

## Research Article

# Combining Video recording and connected Weighing Scale Methods to Describe Mealtime Episodes in Mother-Infant Pair During Complementary Feeding in Rural Area of Southern Benin

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### Abstract

This study aimed to develop a combined of two observational methods, as video recorded and connected weighing scale in order to describe a mealtime episode in mother-infant pair during complementary feeding. Thirty (30) pairs of mother-child aged 11-23 months-old were randomly selected and enrolled in one of the village of Southern-Benin. The mixed of two observational methods showed a high positive correlation in data for describe the meal's episode of mother-infant pair. The results revealed the existence of

different mother-infant pair functioning and highly variability in the eating behaviour. The amount of porridge consumed varied of 150 to 400 g, respectively 150 g for pair 1, 250 g for pair 2 and 400 g for pair 3 from connected weighing scale. The spoon content recorded were higher in pair 3. The total duration of food consumption were 10 min, 7 min 5 s and 8 min 2 s respectively for pair 1, 2 and 3. The time of the first refusal to consume from video recording were appeared respectively in first for the pair 1 at 2 min 28 s, in

middle for the pair 2 at 3 min 16 s and totally in end for the pair 3 at 7 min 45 s during a meal consumption. Intra pair variability, the eating style of pair 2 was adequate models for optimal growth status in complementary feeding. The conditions of the use of combined observational methods might be improved in order to perform the description of mother-infant pair functioning during in mealtime episodes.

**Keywords:** Video recording; Connected weighing scale; Description; Mealtime episode; Eating behaviour; Mother-infant pair; Complementary feeding; Benin

## **1. Introduction**

The complementary feeding (CF) corresponds to the period for infants to discover step by step foods other than milk, their properties in terms of flavour, texture etc. but also energy density [1]. Indeed, most of time, malnutrition starts during CF period since many mothers and caregivers lack knowledges and/or financial resources to give adequate foods to young children [1, 2]. This contributes significantly to the high prevalence of malnutrition in children under 5 years worldwide [3]. Many factors at infant, mothers and socio-economic conditions of household contribute to the vulnerability of children during the period of CF [4].

Child eating and caregiver feeding behaviours are critical determinants of food intake, but they are poorly characterized in undernourished children [5]. Child nutritional status is influenced by many factors related to the foods (viscosity, taste-sweetness, flavour, dry matter content, odour, energy and nutrient densities), to children (stomach capacity, appetite and nutritional status) and to mothers or caregivers (knowledges and complementary feeding practices, frequency, during and care of meal) [6]. In order to increase the infant's intakes, researchers have greatly investigated on improving characteristics of complementary foods [2].

Some studies have described the factors related to mothers and caregivers, which influence also the nutritional status of infant [7]. The knowledge and care of mothers during a mealtime episode determine the level' intake by meal for each infant [6].

According to the national Demographic Health Survey (DHS), the proportion of stunted children decreases significantly from illiterate mothers to instructed ones [8]. Several studies in low and middle income countries in Africa was confirmed this positive relationship between mother instruction and child nutritional status [9]. As in most Sub-Saharan African countries, complementary feeding practices are also suboptimal [3]. Infant nutritional status must to be improved. In Benin, similarly to many low income countries, there is a large burden of malnutrition, 32% of children under five are stunted, with 12% severely stunted [10]. In the perspective of the first 1,000 days, it is essential to understand how to support parents in adopting practices that promote optimal feeding and care capacities. Indeed, the links highlighted with child weight status underline the importance of this dimension of child feeding behaviour [5].

Naturally, the infant is dependent on a third person for food: he does not decide alone when, what and, above all, how much to eat. The main feature of mealtime episodes during complementary feeding is the fact that infants remain dependent on a caregiver to be fed [4]. In Africa context, which complementary feeding practices are also suboptimal, it is relevant to show at mothers some knowledge on feeding style of her child as the correctly infant hunger and satiation signals in meal time episode. In this regard, we had to be considered to describe mealtime episodes in mother-infant pair during complementary feeding. The study of the feeding behaviour more generally of the infant requires to take into account several constraints related to his

psychomotor and cognitive development [5]. Eating and feeding behaviours are the essential link between energy needs and energy intake because a child must eat in order to grow and thrive [5]. In addition, infants cannot communicate their internal states, including their state of satiation through speech [11]. In this study, we want to answer this question: how can we ensure that an infant eats until he is full, that is, neither too much nor too little? How do we decide when to stop eating? We could reach this goals by the study of functioning of the mother-infant pair during a meal.

