

Assessment of the Infant Feeding Age 1 to 12 Months in a Hospital Setting in Antananarivo

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Abstract - In developing countries such as Madagascar, malnutrition remains major problems of public health. We have to evaluate the food and the nutritional status of the infants aged from 1 to 12 months according to the profile of the parents by making a prospective transverse survey based on the interrogation of the mothers of visiting or hospitalized children over a period of 3 months. 100 mothers were interviewed; 46 of the babies had less than 6 months. The rate of exclusive breastfeeding until the sixth month is of 83% and during diversification the economic level socio is the factor more discriminated in the beginning of the food errors. It is especially the error in butter or oil contribution which is correlated with a poor nutritional status of the children. Many errors are finding during diversification and these errors are resounded on the nutritional state of the children. A nutritional education adapted to the context in Madagascar would be essential.

Keywords - Breastfeeding; Dietary Diversification; Infant Feeding; Nutritional Status.

I. INTRODUCTION

The World Health Organization (WHO) recommends exclusive breastfeeding until the age of 6 months, followed by a well-managed dietary diversification to ensure proper stature-weight growth and normal psychomotor development [1, 2]. In Madagascar malnutrition remains a major public health problem such as in developing countries since 2009, 10.6% of childhood deaths in the South region

were related to acute malnutrition and in 2010, 7.5% of children in the South East region of Madagascar were malnourished [3]. Malnutrition linked to the country's precarious economic situation remains a major health problem for children under 5 years of age, affecting more than 50% of the population in this age group in Moramanga (Madagascar) [4].

Our main objective is to study the feeding behaviour of

infants aged 1 to 12 months by linking it to the parents' profile in order to identify the main errors that can prevent malnutrition.

II. METHODS

Our study was carried out in the pediatric ward of Befelatanana Antananarivo, which is a general pediatric ward. The survey lasted 3 months, from January to March 2015.

It was a cross-sectional, prospective survey based on the interrogation of mothers of children aged between 1 and 12 months. The questions focused on their children's eating habits, taking the child's current diet into account, taking into account his or her age and noting what the child had taken the day before the interview.

We included all infants aged 1 month to 12 months whose parents agreed to participate freely in the study after receiving an explanation of the study process and objectives. Not included were those whose parents refused to answer; those who were born prematurely or with a low birth weight (those with a birth weight of less than 2500 g), those who were dehydrated and those who were in very poor general condition.

We analyzed epidemiological parameters such as the age in months and sex of the child; age, education and marital status for the mother; socio-economic level and origin for the parents. Concerning the socio-economic level: according to the professions, we have classified senior managers as high level, ordinary workers as low level and the rest as medium level.

We also studied the mode of breastfeeding and the conduct of diversification, i.e. the age at which diversification begins, the sources of nutritional advice and finally the mode of diversification by studying the age of introduction of each food, the quantity and nature of the foods introduced.

For the assessment of nutritional status, we used the corresponding gender weight-for-height index according to the WHO chart, which mainly evaluates acute malnutrition: a child is considered eutrophic if his P/T index is higher than -2ET; moderate acute malnutrition if P/T between -2ET and -3ET and severe acute malnutrition if $P/T < -3ET$.

For data processing and analysis, we used the statistical software "R" version 2.9.0 and as the test used, we took the chi-2 test and assessed the degree of significance "p" which is significant if its value is less than 0.05.

III. RESULTS

A total of 100 mothers of infants aged 1 to 12 months were interviewed, 46 infants were under 6 months of age and the sex ratio was 0.78. The parents' profile (socio-economic level and origin of the parents; age, education level and marital status of the mothers) was compared with the results of the food assessment.

Concerning the breastfeeding mode; before 6 months 83% of mothers exclusively breastfed their babies, the rest chose the mixed breastfeeding mode using breast milk and infant formula while after 6 months of age the breastfeeding rate was 78%. Two percent of infants were breastfed with infant formula alone and the remainder were breastfed mixed, with 5 mothers combining cow's milk and breast milk and 2 others using sweetened condensed milk with breast milk.

Of the 100 infants included; 61 were diverse and 54 were over 6 months of age. To lead the diversification, 34% of mothers sought advice from family members, 30% took a personal initiative, 26% of mothers sought advice from health workers and 10% received information through the media.

