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**OPERATIONAL RESEARCH ON
THE EFFECT OF ASSP HOME VISITS ON
THE NUTRITIONAL PRACTICES OF
BENEFICIARY HOUSEHOLDS AND
THE NUTRITIONAL STATUS OF CHILDREN
OF THESE HOUSEHOLDS**

Study report

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www.hera.eu

Tel +32 3 844 59 30
hera@hera.eu

Laarstraat 43
B-2840 Reet
Belgium



CONTENTS

EXECUTIVE SUMMARY.....	vi
1 INTRODUCTION	1
1.1 OBJECTIVE.....	2
1.2 RESEARCH QUESTIONS.....	2
2 METHODOLOGY.....	3
2.1 DESIGN AND SITE OF THE STUDY	3
2.2 PARTICIPANTS.....	3
2.3 DATA COLLECTED.....	3
2.4 DATA PROCESSING AND ANALYSIS.....	4
2.4.1 QUALITY ASSURANCE	4
2.4.2 GENERAL ANALYSIS PROCESS.....	4
3 RESULTS.....	5
3.1 CHARACTERISTICS OF PARENTS, CHILDREN AND THEIR HOUSEHOLDS	5
3.1.1 WHAT IS THE SOCIO-ECONOMIC-DEMOGRAPHIC PROFILE OR CHARACTERISTICS OF HOUSEHOLDS WITH A MALNOURISHED CHILD?.....	5
3.2 CHANGE IN THE NUTRITIONAL STATUS OF MALNOURISHED CHILDREN	8
3.2.1 DISTRIBUTION OF HOUSEHOLDS BY NUMBER OF MALNOURISHED CHILDREN.....	8
3.2.2 RECOVERY, DROP-OUT AND MORTALITY RATES.....	8
3.2.3 AVERAGE TIME BETWEEN THE 5 HOME VISITS.....	10
3.2.4 LINKS BETWEEN MALNUTRITION AND FACTORS RELATED TO THE CHILD AND THE HOUSEHOLD TO WHICH THEY BELONG	11
3.2.5 RESULTS ON THE DIFFERENT INTERVENTIONS AND THEIR EFFECTS ON THE CHANGE OF THE NUTRITIONAL STATUS	14
3.3 DETERMINANTS OF RECOVERY OF MALNOURISHED CHILDREN	23
4 CONCLUSION	25
5 RECOMMANDATIONS.....	28
6 ANNEXES.....	29
6.1 Annex 1 - References	29
6.2 Annex 2 – IYCF message.....	31
6.3 Annex 3 – Gardening guidelines	32

LIST OF TABLES

Table 1. Household characteristics of malnourished children in North Ubangi from 2015 to 2019	6
Table 2. General characteristics of fathers of malnourished children in North Ubangi from 2015 to 2019 ...	6
Table 3. General characteristics of mothers of malnourished children in North Ubangi from 2015 to 2019 .	7
Table 4. General characteristics of malnourished children in North Ubangi from 2015 to 2019	7
Table 5. Association between certain characteristics of the household, father, mother and child with the recovery of malnourished children in Nord-Ubangi from 2015 to 2019.....	12
Table 6. Association between the cultivation of different foods and the recovery of malnourished children according to the increase in square meters of production	22
Table 7. Association between crop diversity and recovery of malnourished children	23
Table 8. Determinants of recovery for malnourished children	24

LIST OF FIGURES

Figure 1. Distribution of households by number of malnourished children in North Ubangi from 2015 to 2019	8
Figure 2. Distribution of malnourished children by recovery rate at different visits.....	9
Figure 3. Distribution of recovery of malnourished children during the 5 visits by sex.....	9
Figure 4. Distribution of recovery of malnourished children by city of origin	10
Figure 5. Comparison of average time to recovery or non-recovery for malnourished children	10
Figure 6. Average time between visits	11
Figure 7. Distribution of average time between home visits of malnourished children by residential health zone	11
Figure 8. Comparison of the recovery rate between children with and without RUTF in the ASSP intervention in North Ubangi from 2015 to 2019	14
Figure 9. Comparison of the recovery rate between children with and without RTUF in the ASSP intervention the health zones of Bili and Bosobolo from 2015 to 2019	14
Figure 10. Distribution in percentage of mothers/caregivers of malnourished children who have adopted the different nutrition messages in North Ubangi from 2015 to 2019	15
Figure 11. Correlation between adoption of nutrition messages and recovery of nutritional status by malnourished children benefiting from the ASSP project in North Ubangi from 2015-2019	16
Figure 12. Correlation between different nutrition messages and the recovery of nutritional status by malnourished children benefiting from the ASSP project in North Ubangi from 2013-2020	16
Figure 13. Distribution in percentage of consumption of different foods proposed by the project in North Ubangi from 2013-20200	17