Different methods have been used to describe the sequence of eating and feeding behaviours during mealtime episodes in children. Several studies in different countries found that the use of the analysis of video recordings alone or combined with others methods as a connected weighing scale, could contribute to better feeding practices and/or improved infant nutritional status [4, 12]. Indeed, the meal initiation and end are highly linked to the parent-infant pair functioning [13]. To start the meal when the infant is hungry and to stop the meal when the infant is full, the parent has to interpret correctly this signals that should be clear enough from the infant [14]. The perception of the satiation signals could also be modulated depending on several factors like maternal and infants' characteristics (e.g. sex of the infant, maternal weight status) [15]. Therefore, we aimed to develop such combined of two observational methods, as video recorded and a connected weighing scale in order to describe the mealtime episodes in mother-infant pair during complementary feeding in rural villages of Southern-Benin.

## **2. Methods**

### **2.1 Sampling, selection criteria and study design**

The study was conducted in one of the village of the district of *Adja-Ouèrè* (Southern-Benin). Sampling was

done in a community health centre level. Thirty (30) pairs of mother-child were randomly selected from the list of mothers attending the health centre and enrolled in the study. The selection criteria were relative to infants:

- aged 11- 23 months-old (fifteen mother-baby girls and fifteen mother-baby boy) at the beginning of the study;
- consume usually porridges at least twice a day;
- have a weight-for-length Z score  $> -3$  (not severely wasted) and no particular health problems (no apparent handicap) and
- still be breastfed.

### **2.2 Data collection**

The mother-infant pairs were invited to come twice to the study room to participate in experimental meal episode. Each pair of mother-infant was given the experimental porridge, at the usual porridges feeding time (12PM). For them, data were obtained from both the videotape coding and from the connected weighing scale. The high energy density malted porridge has been used, which present the highest coverage of daily infant' energy and nutrient needs [16]. The malted porridge (700 g) was served in large opaque bowl. The child was seated in a high chair in front of their mother in study room. The mothers fed their infant using their own spoon. They were instructed to remain attentive to recognize the refusals to consume emitted by their infant. Indeed, they had for instruction not to encourage nor restrict consumption and to stop offering when the infant emitted 2 consecutive refusals (the infant refused to open the mouth, pushed away the spoon or shook his/her head).

### **2.3 Connected weighing scale**

Before the beginning of consumption, the opaque bowls were placed on a digital weighing scale of 0.1 g sensitivity (PCE-LC 2000 on the table of study room)

connected to a computer which recorded the weight every second. Indeed, mothers can easily eat her child with spoon and without handling the bowl. For each mother-infant pair, the experimenter must be vigilant, started off and stopped the recording manually for each meal. The porridge intake was measured, by weighing scale by the difference between the final and the initial weight and time recorded. Directly, the output variables were obtained as the total weight intake (g) and the total duration of food consumption (s).

Other parameters were determined like the number of spoonful, the weight of spoonful content and the time at which each spoonful was taken off. Thus, the amount of porridge intake was determined and expressed in gram or in number of spoonful per second.

**2.4 Videotape coding**

For each meal, the functioning of mother-infant pair was video recorded with two cameras (Toshiba Camcorder X150) filming the infant of the face and profile. Four descriptive behaviour parameters were coded with the table of Responsiveness to Child Feeding Cues Scales (RCFCS) developed for 7 to 24 months' child by [17] (Table 1). The video recording of each mealtime episode of mother-infant pair has been examined and coded after the consumption of porridge by three trained experimenters. The first removed spoon from the bowl was methodological parameter of video coded. This point corresponded to the time when the first spoon was removed from the bowl and the duration from the start of the videotape and the start of the connected weighing scale recording. This point event was necessary to synchronize data from the videotape with data from the connected weighing scale.