Thirty-four children or 56% had been diversified before 6 months of age, 26 (42%) were diversified at 6 months of age and 1 child or 2% was diversified beyond 6 months of age.

Concerning the Conduct of food diversification:

For the 54 diversified children over 6 months of age, analysis of the different types of foods given during diversification before 1 year of age showed the following results:

- ❖ Regarding starch intake, 46% of the children included took the recommended amount, 18% ate less than recommended and 35% of the infants included took more than recommended. This intake is correlated with the origin of the parents ($p < 0.0272$) (Table I).
- ❖ In addition, the analysis of infant meal intake showed that more than a quarter (28%) of infants did not consume infant meal on a daily basis, 9% took a larger quantity than recommended; 19% took a smaller quantity than recommended and 45% consumed the recommended quantity on a daily basis. The intake of infant flour was not correlated with the parents' profiles.
- ❖ Vegetable intake was correlated with the socio-economic level of the parents ($p = 0.01845$) (Table II). Thirty children, or 56%, did not consume vegetables on a daily

- basis; 24% consumed the recommended amount and 20% consumed less than recommended.
- ❖ Fruit intake data were not correlated with parental profiles. A significant proportion of the diverse children included (4%) did not consume fruit regularly; 35% regularly consumed fruit and in sufficient quantity, 19% took an insufficient quantity and 4% consumed much more fruit than recommended for age.
 - ❖ Meat intake during diversification was also correlated with the socio-economic level of the parents ($p=0.02419$) (Table III); 59% of infants before 1 year of age did not eat meat on a daily basis, 4% consumed an insufficient amount and only 37% of children received the recommended amount.
 - ❖ Consumption of dairy products (cheese and yoghurt) was irregular, 63% of children did not consume them at all, the rest of children (37%) had dairy products in their diet.
 - ❖ More than 61% of mothers did not add oil or butter to their baby's diet during dietary diversification, only 25% of children consumed the recommended amount and 15% of children consumed less than recommended. We have not had any cases of excess oil intake. The oil and butter intake were not correlated to the parents' profiles.
 - ❖ Other consumptions were also found before one year, such as the consumption of biscuits, hygienic drinks and sweets.
- The nutritional status analysis revealed that before 6 months we had no cases of severe malnutrition while during the diversification period, 5 children (9%) were severely malnourished (Figure 1).
- By comparing the nutritional status of children and the conduct of feeding; we found that it was closely correlated with oil and butter intake ($p=0.0077$). (Table V).

Table I: Correlation of starch intake and parental profile

	Recommended	Less	More	No Contribution	p
Educational level					
Illetered	0	0	1	0	0.7279
Primary	6	2	5	0	
Secondary / High school student	16	8	10	0	
University	3	0	3	0	
Socio-economic level					
Low	9	7	9	0	0,4385
Medium	13	3	8	0	
High	3	0	2	0	
Marital status					
Single	12	5	10	0	0.9547
Married	13	5	9	0	
Parent's origin					
Urban	22	10	12	0	0.02726
Rural	3	0	7	0	
TOTAL	25(46,29%)	10(18,51%)	19(35,18%)	0(0%)	

Table II: Correlation Vegetable intake and parent profile.

	Recommended	Less	More	No Contribution	p
Educational level					
Illetered	0	1	0	0	0.2934
Primary	2	5	0	6	
Secondary / High school student	7	8	0	19	
University	4	1	0	1	
Socio-economic level					
Low	4	10	0	11	0.01845
Medium	5	5	0	14	
High	4	0	0	1	
Marital status					
Single	7	7	0	13	0.9307
Married	6	8	0	13	
Parent's origin					
Urban	8	14	0	22	0.0824
Rural	5	1	0	4	
TOTAL	13(24,07%)	15(27,77%)	0	26(48,14%)	

Table III: Correlation Meat intake and parent profile.

