

NUTRITIONAL STATUS OF INFANT AND YOUNG CHILD IN THE URBAN COMMUNE OF FANDRIANA - MADAGASCAR

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ABSTRACT

Madagascar is by far the most heavily country hit by cumulative forms of malnutrition, combination of dietary intake and infection; children under 5 years are the most vulnerable group. The objective of this work is to assess the nutritional status of those children aged between 0-5 years and to identify the factors influencing their malnutrition in the city of Fandriana in 2018. A comparative survey of 310 children in times of abundance and 286 children during the lean season was conducted. Anthropometric, socio-economic and health data were collected. The sampling method used was a two-stage cluster survey. These data were processed and analyzed using the Epi info 7 software. The results indicate that during periods of abundance, the prevalence of underweight, chronic malnutrition and wasting are 32.9%, 63.87% and 7.84% respectively. Chronic malnutrition is significantly associated with colostrum intake and breastfeeding upon request, wasting with family planning and with maternal exclusive breastfeeding while underweight is significantly associated with the mother's level of education. On the other hand, during the dry season, 81.82% of children suffer from stunting, 45.45% from underweight and 8.39% from wasting, strongly associated with permanent weaning. By comparing both periods, the statistical test shows a significant difference between the prevalence of underweight in the period of abundance and in the hunger season.

Key words: nutritional status, determining factors, children, Fandriana, Madagascar

1. INTRODUCTION

The nutritional status is primarily determined by its relationship with the physical, biological and cultural environment. A poor nutritional status affects various aspects of society's life and is a major handicap to well-being and economic development of a nation [1]. Malnutrition, especially under nutrition, is a major public health problem in any developing countries. When it does not kill, it causes sequelae for adulthood which are transmitted from generation to generation with serious consequences for the development of territories [2].

In 2015, Madagascar has agreed to the 2030 Agenda for Sustainable Development adopted by all UN member states. A particular emphasis was placed on MDG2-zero hunger, i.e. to provide access to safe, nutritious and adequate food for vulnerable people including infants, and to reduce all forms of under nutrition including stunting and wasting in children under 5.

Like in other developing countries, Madagascar's fight against malnutrition is complex, for various reasons including poverty, lack of resources, ignorance of mothers [3]; the most available recent data shows that the challenge has not yet been recorded. Stunting affects more than one child under 5 years of age.

In terms of feeding practices, one in two children are exclusively breastfed for the first 6 months, one in four children from 6 to 23 months have minimal dietary diversity and approximately 20% have a diet [4]. In addition, infants and young children with a high prevalence of under nutrition are frequently affected by the problem of "small appetite", which manifests itself at very low intakes [5], [6]. Thus, during a meal, the quantities ingested by these children are often less than half their theoretical gastric capacity of 30g/kg of body weight [7].

These different reasons led us to undertake an evaluation of the nutritional status of children in the city of Fandriana. The choice of this locality is based on the fact that it belongs to the Amoron'i Mania region, which is one of the most affected by malnutrition. Indeed, according to the few available data, the nutritional status of the region's population remains very worrying, with 5.6% of children aged 0-4 years affected by wasting [8]. Thus, the present study aims, first, to update these data, specifically to determine the nutritional status of children by comparing the period of plenty (PA) and the hunger gap (HS) and, on the other hand, to see how to improve the nutritional status of children in the above-mentioned commune.

Children aged 0-5 years were chosen because they are in the growth period. They are also very vulnerable to diseases, the most common of those are respiratory infections, diarrhea and malaria. However, this intervention has been implemented on a too small scale and/or in isolation, which does not allow for significant results to influence national indicators.

The study employed anthropometric nutritional assessment, a widely applicable, quick, easy, trustworthy, and affordable method for identifying malnutrition [9]. It uses a range of markers, including weight-for-height, weight-for-age, and height-for-age, to describe the nutritional status of children.

The following hypothesis is put forward: "The nutritional status of children aged from 0 to 5 years is precarious". To test such hypothesis, the overall goal is risk factors for poor nutritional status of children under 5 years of age in the city of Fandriana by comparing the period of abundance and the hunger season. The specific objectives contribute to assessing the prevalence of malnutrition in children and to investigate the determinants of malnutrition.

First, a general overview of the study area will be given, followed by the methodology and finally the results the discussions and the conclusion. The causes of child malnutrition will be presented through a causal model.