<b>Behaviours (descriptive parameters of meal time episodes)</b>	<b>Coding methodology</b>	<b>Output variable</b>
<b>1. Consumption duration</b> (the start corresponded to the first spoon food contact and the end corresponded to the last spoon food contact)	Measured the duration	Effective consumption duration (s) (Consumption duration - duration of meal's breaks)
<b>2. Meal's break</b> (for each break, the start was coded when the mother stopped to offer the food in response to an external or unusual event and the end was coded when the mother went back to feeding her infant)	Measured the duration	
<b>3. Bite</b> (when each spoon was accepted and swallow in mouth of the infant)	Recorded this point	Number of bites

<p><b>4. First refusal to consume the offered spoon by the infant</b> (This behaviour varied between individuals)</p>	<p>Recorded this point</p>	<p>Duration from the start of consumption and the appearance of the 1st refusal to consume (s)</p>
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**Table 1:** Video-coded behaviour and output variable.

**2.5 Analysis**

The analyses were performed using Statistica 7.1. Statistical significance was set at  $P < 0.05$ . The connected weighing scale give the data of measurement of weights of spoon recorded each second. The series of consecutive equal weights corresponding to periods where the spoon was left in the bowl were automatically removed. Then, the measurement between each spoon remaining run was selected. Thus, the recording was not taken into account if less than two measurements were selected or if the weight range was less than 2 g over the meal. For each meal, when the spoons were stopped during a meal, the scale measured a null weight. The reliability of two methods was assessed by evaluating the consistency between the video recording and the connected weighing scale data using both graphical comparisons and significance correlation.

**2.6 Ethical considerations**

Local health authorities were informed about the study. For mother-infant pair selected to participate the study, a consent form was presented and explained to parents (father and mother) in their local language in order to have their verbal and written consent. Mothers gave also their consent to participate in the consumption of porridge.

**3. Results**

Among the 30 mother-infant pairs who participated in the experimental meals, video recording and weighing scale data were obtained for  $n=26$ . The data were obtained from both the videotape recording and from

the connected weighing scale for each porridge consumption. Thus, we analysed data of 26 food consumption episodes and we have presented the three models of meal episode.

**3.1 Correlation of the data from the combined of video recording and connected weighing scale**

The use of two mixed observational methods showed a high positive correlation between the data obtained from the video recording and the connected weighing scale regarding respectively the effective and total duration of food consumption ( $p < 0.001$ ). The result has showed that also a strong correlation between the number of bites from the video recording and the number of spoonful from connected weighing scale ( $p < 0.001$ ) (Figure 1). These results confirmed the reliability of the synchronization between the connected weighing scale and the video records.

During a meal, we observed the total consumption duration (from the connected weighing scale) is higher than the effective consumption duration (from the videotape coding) (Figure 1A). The similarly effect have been observed in Figure 1B, the number of spoonful (from the connected weighing scale) tended to be lower than the number of bites (from the connected weighing scale); this reflects that one spoonful may be consumed in real bites before the spoon returned to the bowl of porridge.

**3.2 Experimental models of different mother-infant pair functioning revealed by the combined observational method**

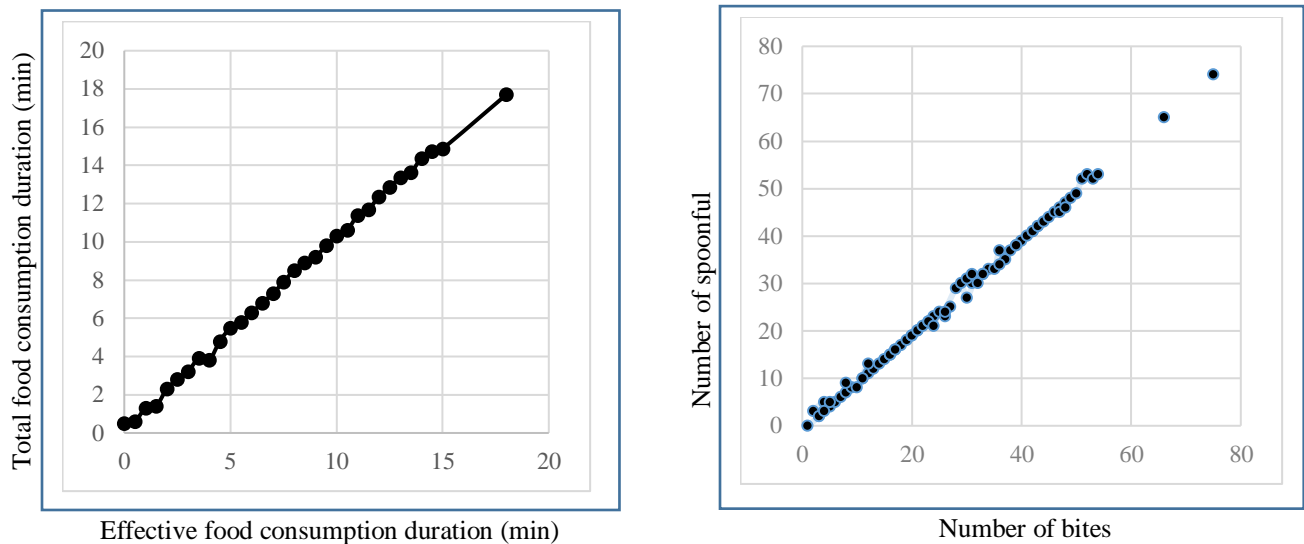
Experimental models of some mealtime episode showed 3 different models of mother-infant pair were presented by graphic representations (Figure 2). The results revealed different cases of mother-infant pair functioning during a meal time episode which explain the change of typical cases of feeding behaviours.