Figure 14. Change in weekly frequency of sales of vegetables grown by ASSP beneficiary households in North Ubangi from 2015 to 2019	17
Figure 15. Average number of bundles sold by households growing vegetables in their gardens in North Ubangi from 2015 to 2019	18
Figure 16. Average gain in sales of vegetable bundles by households growing vegetables in their gardens in North Ubangi from 2015 to 2019	18
Figure 17. Changes in the number of perennial plants by households with malnourished children benefiting from the ASSP project in North Ubangi from 2013-2020.....	19
Figure 18. Change in the number of square meters of vegetable flowerbeds by households with malnourished children benefiting from the ASSP project in North Ubangi from 2013-2020.....	20
Figure 19. Change in the number of fruit trees planted by households with malnourished children benefiting from the ASSP project in North Ubangi from 2013-2020	20
Figure 20. Distribution of messages adopted during the different visits.....	21
Figure 21. Correlation between adoption of the gardening message and child recovery.....	21
Figure 22. Correlation between adoption of gardening messages and recovery of malnourished children benefiting from the ASSP project in North-Ubangi province from 2015 to 2019	22

ABRÉVIATIONS

AMV	Anti-Measles Vaccine
ASSP	Accès aux Soins de Santé Primaires (Access to Primary Health Care)
BP	Brachial Perimeter
CI	Confidence Interval
DRC	Democratic Republic of Congo
FC	Franc Congolais (Congolese Franc)
FCDO	Foreign, Commonwealth and Development Office
HF	Home follow-up
HG	Home Gardening
HZ	Health Zone
IMA	IMA World Health
IYCF	Infant and Young Child Feeding
LLINs	Long-Lasting Insecticide-treated Nets
MAM	Moderate Acute Malnutrition
MICS	Multiple Indicator Cluster Survey
MPH	Ministry of Public Health
MUAC	Middle Upper Arm Circumference
OR	Odds Ratio
PCIMA	Prise en Charge Intégrée de la Malnutrition Aïgue (Integrated Management of Acute Malnutrition)
RECO	Relais communautaire (Community Health Worker)
RUTF	Ready-to-Use Therapeutic Food
SAM	Severe Acute Malnutrition
SD	Standard deviation

EXECUTIVE SUMMARY

Background

Malnutrition continues to be one of the main public health problems in the Democratic Republic of Congo (DRC). To help reduce the effects of malnutrition and its consequences, the Access to Primary Health Care (ASSP) project, in its component funded by FCDO (Foreign, Commonwealth and Development Office) and implemented by IMA World Health, focused mainly on nutritional education and counselling of families with malnourished children, using a case management approach, including home gardening education.

Objective

The overall objective was to demonstrate the effect of the different interventions planned as part of the ASSP project and carried out by the Community Relays (RECOs) on the development of malnourished children of the beneficiary households.

Method

This research aims to analyse the different effects of the project using data collected from families with malnourished children in the 11 health zones of North Ubangi. It is therefore a "non-experimental" study. The duration of follow-up by the RECOs was approximately 3 months for each household. Follow-up of malnourished children through home visits took place from 2013 to 2019.

The data collected was analysed to produce relative frequencies as well as mean and standard deviation to describe study variables. Bivariate analyses, mainly the Chi-square test and Student's t-test, were conducted to look for associations between recovery status and potential explanatory variables.

Results

a. Characteristics of parents, children, and their households

- Households in this study had an average size of 7.3 ± 5.8 people, were mostly owners of their own homes (90.9%) and had latrines (78%) with washable floors (19%). Most of these households did not have a radio (66.2%), a mobile phone (72.3%) or a bicycle (52.7%).
- Three-quarters of fathers did not have a level of education higher than primary school. In 72.6% of cases, they had an average age of 35.5 ± 8.9 years and 45.4% were farmers. Mothers had an average age of 28.4 ± 6.4 years with no more than primary education in 90.6% of cases. They were mostly unemployed (63.7%), married or living in a common-law union (90.9%), non-pregnant (84.3%).
- The malnourished children in North-Ubangi in our study were mostly boys (53.1%), with an average age of 2.1 ± 1.3 years. The mean age of cessation of breastfeeding was 15.4 ± 9.1 months and the mean age of starting introduction of complementary food was 4.9 ± 3.1 months. The average age of the caregiver was 21.3 ± 16.5 months. These children were mostly the mother's biological children (93.6%), had been vaccinated against measles (89.8%), had received vitamin A supplementation (90.8%), had received Mebendazole (79.7%), were sleeping under the long-lasting insecticide-treated mosquito nets (82%) and had not benefited from integrated management of acute malnutrition (IMAM) (59.3%).