2. MATERIALS AND METHODS

2.1. Study sites

The survey took place in the UC of Fandriana

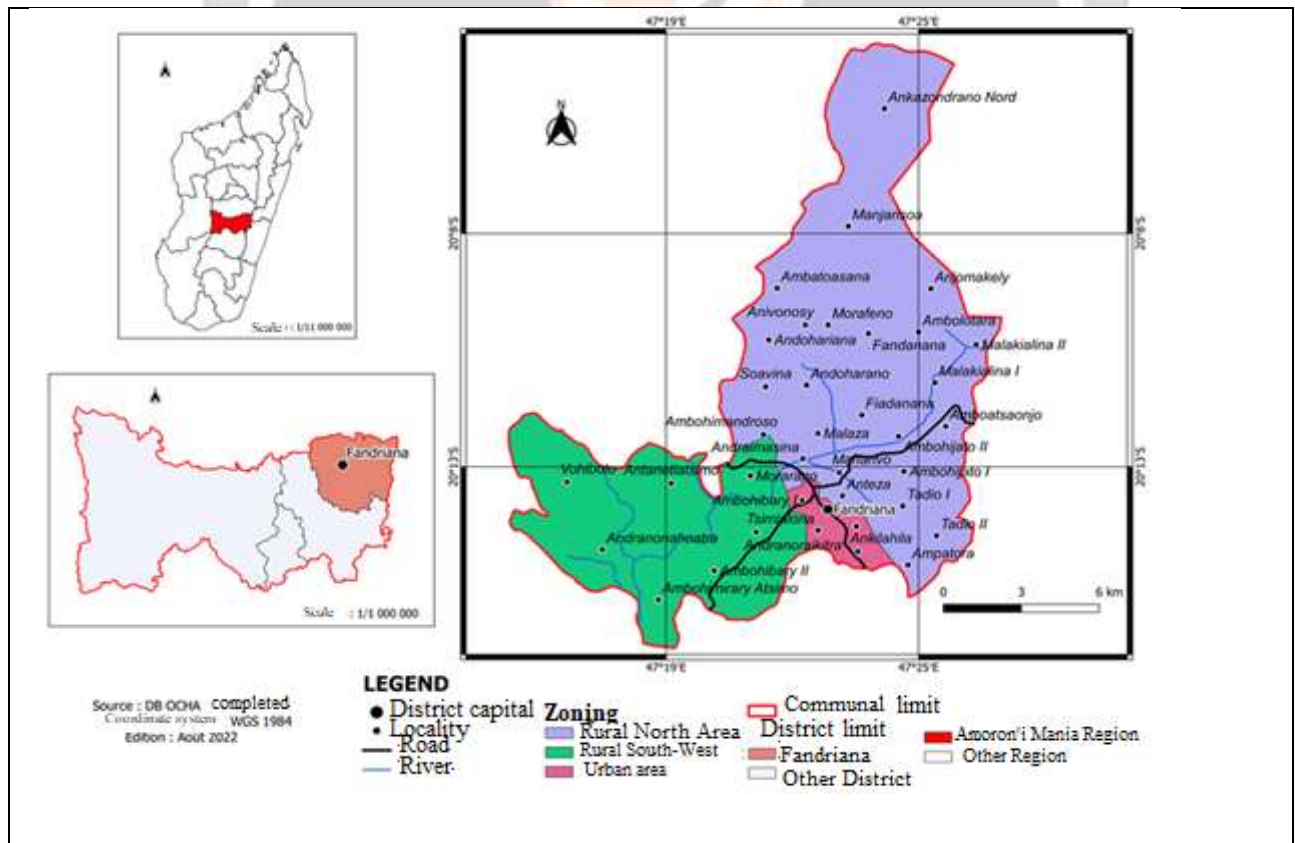


Fig - 1: Location of the study area

2.2 Type and period of survey

This is a perspective, cross-sectional and analytical study. The first survey was conducted during the months of June and July 2018 in the period of abundance (PA) and the second in November and December, in the hunger season (HS) during which the previous year's crop is exhausted while the next crop is not yet in the bin.

2.3 Subjects and questionnaire administration

All parents with children aged 0-5 years old are surveyed. The questionnaire is administered to the primary caregiver: age; sex; diseases; vaccination; sibling rank; sibling size; child feeding and characteristics of the household heads (age; sex; education level; marital status; occupation and family planning).