In regarding in inter-pair variability, the mean spoon content in each a meal consumption showed that all the spoon content recorded was higher in pair 3 (E') than in others pair 1 (C') and pair 2 (D'). Precisely in pair 3, the spoonful content increase until the end of meal consumption. This eating behaviour of pair 3 (E') was clearly different of the other pair 1 (C') and pair 2 (D'). So, the amount consumed porridge was higher in pair 3, lower in pair 1 and mean in pair 2. In function of intra-

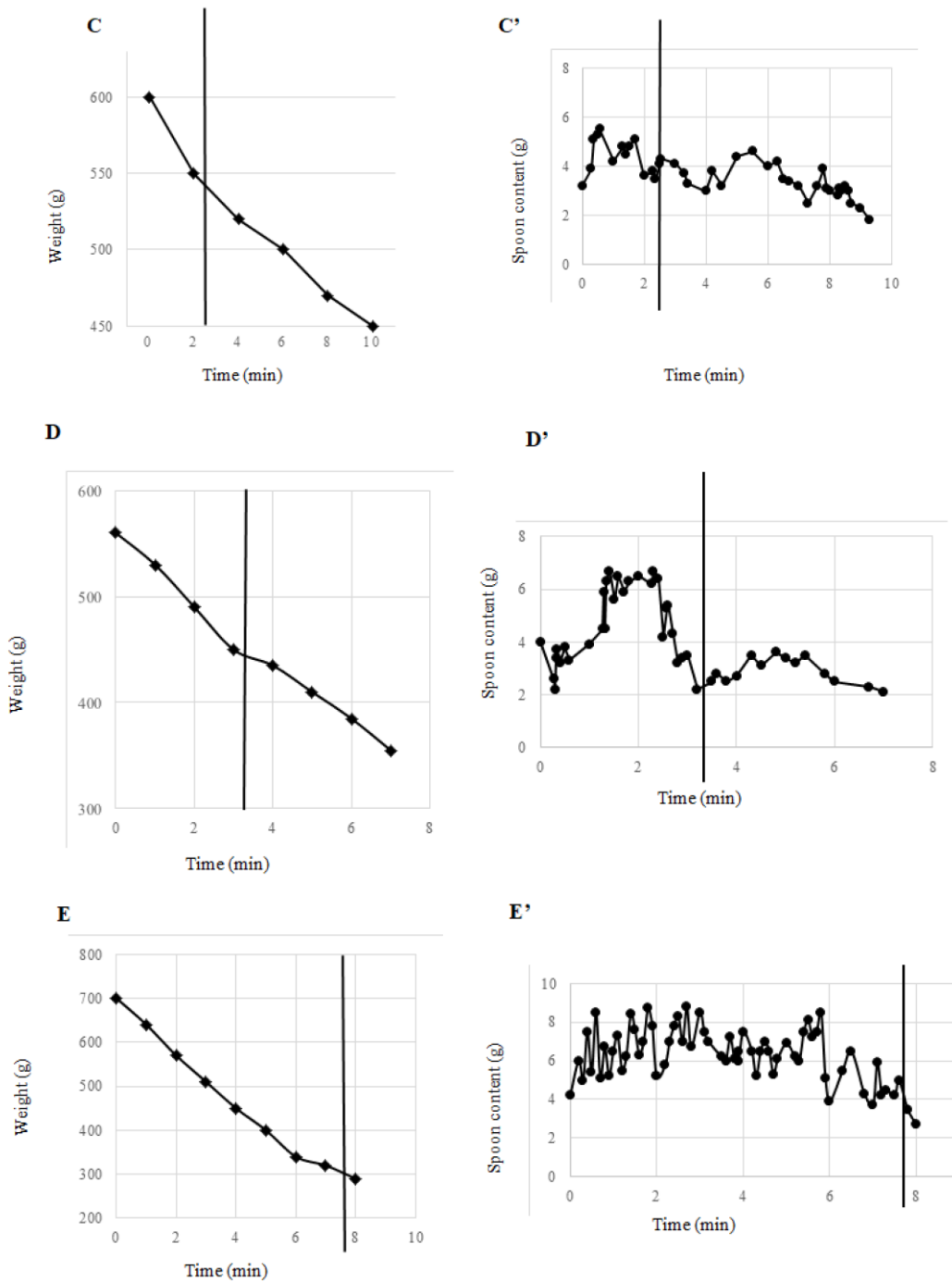
pair parameters comparison, we were interested by the eating behaviour of pair 2. The appearance time of first refusal to consume was associated with an exact decrease of the spoonful content and a higher difference of time consumption between the successive spoons (D/D'). The mother and her child communicated really and responsive correctly to each descriptive behaviour parameters during the meal episode.