	Recommended	Less	More	No Contribution	p
Educational level					
Illetered	0	0	0	1	0.4674
Primary	5	0	0	8	
Secondary / High school student	11	1	0	22	
University	4	1	0	1	
Socio-economic level					
Low	7	0	0	18	0.02419
Medium	9	1	0	14	
High	4	1	0	0	
Marital status					
Single	8	1	0	18	0.522
Married	12	1	0	14	
Parent's origin					
Urban	16	1	0	27	0.4676
Rural	4	1	0	5	
TOTAL	20(37,03)	2(3,7%)	0(0%)	32(55,25%)	

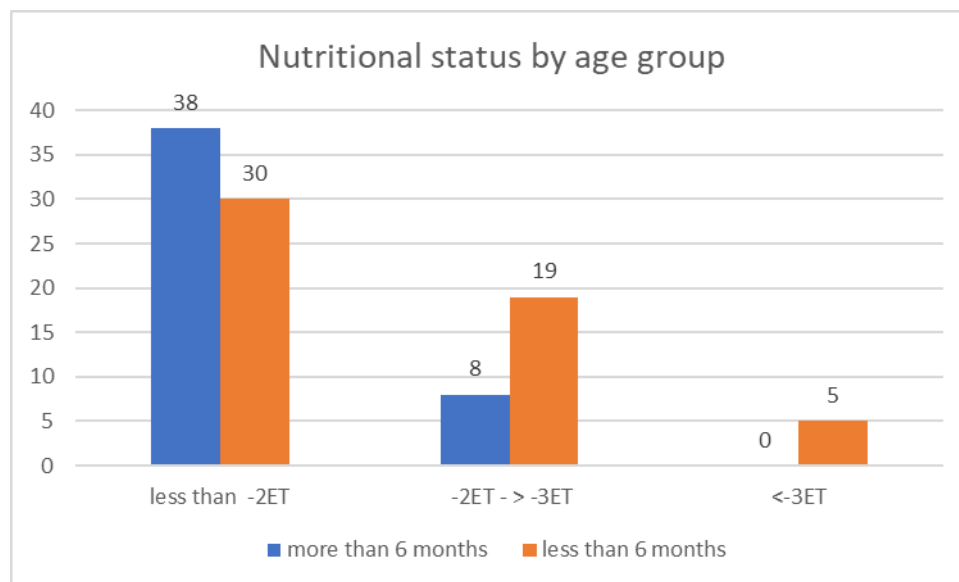


Figure 1: Nutritional status by age group

Table V : Correlation of nutritional status and food management.

Supply control	Correlation with nutritional status (p)
Breastfeeding mode	0.3573
Starch intake	0.3531
Infant meal intake	0.2461
Vegetable intake	0.5122
Meat intake	0.679
Oil/butter supply	0.007705

IV. DISCUSSION

Concerning the mode of breastfeeding, before the age of six months 83% of the mothers of the children included were exclusively breastfeeding their children, so we can say that the majority of mothers followed the recommendations of WHO and the Malagasy Ministry of Health regarding the interest of exclusive breastfeeding until the age of 6 months. There are still 17% of mothers who did not follow this recommendation and who have opted for mixed breastfeeding; the first explanation is that some mothers work after the third month or even before and there is also the lack of support and education for these women on how to continue breastfeeding even if they work [1]. Authors have reported that good support for breastfeeding with good maternal education could solve difficulties in breastfeeding practice [5].

We found a majority figure for exclusive breastfeeding such as that of Senegal, which is a southern country like Madagascar, with an exclusive breastfeeding rate of 66%

[6]. Another Tunisian survey of mothers who came for vaccination in basic health centres found that the rate of use of exclusive breastfeeding was 41.5% [7]. On the other hand, in developed countries such as France, the rate of use of exclusive breastfeeding until the sixth month is very low, at 33%. This difference is explained by the difference in cultures and also in health policies in these different countries, which have an impact on the rate of use of breast milk.

The use of infant formula alone before 6 months of age has not been found. Despite this high rate found in our survey, continued efforts to promote, support and protect breastfeeding must be maintained to ensure that the Malagasy population benefits from breastfeeding in accordance with WHO guidelines [8].