2.4. Sampling [10]

Sampling was based on a two-stage cluster survey using available demographic data. Eight Fokontany in the commune's chief town were randomly selected to form clusters. Three hamlets per cluster were drawn exhaustively. A hamlet is composed of a group of households drawn at random. When the head of the household is absent during the visit or if he/she is unaware of the questions to be asked, the surveyed family is excluded from the survey.

2.5. Assessment of nutritional status

2.5.1. Anthropometric measurements

In ten minutes, weight and height measurements were taken during the home visit of the naked child using a hanging baby scale and a bathroom scale.

2.5.2 Indicators of nutritional status

Based on the two measurements (weight and height) and age, the nutritional status of the children was assessed according to the anthropometric indicators below [11]:

- Weight for height (W/H)

This is an indicator of acute malnutrition or "wasting" and reflects cyclical under nutrition. Acute malnutrition is characterized by a deficit in tissue and fat mass. It may be due to infection and/or nutritional deficiency.

- Height for age (H/A)

This is an index of chronic malnutrition or "stunting" which reflects stunted growth and is due to the cumulative effects of undernourishment and infections since birth and even before.

- Weight for age (W/A)

Underweight or global malnutrition is a general indicator determined by W/A. It affects children with either or both types of malnutrition, and can be influenced by long-term or short-term causes of malnutrition.

The table below presents the indicator of nutritional status

Table-1: Indicators of nutritional status

Indicators	Assesment criterion	Nutritionnel status		
		underweight	normal	overweight
Weight for age (W/A)	growth: weight gain	underweight	normal	overweight
Height for age (H/A)	skeletal development and stature slowed	chronic malnutrition or stunting	normal	Advanced Bone maturity
Weight for height (W/H)	emaciated or overly thin child	acute malnutrition or wasting	normal	obesity

2.6. Assessment of children's diet

The interview focused on breastfeeding and complementary foods.

2.7. Statistical analysis

Data were entered into Excel 2013 and analysed using Epi info 7 software. All statistical tests are considered significant if the p-value is less than 0.05. The statistical test used is the chi-square test of independence which aims to investigate whether or not there is a relationship between two qualitative characteristics [12].

3. RESULTS AND DISCUSSION

3.1 Characteristics of parents

Parents play the main role in improving the child's environment according to **Table-2**.

Table-2: Parents' characteristics

Variables	Catégories	workforce	percentage
Gender of household heads	Male	144	60
	Femal	96	40
Age of household heads	≤45	230	95,33
	>45	10	4,17
Education level of heads of household	Never been to school	62	25,83
	Primary school	104	43,33
	Secondary school level I	62	25,83
	Secondary school level II	10	4,17
	Higher education	2	0,84
Household size	≤ 3	128	53,34
	4 à 5	74	30,83
	6 à 7	32	13,33
	8 à 9	6	2,5
Branch of activity of heads of household	Agriculture	114	47,5
	Small trade	18	7,5
	Private public employment	10	4,17
	Small trade	30	12,5
	Handicraft	52	21,67
	Other	16	6,66
Physiological status	Pregnant mother	6	4,96
	Mother not pregnant	115	95,04
Family planning (mother)	Yes	52	42,98
	No	69	57,02

In this locality, households were predominantly headed by men under the age of 45. The following two cases are possible:

- married: mother and father living together with their children (60.66%);
- unmarried: single, or temporarily separated from their spouse, or divorced or widowed (39.34%).

The percentages of illiterates (16.67%) and those who have attained primary education (52.08%) are not negligible. More than half of the households have a size of less than three (52.46%). One in two heads of household is a farmer (primary sector) while the other works in the tertiary sector. One household in four respects food taboos. One mother in ten is pregnant. More than half of the women practise family planning.

3.2 Child feeding practices

The term child feeding practices refers to both breastfeeding and complementary feeding which concerns all liquid, semi-solid and solid foods consumed by the child in addition to breast milk, ideally after the age of 6 months when breast milk alone is no longer sufficient to cover the requirements of the child.

3.2.1- Breastfeeding

All social and health information concerning the child in person is considered in this section.

