combined with continuation of breastfeeding and dietary diversification, only 52.6% of children achieved optimal feeding practices, highlighting the need for additional educational support for mothers. Despite a generally diversified diet among the children, dairy products and eggs were absent, and meats, poultry, offal, and fish were not consistently included. This may be attributed to the high cost of eggs and dairy products in Benin [13], potentially linked to low domestic egg production [34]. For instance, a carton of 30 eggs costs approximately 3000 XOF (5 USD), translating to 7.5% of a mother's monthly salary for a single egg per day for her child. This situation extends beyond Benin, with lower egg production and consumption documented in other West African countries, for instance in Burkina Faso, Ghana, or Togo. Existing initiatives have demonstrated that support to local farmers, not-for-profit microfinance, and behavior change campaigns can improve knowledge regarding the nutritional value of eggs and encourage their inclusion in children's diet [35-39]. Another plausible explanation involves mothers consciously substituting eggs and dairy products with fish, given their higher cost. Research indicates that low or inadequate consumption of specific nutritious foods such as eggs, dairy products, fruits, and vegetables between 6 and 23 months of age is a factor associated with stunting [40].

Across all CD locations, mothers prepared "atassi" a local dish combining rice (low in lysine and isoleucine) and beans (high in lysine and isoleucine) [41]. This dish exemplifies the principle of protein complementarity, where certain proteins compensate for the deficiencies of others in terms of essential amino acids [42]. The majority of meals exhibited adequate protein and vitamin C levels. This protein adequacy reflects the use of beans and animal products (fish, chicken and rabbit meat, quail eggs) – all significant sources of high biological value protein. Vitamin C adequacy is potentially attributable to the inclusion of vitamin C-rich ingredients such as chili peppers [43] and moringa leaves [44] in the recipes. However, most CD-prepared meals demonstrated inadequate iron and zinc levels (8 out of 10 dishes). Foods rich in iron and zinc are primarily derived from meat products, which were used in limited quantities during the CD sessions. This likely explains the observed iron and zinc deficiencies in our study. These results are comparable to those reported in a 2014 South African study investigating dietary diversity and nutritional density of complementary foods in children aged 6 – 24 months [45]. Our results suggest a need for improvement in mothers' ingredient selection, emphasizing complementary foods and potentially incorporating fortified options.

Fats are crucial in infant and young child diets as they provide essential fatty acids, facilitate fat-soluble vitamins absorption, and increase energy density and sensory appeal [46]. Our study revealed a high lipid contribution to energy intake (50.1%), potentially leading to macronutrient imbalances if subsequent meals throughout the day exhibit similar lipid values. Therefore, raising awareness among mothers regarding the moderate use of high-fat ingredients like red palm oil and nut puree during complementary food preparation is crucial. While the average protein intake from meals reached approximately 60% of recommended daily allowances, coverage for micronutrients like vitamin C, iron, and zinc fell short, ranging from only 22% to 38%. Nevertheless, it cannot be concluded that the recommendations were met in the absence of data on children's intake of additional meals on the day of the CD. Mean energy densities were high in both breastfed and non-breastfed children. This is likely attributable to the high consumption of lipid-rich foods such as palm nut oil. Interestingly, the energy density of the meals did not correlate with the daily meal frequency. This finding contradicts the observations reported by Islam et al. [47] in their Bangladeshi study, where an inverse association between energy density and meal frequency was observed in breastfed children aged 8 – 11 months. The disparity in results could be attributed to differences in age groups and limitations in our sample size.

A key strength of this study lies in the direct observation method employed to assess the nutrient content of complementary foods prepared by mothers during the CDs. This approach allowed for a more accurate evaluation of the contribution these meals make to children's daily nutrient intake. However, limitations are acknowledged. The COVID-19 pandemic restricted the number of participating mothers (n = 37) and consequently limited the CDs conducted (approximately 10) and the sample size of children studied (n = 38). Furthermore, the analysis focused solely on a single meal prepared during each CD session, which may not r be entirely representative of the children's usual daily dietary intake, despite the inclusion of a 24-hour dietary recall. In addition, the study did not explore aspects related to mothers' hygiene practices surrounding food preparation for their children or assess the children's overall nutritional status. Finally, data on feeding practices relied primarily on maternal declarations, introducing a potential for bias due to misreporting. Future research endeavors could investigate the factors contributing to the low rates of continued breastfeeding beyond two years of age. Additionally, studies examining the effectiveness of educational interventions designed to promote the inclusion of diversified foods, including dairy products and eggs, in children's diets within the Benin context would be valuable.

5 Conclusion

In conclusion, the present study revealed that meals prepared during supervised cooking demonstrations (CDs) met World Health Organization (WHO) recommendations for protein and vitamin C content. However, iron and zinc were generally insufficient. Additionally, the energy density of the consumed meals exceeded the WHO thresholds. These findings underscore the necessity for enhanced interventions promoting optimal feeding practices in children aged 12 – 23 months. Specifically, such interventions could emphasize the inclusion of nutrient-rich options such as eggs, dairy products, and fortified foods.

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Data share statement: Data described in the manuscript, code book, and analytic code will be made available upon request pending contact of the corresponding author.

Authors' Contribution: C. MA, K. M, H. E, A. F and E.K. A conceptualized the study, collected the data, updated the database, and assembled the analytic data set. G.S.R. P & M.A. W carried out data analyses and all authors interpreted data analysis. C. MA, K. M, K. E and E.K.A drafted the manuscript. All authors reviewed and commented on subsequent drafts of the manuscript.

Ethical statement: This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the ethics committee of the Faculty of Health Sciences of Abomey-Calavi University. Verbal consent was witnessed from all participants and formally recorded.

Conflicts of Interest: The authors declare that they have no conflict of interest.

Preprint deposit: No

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