b. Changes in the nutritional status of malnourished children

- Most children were the only ones in the household to suffer from malnutrition (79%); about two households out of ten had at least two children suffering from malnutrition.
- More than eight out of ten children (84.1%) had recovered from malnutrition. The recovery of these malnourished children was similar between girls and boys with a recovery rate of 85% and 83%, respectively.

- As for the Health Zones (ZS), the recovery rate was highest in the HZ of Bosobolo, (92.9%) and Bili (92.9%) while it was lowest in the HZ of Mobayi (71.5%).
 - The average period of the visits was 60 days with 15 days interval between the different visits.
- c. *Links between malnutrition and factors related to the child and the household*
- The age of the father was associated with the recovery of malnourished children. Children, whose fathers were 24 years or younger, were half as likely to recover from malnutrition (OR: 0.48; 95% CI: 0.37-0.9).
 - Children who had stopped breastfeeding at 9 months or earlier were about half as likely to recover (OR: 0.48; 95% CI: 0.34-0.69).
 - The existence of a latrine (86%; OR=1.58; 95% CI: 1.15-2.17) increased the likelihood of recovery from malnutrition by 50%.
- d. *Different interventions and their effects on changes in nutritional status*
- Nutritional message
 - The intervention strengthened household knowledge about infant and young child feeding. These messages differed by age group (A: 0 to less than 6 months; B: 6 to less than 9 months; C: 9 to less than 12 months; D: 12 to less than 24 months; E: to pregnant/breastfeeding women) (see details on messages in Annex 6.2). At the end of the 5th visit, at least 8 out of 10 women had adopted the different nutrition messages, with messages A and C being the most adopted, with 91% and 92% respectively.
 - Messages A (84% vs. 45%, P=0.008) and D (87% vs. 69%, P<0.0001) were significantly more correlated with recovery.
 - Message on gardening
 - During the five visits to households, vegetable consumption increased by 26%, followed by consumption of moringa powder (+24.7%). Consumption of chaya, which was already lower at the start, had the lowest increase at 4.7%. Consumption of moringa leaves and potatoes also improved with 17.8% and 12.1% respectively. It is important to note, however, that apart from vegetable consumption (57%), no food item exceeded 50% consumption.
 - The sale of vegetables grown in gardens by the household increased from 6.8% to 21.8%.
 - The number of bundles increased by 9 bundles after the five visits. The average gain from selling cultivated vegetables by the household was 1,450 Congolese francs (FC), an improvement of 850 FC from the first to the fifth visit.
 - The number of trees of moringa cultivation increased by at least one tree during the visits from 24.5% during the first visit to 49.9% during the fifth visit. More generally, less than half of the households adopted the cultivation of these plants.
 - The cultivation of matembele, bitekuteku and cassava respectively increased by 21%, with 19% and 10% of households increasing the cultivation of these vegetables by at least one flowerbed.
 - The number of fruit trees planted increased slightly by 5% and 3% for banana and papaya, respectively of the number of households having planted at least one fruit tree.
 - Among households with no limiting factors, adoption increased from 39% to 56% (+17%). For the others where at least one limiting factor was found, message adoption increased by 17%, 14% and 11% respectively for households that lacked space to grow crops, water, or both.
 - Crop diversity of at least 2 plants increased by at least 2 times the probability of recovery from malnutrition.

e. *Determinants of recovery for malnourished children*

- The age of the father: children whose fathers were 24 years old or younger were 2.6 times less likely to recover.
- Breastfeeding cessation: stopping breastfeeding at 9 months or less reduced the chance of recovery by 2.3 times.
- Mebendazole supplementation increased the chance of recovery from malnutrition in children by 2.8 times.
- Benefiting from Integrated Management of Acute Malnutrition (IMAM) reduced, paradoxically, the chance of recovery by 2 times.
- Adopting the nutrition message increased the chance of recovery from both moderate and severe malnutrition in malnourished children by 2.5 times.
- The severity of nutritional status at baseline was the most important factor influencing the child's recovery. Children with moderate malnutrition had a 2.6 greater chance of recovery.