Table-3: Comparison of breastfeeding characteristics of children in the two periods

Variables		Period of abundance		Hunger season	
		workforce	percentage	workforce	percentage
Type of breastfeeding	Breastfeeding	302	97,42	280	97,9
	Mixed breastfeeding	8	2,58	6	2,1
Destination of colostrum	Given to the child	128	41,29	138	48,25
	Discarded	182	58,71	148	51,75
First fluid before the first feeding	Yes	60	19,35	46	16,08
	No	250	80,64	240	83,92
Reasons to give fluid before the first feeding	Delayed milk supply	17	28,33	14	30,43
	Mother ill	10	16,67	8	17,39
	Poor colostrum	33	57	24	52,17
Feeding frequency per day	On demand (> 10)	270	87,1	262	91,61
	< 10	40	7,74	24	8,39
Duration of exclusive breastfeeding (months)	< 6	250	80,64	240	83,92
	≥ 6	60	19,35	46	16,08

In **Table-3**, the percentage of breastfed children is very high (97.42% in PA and 97.90% in HS) while six out of ten children do not receive colostrum because their mothers consider colostrum to be unsafe for children due to its clearance.

Two out of ten children drink water before the first feeding; the reasons are: delay in the onset of milk production due to tiredness and insufficient feeding of the mothers; illness of the mothers; colostrum considered bad at first sight. Eight out of ten children are breastfed more than 10 times in 24 hours, while the others are breastfed 10 times or less because the mothers do not have much time to breastfeed their children due to their occupations. The duration of exclusive breastfeeding is not respected for these children (80.64% in PA and 83.92% in HS).

The percentage of children breastfed is very high.

3.2.2 Complementary foods

The two most common types of complementary foods are:

- liquid supplements that mothers give their children in addition to breast milk: tea, coffee, fruit juice and rice water;
- solid supplements: very soft purees, or diluted with a little liquid

These foods can also be porridge prepared from cereals or starchy foods.

Table-4: Characteristics of complementary foods for infants and periods

Variables		Period of abundance		Hunger season	
		Workforce	Percentage	Workforce	Percentage
Age of first liquid and solid supplement (months)	≤ 6	60	19,35	46	16,08
	≥ 6	250	80,85	240	91,92
Number of snacks per day	0	198	63,87	212	74,13
	1	80	25,81	74	25,87
	2	32	10,32	0	0

The **Table-4** shows the characteristics of these complementary foods for infants and children. Two out of ten mothers do not respect the WHO recommendation on the introduction of complementary foods (liquid and solid) in children under 6 months. The consumption of snacks is not very important for them.

3.3. Nutritional status of children

The nutritional status of children was assessed using the classic anthropometric indices: i) weight for height, ii) height for age, and iii) weight for age. These indices were calculated from data on the child's age, weight and height measurements collected during the survey. The calculated indices were compared to both the NCHS/CDC/WHO reference population and the new WHO reference [13].

3.3.1. Prevalence of malnutrition and χ^2 test

The χ^2 test allows us to see whether or not there is a significant difference in the number of malnourished children of all sexes between the two periods for the three nutritional indicators. The null hypothesis H_0 is expressed as follows: the period has no influence on the number of malnourished children whatever the nutritional indicators studied. The results obtained are presented in **Table-5**.

Table-5: Prevalence of malnutrition for all sexes combined and χ^2 test

Indicateurs	W/A	H/A	W/H
Period of abundance n=310	32,9	63,87	7,84
Hunger season n= 286	45,45	81,82	8,39
χ^2	6,48	0,1	0,16
p	0,04	0,75	0,68
Significance	+	-	-

+ : significant test; - : non-significant test; χ^2 : chi square; p : probability; W/H: weight/height; H/A: height/age; W/A: weight/age

- Chronic malnutrition or stunting

The prevalence of stunting is high in both periods (63.87% in PA and 81.82% in HS). Compared to national data, the nutritional status of children in Fandriana is extremely precarious. Two out of three Malagasy live in poverty and 50% of children under the age of five show stunted growth due to malnutrition [14]. A high rate of chronic malnutrition is a reflection of deprivation suffered over months and years. Chronic malnutrition can permanently affect a child's ability to develop physically and mentally [15]. Because of the extremely low purchasing power, particularly during the lean season, there is a severe food insecurity. Many single mothers struggle to provide for their children with the income they receive.

- Acute malnutrition or wasting

Acute malnutrition affects children with a rate of 7.84% in PA and 8.39% in HS. The situation of children in Fandriana is almost equal to the national situation, with 8.6% of children suffering from acute malnutrition and therefore at high risk of mortality. This form of malnutrition is the consequence of a food deficit and/or recent illnesses that have led to a rapid loss of weight, reflecting the nutritional state of the country, the causes of which are recent [16]. The high prevalence of acute malnutrition especially in SP can be explained by the difficult food situation during this period. Granaries are empty and the price of food is beyond the family's reach. "This form of acute malnutrition may be the result of recent illnesses, especially diarrhoea, or of a rapid deterioration in feeding conditions" [17].