**3.3 Description of satiation signals during a mealtime episode**

In regarding the eating behaviour of children by video recording method, we noticed different satiation signals, which variable in mother-infant pair functioning (Table 2). During a mealtime episode, in mother-infant pair 1, the infant has presented an early satiation and active signals. The active satiation signals were directly presented by the mother-infant pair 2, and the infant 3 have been presented the late satiation signal.



**Figure 1:** Graphic representations of the (A) Effective porridge consumption duration (from the videotape coding) and the total food consumption duration (from the connected weighing scale); (B) Number of bites (from the videotape coding) and the number of spoonful (from the connected weighing scale).



— First refusal to consume

**Figure 2:** Graphics representation (C), (D) and (E) show the amounts of consumed porridge (g/min) and spoon content obtained with the connected weighing scale (Graphics C', D' and E'). With the video recording, we have obtained the appearance time of first refusal to consume. This time was variable between pair. Each time of first refusal to consume was represented by a vertical black line. The data obtained of connected weighing scale and comparison of graphics C, D and E showed that the total amount of consumed porridge and total duration of consumption were highly variable between pairs. In regarding the graphics C, D and E the first refusal to consume

appeared in the first of the pair 1, in middle for the pair 2 and totally in end for the pair 3 during a meal consumption. The result showed a highly variability the eating behaviour of three mother-infant pairs. Moreover, this case analysis also showed a change in the dynamic occurring around the appearance of the time of the first refusal to consume. Contrary to the pair 1, the time of first refusal was followed with a decrease of spoon content until the end in the eating rate in the pair 2. In comparison of three eating behaviour graphics C, D and E, we observed a highly variability in the three eating behaviour of three pairs during a meal consumption.

<b>Child satiation signals</b>	<b>Early</b>	<b>Active</b>	<b>Late</b>
Mother-infant pair 1	turning the head away	Pushes tray of feeding hand away	-
Mother-infant pair 2	-	pushing away the spoon	-
Mother-infant pair 3	-	refusing to open the mouth	Physical struggling

**Table 2:** Description of child satiation signals during a mealtime episode.

**4. Discussion**

The combining of the connected weighing scale and the videotape recording have permit to show the high positive correlation in data for describe the meal’s episode of mother-infant pair. Thus, this two method did not evaluate exactly the same meal’s episode parameters. We noticed the overvaluation of the total consumption duration (from the connected weighing scale) compared to the effective consumption duration (from the videotape coding). This could be explained by the fact that the connected weighing scale, contrary to the videotape recording analysis, included the meal’s breaks as part of the course meal. Same trend was obtained, as shown in the number of spoonful tended to be lower than the number of bites. This reflects that one spoonful may be consumed in several bites before the spoon returned to the bowl.