Conclusion

ASSP's intervention was effective as it provided solutions that were easy to adopt and sustainable for the beneficiary communities.

Recommendations

On the intervention

- Conduct qualitative studies on the acceptability of certain products proposed that are not commonly consumed by beneficiary communities. These include chaya and moringa.
- Strengthen measures for children suffering from more severe forms of malnutrition.
- Put in place interventions targeting capacity building for fathers, particularly the youngest fathers, on child nutrition.
- Propose other interventions including those related to water, hygiene and sanitation to enable community members to know how to manage waste.
- Conduct a study on the recovery rate of children who have benefited from Integrated Management of Acute Malnutrition (IMAM) with a ready-to-use therapeutic food (RUTF) and those who have not, and between Plumpy'Nut and locally prepared RUTFs, in order to better understand the impact of these different products on the improvement of children's nutritional status.

On data collection

- Upgrading of RECOs on data collection.
- Involve health personnel in the collection of other anthropometric parameters, particularly height and weight.
- Set up a mechanism for regular monitoring and supervision of activities.

1 INTRODUCTION

Malnutrition continues to be one of the main public health problems in the Democratic Republic of Congo (DRC). The 2017/2018 Multiple Indicator Cluster Survey (MICS) for the DRC revealed acute malnutrition of 7% among children under five years of age; this represents a decrease of only 1% compared to the 2014 Demographic and Health Survey (DHS) study ((MPSMRM), (MSP), & International, 2014; INS, 2018). Underweight remained stagnant at 23%. Chronic malnutrition decreased by only 1% between 2014 and 2018, from 43% to 42%. In the central region of Kasai, the rate of chronic malnutrition is 54%, which is higher than the national average. According to MICS 2017/2018, stunting starts earlier. For children under six months of age, one child in five already suffers from chronic malnutrition. The Ministry of Public Health (MPH) estimates that 51% of infant mortality in the DRC is directly or indirectly attributable to malnutrition (INS, 2018).

The nutrition component of the previous Accès aux Soins de Santé Primaire (ASSP) (Access to Primary Health Care) project, funded by Foreign, Commonwealth and Development Office (FCDO) and implemented by IMA World Health, focused mainly on nutritional education and counselling of families with malnourished children, using a case management approach, including education on home gardening. During the ASSP project, 373,462 children with a MUAC (Middle Upper Arm Circumference) code reading <125 mm were counselled at home by a qualified specialist, a relais communautaire (RECO, Community Health Worker) trained in Infant and Young Child Feeding (IYCF), gardening, and follow-up of malnourished children through home through home visits. Over the life of the project, 261,423 children recovered with a Middle Upper Arm Circumference of 125 mm or more (70.3%). Most of these children did not receive any Ready-to-Use Therapeutic Food (RUTF). The ASSP preliminary study on the recovery rates of children in North Ubangi was 74% for Severe Acute Malnutrition (SAM) and 88% for Moderate Acute Malnutrition (MAM). During the ASSP programme, prevention activities and the rehabilitation of children with MAM & SAM through counselling on Infant and Young Child Feeding (IYCF) during home visits cost approximately \$6.50 to \$12.00 per child, compared to \$100 to \$117 for treatment with RUTF.

Another indicator monitored was the proxy prevalence rate. During the ASSP, 4,750,883 children were screened, and 438,016 children were referred to health centers with a MUAC reading of less than 125 mm. The indirect prevalence rate initially decreased in all project health zones but increased again in Kasai and Central Kasai during the Kamwina Nsapu crisis, further exacerbated by the expulsion of Congolese from Angola. At the same time, indirect prevalence rates have steadily decreased in North Ubangi and Maniema. However, the Tulane study did not reveal a significant decrease in malnutrition in the ASSP-supported health zones (Eisele, Wisniewski, & Yongho, 2019). This may indicate that where RECOs were active, there was a localised impact, but that the number of RECOs and their reach was not sufficient to make a measurable change in relation to the total population.

During the ASSP programme funded by FCDO, RECOs were trained on:

- Infant and young child feeding (IYCF).
- Home Gardening (HG). RECOs were trained on basic vegetable garden practices and the advantages of having a vegetable garden. The training focused on 20 square meters of perennials (cassava (*Manihot esculenta* & *Manihot glaziovii*), moringa (*Moringa oleifera*) & chaya (*Cnidocolus chayamansa*) and 20 square meters of annuals, thus short duration (biteku-teku (*amaranthes* sp.), ngayi ngayi (*Hibiscus acetosella* & *Hibiscus sabdariffa* etc.) etc.) plus fruit trees. Two new nutritious plants were introduced: *Moringa oleifera* and *Chaya chayamansa*.
- Home follow-up (HF): the training covered how to conduct home visits and fill in the forms.