- Global malnutrition (underweight)

It appears that 32.9% of children in PA and 45.45% in HS are underweight. According to the ENSOMD 2012/2013, the most affected regions are Vakinankaratra (47%), Amoron'i Mania (44%) and Itasy (43%) [18]. Underweight reflects chronic or acute malnutrition or a combination of both. Global malnutrition is influenced by long-term or short-term causes of malnutrition. This form of malnutrition identifies children who are underweight compared to the normal weight for their age. Global malnutrition is of particular importance to the health status of children. There is a significant difference between the two periods studied because weight is very sensitive to changes in diet. In PA, which is the harvest period, the standard of living of the population improves a little, the mother has the possibility to buy and vary the food for her children. In PA all foods are available in the market, so families are able to eat any food. Whereas in SP, the purchasing power is low, the imbalance in the diet is obvious and the deficit in nutritional intake of nutrients is relatively high. The consumption of fat-rich foods is very low.

3.3.2. Factors associated with the nutritional status of children

This section presents the association of socio-economic and health characteristics with the nutritional status of children in both periods. The null hypothesis H_0 assumes that there is no significant association between the characteristics studied and the nutritional status of children.

Table-6: χ^2 test and mother's characteristics and children's nutritional status

Caractéristiques	Indicators	W/A		H/A		W/H	
		PA	HS	PA	HS	PA	HS
Educational level	χ^2	3,72	16,96	11,69	9,94	10,89	9,59
	p	0,0001	0,11	0,39	0,54	0,45	0,57
	sig	+	-	-	-	-	-
Family Planning	χ^2	3,81	8,3	5,55	1,23	10,86	3,63
	p	0,28	0,04	0,14	0,75	0,01	0,3
	sig	-	-	-	-	+	-
Exclusive breastfeeding	χ^2	2,36	0,56	0,3	0,03	4,03	2,11
	p	0,12	0,45	0,59	0,86	0,04	0,15
	sig	-	-	-	-	+	-
Colostrum	χ^2	0,026	0,002	4,08	1,87	0,3	0,28
	p	0,87	0,96	0,04	0,17	0,58	0,6
	sig	-	-	+	-	-	-
Withdrawal	χ^2	14,7	0,12	13,06	20,81	3,79	27,06
	p	0,26	0,72	0,36	0,07	0,98	0,01
	sig	-	-	-	-	-	+
Teat on demand	χ^2	0,71	2,14	4,13	0,08	0,01	1,23
	p	0,4	0,34	0,04	0,78	0,92	0,27
	sig	-	-	+	-	-	-

p: probability; sig: significance; χ^2 : chi square; %: percentage; W/H: weight/height; H/A: height/age; W/A: weight/age

- Factors related to chronic malnutrition

✓ Period of abundance

Colostrum: the 58.71% in PA and 51.75% in PS of children do not eat enough. Parents are unaware that during the first six months, the only food needed by children is colostrum followed by breast milk. Discarding colostrum causes chronic malnutrition [19].

Breastfeeding on demand: 7.74% in PA and 8.39% in HS are breastfed less than 10 times in a day. The nutrients provided by breast milk such as vitamin A and calcium are then insufficient.

- Factors associated with acute malnutrition

✓ Period of abundance

Duration of exclusive breastfeeding: 80.64% in PA and 83.92% in SP of children do not respect the duration. The WHO recommendation is not respected. It is generally practiced on request. A child who is exclusively breastfed should suck for at least one hour out of 24" [20]. The duration of exclusive breastfeeding is strongly related to the number of acutely malnourished children. Early introduction of complementary foods (before 6 months) increases the risk of wasting. Most mothers work outside the home, so the addition of water or other sometimes dubious complementary foods in the first few months of life becomes a common practice that promotes diarrhoea which is a factor in acute malnutrition. Children who are only breastfed until an older age (over 6 months) are also at risk of wasting because breastmilk alone can no longer meet their nutrient and energy needs. Thus, whether complementary foods are given too early or too late influences the number of wasted children. A child fed only on breastmilk is protected against infections [21], [22], [23].