After diversification, we have seen a decrease in the use of breast milk from 83% to 77%. This decrease was less significant compared to what has been seen in northern countries, whereas at this age breast milk remains the milk

recommended by WHO because of its benefits, which have been highlighted in numerous publications, including improved digestibility, prevention of infections and allergies, adaptation for age and scalability over time [1]. Two percent of children over 6 months of age were breastfed with follow-on milk (artificial milk): these products are expensive and are the most popular in high-income countries. We can therefore say that we are closer to the WHO recommendations for maintaining breastfeeding during diversification [3]. Unfortunately, we have identified 7 children or 11% of the diversified children who were breastfed mixed with breast milk and cow's milk or concentrated milk; while the use of these milks is inadequate and responsible for deficiencies in iron, essential fatty acids and vitamins [9,10,11].

As for the conduct of food diversification: our main bias is that the assessment of the amount of food consumed by the child was approximate, but we can say that this study reflects the practical reality of mothers in Antananarivo.

For the conduct of diversification only 26% of mothers received nutritional advice from medical staff; several reasons could explain this situation: either parents do not consult, or do not know that it was necessary to see medical staff to properly carry out food diversification in accordance with standards; or medical staff tend to forget to give this advice during consultations or systematic visits; or finally, staff do not have time to give nutritional advice due to the workload. Thus, the majority of mothers take personal initiatives or seek the advice of family members to lead their children's dietary diversification; all this can lead to diversification errors that can affect the child's nutritional status.

Concerning the age at which diversification began, 26 children, or 43% of the children, started diversification at 6 months compared to 56% before 6 months. However, before 6 months, the literature emphasizes that diversification is early and the child will be exposed to allergic risks as well as major intolerances [9, 10]. In 2005, a study conducted in France found that 3% of children were diversified at an early age [9]. Our figure is therefore very high compared to the French figure. A child in our series was diversified after 6 months; the risk of a delay in diversification is mainly under-nutrition [12].

Concerning the carbohydrate intake, a high consumption of cereals has been found. This situation could be explained by the eating habits of Malagasy people who consume a lot of rice and by the existence of cheap products such as potatoes in the study area. Many of the mothers did not use

infant flour to feed their children; this could be explained by the cost of these products whereas these products are designed for infants because of their properties which are powdered products to swallow directly without being chewed and also because they are supplemented with vitamins. In the literature, the excess sugar provided by cereals and starchy foods can be responsible for a dietary imbalance that leads to excess calories and possible deficiencies [13-14].

A small percentage of children, 10%, consumed less than the recommended daily intake of starch and infant meal. This is responsible for energy malnutrition [2]. The intake of infant meal was not significantly related to the profile of the mothers, while the starch intake was correlated with the parents' origin. This implies that outside the cities, children consume more rice than Malagasy adults.

Regarding meat consumption, less than half, or 37% of the children included, consumed the necessary daily amount and the majority, or 60% of the children, did not consume meat at all. There is therefore a very marked lack of animal protein intake in infant feeding in the study area. It is the lack of resources due to the economic precariousness of the Malagasy population that explains this since we have observed a significant correlation between meat intake and the socio-economic level of the parents. It is also noted that some mothers are unaware of the benefits of these products for infants. Since the majority of the parents of the included children had a low socio-economic level, we can say that poverty is at the root of the error in meat intake when these products are a source of nitrogen and essential amino acids that are necessary for growth and balance in the indoor environment [11,12]. In low- and middle-income countries such as Madagascar, insufficient protein intake combined with energy malnutrition will lead to protein-energy malnutrition.

Concerning the intake of vegetables and fruit; more than a quarter of mothers did not give their children vegetables or fruit; we were able to observe during this study that these errors were significantly linked to the socio-economic level of the parents. Yet in Antananarivo, these products are cheap and if mothers did not give them to their children it is mainly because of ignorance. These products are sources of vitamins, so they are very interesting for infants. In addition, to educate taste, it is necessary to accustom children to eating vegetables and fruit from an early age so that when they are on an adult diet, they will be accustomed to it, given the importance of these products in preventing cardiovascular risks [13-14].

When analysing oil and butter intake, a very large proportion of mothers (61%) did not give oil or butter to their children, whereas to have good staturo-ponderal growth, infants' bodies need these products, which provide both energy and essential fatty acids [12]. In addition to the lack of knowledge; the poverty of some families does not allow them to buy oil. This study also found that the nutritional status of diversified children was significantly correlated with oil or butter intake.