However, in regarding the representative graphics, we noticed the high positive correlations ( $p < 0.05$ ) obtained between data from these two methods. Researchers have founded the similarly result concerning the strong positive correlation between the connected weighing scale and video recording in

description of mother-infant pair functioning during a meal [18].

The connected weighing scale has permit to obtain the number and weight of spoonful and weight of each offered spoonful and the total consumption duration. In function of data obtained, the connected weighing scale could be a reliable method to describe the food consumption episode. This would not be possible through the videotape recording method only. Indeed, the videotape recording method permit to analyse the qualitative description of meal episode parameter of mother-infant pair. Researchers [19] showed that the use of video recording is the one of relevant observational method for shown the dynamic nature and interaction between mother-infant during a mealtime episode. This method provides the data on appearance of the first refusal to consume and total effective duration food consumption for each pair. The time of first refusal to consume is precisely important for the parent/mother in meal episode, this parameter is the signal, which permit the parent has adapted and changed his feeding style. In regarding data on description of mealtime episode (Figure 2), we noticed that, the first time refusal to consume varied in function of pairs. The graphics C, D



and E showed the highly change as the first refusal to consume appeared in the first of the pair 1, in middle for the pair 2 and totally in end for the pair 3 during a meal consumption. The time of the first refusal to consume seemed to be associated with a punctual decrease of the spoonful content and a greater time lapse between last successive spoons. The decreasing of spoonful content was showed in Figure C', D' and E'. Precisely in pair 2, we observed after the time of first refusal to consume, mother recognize this first satiation signal of her infant, by changing her feeding style in decreasing of spoonful content. The mother has interpreted correctly this signals that should be clear enough from the infant. [14] have found that the mother who interpreted the correctly signals of her infant, adopted frequently the adequate eating models. This showed that this eating behaviour of pair 2 was adequate models for to fed the infant and young children in complementary feeding. Contrary of others mothers, her feeding style was optimal and permit to start the meal when her child is hungry and to stop gradually the meal when her child is full. [20] showed that the quality of interaction and dynamic in mother-infant pair during a meal episode is important time which permit to modulate the infant energy intake and equilibrate the nutritional status. But, the use of combined observational method was important to describe mealtime episode in mother-infant pair during complementary feeding. The study of eating and feeding behaviours by mixed observational method was relevant for help the parent to improve or change their feeding style. We noticed different satiation signals, which variable in mother-infant pair functioning (Table 2). In mother-infant pair 1, the infant has given an early satiation and active signals. The active satiation signals were presented by the mother-infant pair 2, and the infant 3 has presented the late satiation. Researchers have showed that the satiation signals could also be modulated depending on several factors like maternal and infants' characteristics (e.g. sex of the infant,

maternal weight status) [15]. Researchers [17] have described the three type of hunger and satiation signal gave by the infants and young children under two years in complementary feeding. The three types of satiation signals were precocious, effective and late signals. This behaviour being highly variable between each mother-infant pair functioning. The study showed that the good eating behaviour for child was positively associated with their optimal growth status [5]. It is important, in a context of decreasing prevalence of stunting in developing country, to understand the eating behaviour and functioning of mother-infant pair during a mealtime episode. The combined observational method showed the variability of interaction and functioning of mother-infant pair during a mealtime episode. It is very interested, that the mixed of connected weighing scale and the video recording revealed the existence of different mother-infant pair functioning. The similar results have been showed by the studies of [21].

## **5. Conclusion**

We have showed the existence of different mealtime episode in mother-infant pair functioning during complementary feeding with the combining of video recording and connected weighing scale in rural villages in Southern-Benin. A high positive correlation has been observed in data for describe the meal's episode of mother-infant pair. Each method is special and did not evaluate exactly the same meal's episode parameters. We noticed that, the quantitative and qualitative eating and feeding behaviours parameters varied in function of pairs. Contrary of others mothers-infant pair, the pair 2 feeding style was adequate models for to fed the infant and young children in complementary. This study proved that the quality of interaction of mother-infant pair during a meal is central unit which permit to modulate the intake and the optimal growth status of infant and young children in complementary feeding. This quality of interaction has important implication for

successful treatment of malnutrition. In future research, this would be interested to demonstrate the relation between the different form of mother-infant pair functioning and the infant's anthropometrics status.

### **Conflicts of Interest**

The authors declare that they have no conflicts of interest.

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