Family planning: acute malnutrition in children is influenced by family planning. The risk of acute or chronic malnutrition increases dramatically if birth spacing is short. Indeed, "children conceived after a reproductive interval of only 12 to 17 months are 25% more likely to be short and 25% more likely to be underweight than those conceived after 36 to 47 months [24].

✓ Hungry season

Final weaning age: child wasting was positively associated with the age of permanent weaning. Weaning is the point at which the child receives something else in addition to the mother's milk [25]. In case of poor hygiene conditions, diarrhoeal diseases occur more frequently in weaned children and are responsible for severe wasting or emaciation [26].

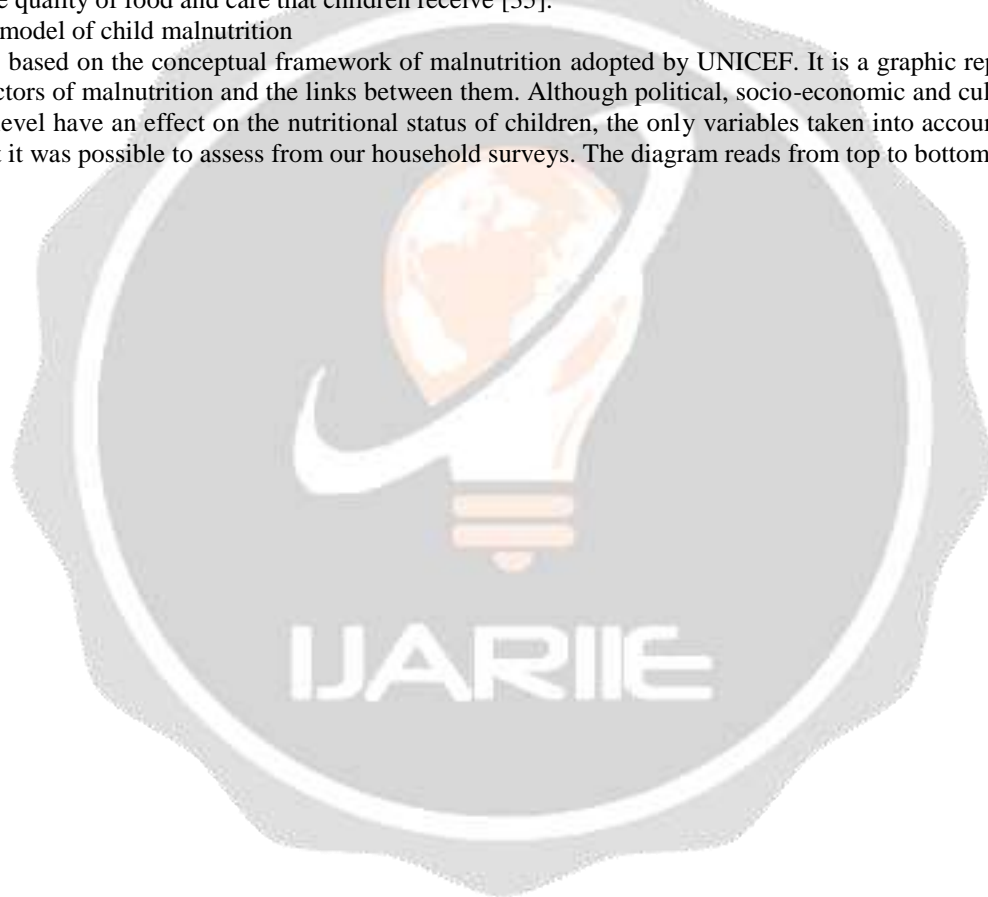
- Factors associated with global malnutrition

✓ Period of abundance

Level of education: maternal education is associated with a lower prevalence of child stunting. The majority of mothers have a low educational level, the rate of malnutrition is high [37]. A similar observation was reported by Delpuech et al (2000) in Brazzaville [38] and Bhandari et al (2002) in India [29]. This association could be explained by the fact that the level of education can improve income, use of health services, hygiene and nutrition [30]. Several studies show a negative relationship between parental education and child morbidity or mortality. They believe that education helps to break the barriers of tradition, to break with harmful practices and to adapt to the modern world. Education can change certain practices that result from traditional views on food such as the prohibition of women and girls eating before men and the prohibition of children eating eggs and meat [31], [32], [33], [34]. Educated women are also those who often marry educated men with high professional status, which increases the purchasing power of the household and influences the quality of food and care that children receive [35].