Other foods that are not necessarily useful in the feeding of infants under 1 year of age have been found during the diversification period. The consumption of these products could be a source of excess sugar intake (fruit juices, sugar water, candies, biscuits...) which is described among the errors of food diversification [12,13]. These other foods are taken irregularly and the time of intake is not fixed and in most cases between meals. This could lead to poor snacking habits in children and may lead to inappetence at mealtimes.

The analysis of the nutritional status of the included children revealed that before the age of 6 months, 38 children or 82% of the children were eutrophic; 8 children were moderately malnourished and we did not encounter cases of severe malnutrition. At this age, children are fed exclusively on milk; for our series the majority of mothers were breastfeeding and as stated in the literature, breast milk covers all needs until 6 months of age, hence the majority of eutrophic children at this age and no cases of severe malnutrition have been found. After six months of age, however, 19 children or 35% were moderately malnourished, and we had 5 children (9% of those over 6 months of age) who were severely malnourished.

In a study conducted in Algeria, breastfeeding practices, introduction and early weaning were implicated in infant malnutrition [15]. We therefore agree with the results of this Algerian study because it is mainly the error of food diversification that was responsible for malnutrition in infants under 1 year of age and during this study, we were able to link the lack of oil intake and the nutritional status of diversified children.

V. CONCLUSION

In the context of this prospective study on the eating habits of children in hospitals in Antananarivo: before 6 months 83% of mothers were exclusively breastfeeding and we did not find any inadequate breastfeeding mode. During the diversification period, many errors were found both quantitative and qualitative, namely the use of milk not suitable for infants such as cow's milk and concentrated

sweetened milk, excess starch intake and insufficient vegetable and meat intake. The nutritional status assessment did not find any cases of malnutrition until 6 months, while after the sixth month, 5 children were severely malnourished. Nutritional status was significantly related to oil or butter intake. A nutritional education adapted to the context of Madagascar would have its place.

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APPENDIX 1 : QUESTIONNAIRE

FOOD FOR CHILDREN UNDER 12 MONTHS OF AGE

AGE OF CHILDREN: month

GENDER: M F

WEIGHT: g SIZE : cm P/T :ET

MOTHER'S AGE: years old

MOTYHER'S EDUCATIONAL LEVEL : illettrate primary secondary school university

PARENTS' OCCUPATION :

SOCIO-ECONOMIC LEVEL : Low medium high

PARENTS'ADRESS : urban rural

NUTRITIONAL ADVICE RECEIVED: YES NO

Medical staff Media Parents

EATING HABITS

• BREASTFEEDING :

Breast milk : YES NO number of doses :

Artificial milk :

Name of the milk :

Quantity per bottle : ml number of bottles per day :

• DIVERSIFICATION : yes No

DIVERSIFICATION STARTING AGE : month

FECULENTS : YES ☐ ☐ NO ☐ ☐

RICE quantity per day: ☐ ☐ tablespoon

POTATO Number per day ☐ ☐

BREAD Number per day: ☐ ☐

FLOURS OR CEREALS

Quantity per day ☐ ☐ ☐ ☐ tablespoon

VEGETABLES : YES ☐ ☐ NO ☐ ☐

Quantity per day: ☐ ☐ ☐ ☐ (3 carrots = one zucchini = 1/2 pumpkin portion = 100g)

FRUITS : YES ☐ ☐ NO ☐ ☐ (an apple medium size = an orange = a banana = 100g)

Name of the fruit : Number per day :

MEAT : YES ☐ ☐ NO ☐ ☐

Type of meat :

BEEF ☐ ☐ CHICKEN ☐ ☐ PIG ☐ ☐ FISH ☐ ☐ Other ☐ ☐

Quantity per day: ☐ ☐ ☐ ☐ teaspoon

Other dairy products :: ☐ ☐

Yoghurt : Yes ☐ ☐ No ☐ ☐ Number of pots / day : ☐ ☐

Cheese : Yes ☐ ☐ No ☐ ☐ Number of portions / day : ☐ ☐

OTHER FOODS

Water : Yes ☐ ☐ No ☐ ☐ quantity : tablespoon

Biscuits or chips ☐ ☐ Candy ☐ ☐ Drink ☐ ☐ Sweet water ☐ ☐ Fruit juices ☐ ☐ Other ☐ ☐