3.3.3 Causal model of child malnutrition

The model is based on the conceptual framework of malnutrition adopted by UNICEF. It is a graphic representation of the causal factors of malnutrition and the links between them. Although political, socio-economic and cultural factors at the national level have an effect on the nutritional status of children, the only variables taken into account in this study are those that it was possible to assess from our household surveys. The diagram reads from top to bottom.



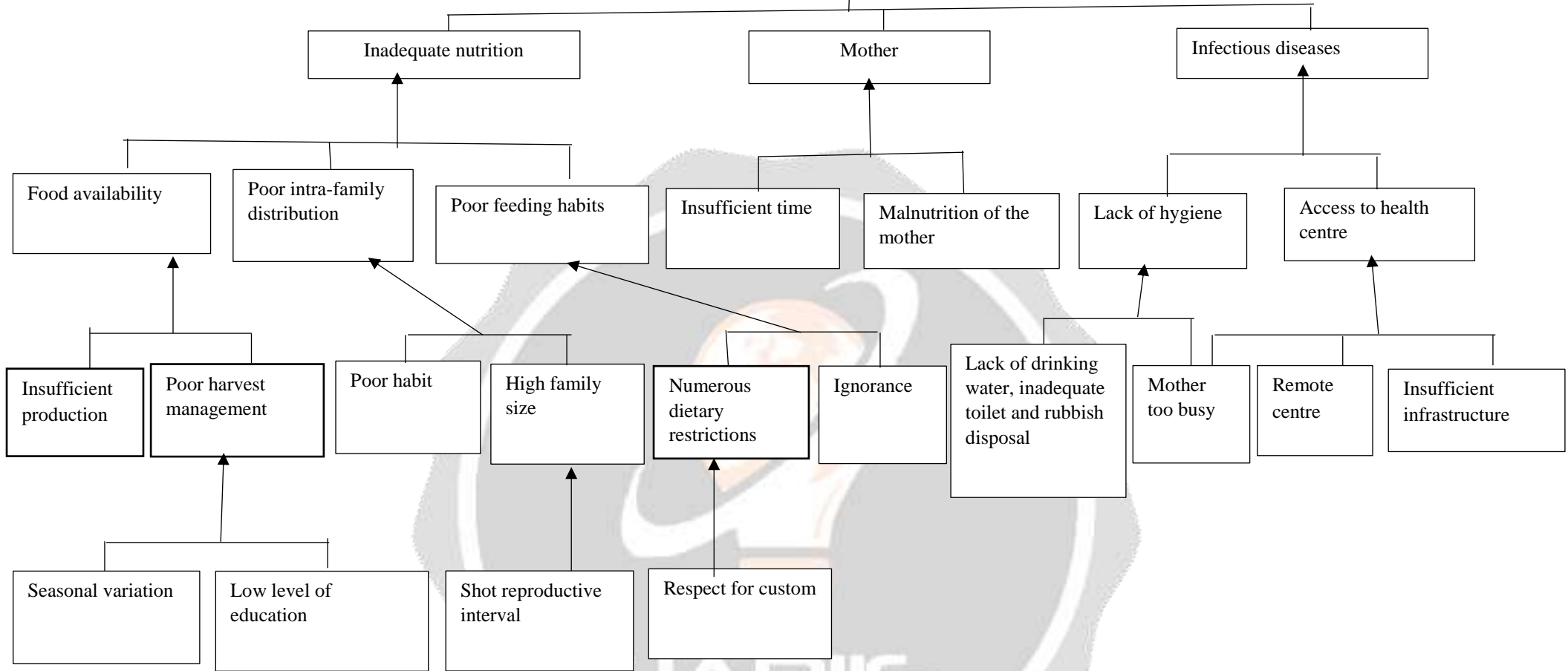


Fig - 2: An example of a causal model of the studied commune

4. CONCLUSION

In conclusion, this survey reveals high prevalence of malnutrition in all its forms, which remains a major problem among young children in Fandriana locality. The prevalence of stunting is particularly high during both periods studied. There are several reasons for this. Thus, the advanced research hypothesis is verified.

Therefore, it is clear that the prevention of malnutrition in infants and children requires a multidisciplinary approach, including the promotion and protection of breastfeeding and the safe preparation and handling of complementary foods. In view of this, the education of mothers on food safety principles is one of the most important interventions to promote the health and nutritional status of infants and children.

As specified by the International Conference on Nutrition, not only food must be available in sufficient quantities, but it must be healthy and of satisfactory nutritional quality.

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