RECOs made five home visits to families with malnourished children. These five visits were conducted over a period of 3 months, with an interval of about two weeks between each visit. The data from each visit was recorded on the SAD form.

The aim of the home visits was to help the family to adopt positive deviant behaviours over time and to achieve a sustainable reduction in malnutrition not only for the child in question, but for the other children in the household and for children born in the future in those households, and avoid relaps..

This research set out to analyse the data collected during these different visits over the period 2015-2019.

1.1 OBJECTIVES

The general objective is to demonstrate the effect of the different interventions planned as part of the ASSP project and carried out by the RECOs in the communities on the development of malnourished children of these beneficiary households.

1.2 RESEARCH QUESTIONS

The main question of the study was: “Based on the data collected, which messages or actions had the greatest impact on the recovery of malnourished children from households benefiting from interventions by the project in the community?”

Other questions under consideration are the following:

ON MALNOURISHED CHILDREN AND THEIR HOUSEHOLDS

1. What is the socio-economic-demographic profile or characteristics of households with a malnourished child?
2. Is malnutrition clustered? How many malnourished children had a sibling who was also malnourished? What is the percentage of households with more than one malnourished child?
3. How many mothers of malnourished children are also pregnant?
4. What is the average age of mothers with malnourished children? What is the average age of fathers of malnourished children?
5. What are the rates of recovery, default from the programme and mortality?
6. What was the average time between the 5 home visits for all?
7. Among those who have recovered, what was the average time between 5 home visits.
8. Among those who did not recover, what was the average time between the 5 home visits?
9. What is the recovery rate of malnourished children who received RUTF?
10. What was the same rate of recovery among those who did not receive it (RUTF)?

NUTRITION MESSAGING

11. Which nutrition message was most easily adopted?
12. Which nutrition message was most correlated with a positive outcome?

GARDEN MESSAGES

13. What message about the garden was most readily adopted?
14. Which message about the garden was most likely to have a positive outcome?
15. What was the recovery rate based on the intensity of the increase in square meters of production?
16. What was the recovery rate based on the intensity of the increasing diversity of crop plants?

2 METHODOLOGY

2.1 DESIGN AND SITE OF THE STUDY

This research set out to analyse the different effects of the project conducted using data collected on families with malnourished children in the 11 health zones of North Ubangi during the period 2015-2019. It is therefore a "non-experimental" study, with no control group or randomization, which allowed to better understand implementation as well as to determine the impact of different interventions carried out by IMA with FCDO funding, on the change in nutritional status of the malnourished children benefiting from the project.

2.2 PARTICIPANTS

The DHIS2 IMA shows that between April 2016 and March 2019, in North Ubangi, 29,848 children with a MUAC perimeter less than 125 mm and/or oedema benefited from five home visits by a RECO and received various interventions to correct the problem of malnutrition. Among these 29,848 children, a total of 20,209 children (68%) recovered with MUAC = or > 125mm and without oedema after five follow-up home visits. And 8,985 children (30%) did not recover with PB < 125mm and/or oedema.

A total of 1,835 household home follow-up forms, with at least one malnourished child who were followed up by a RECO, were sent to Kinshasa for analysis. 373 of these forms are not completed in full but are nevertheless considered useful for extracting information on the profile of households in relation to MUAC measures. The forms come from all 11 health zones in North-Ubangi. The duration of follow-up was approximately three months for each household. Home visit follow-up of malnourished children was conducted from 2015 to 2019, but most of the forms are for the period 2016 - 2018 during which the intervention was scaled up across the province.

2.3 DATA COLLECTED

The forms were used to collect the following data:

1. Baseline data on the child and the household at the 1st visit.
2. MUAC (brachial perimeter) measures taken by RECO at each of the five home visits (malnourished child in question and other children at home between 6 and 59 months).
3. Weight and height of the malnourished child taken at the health centre at the beginning and at the 5th visit.
4. Baseline information about the vegetable garden.
5. Production and consumption of the family garden at each of the 5 home visits.
6. Messages specific to each home visit on IYCF and home gardening. The nutritional messages were adapted to the age of the child. The gardening messages were adapted to the limiting factor identified by the family for the adoption of the gardens.

2.4 DATA PROCESSING AND ANALYSIS

2.4.1 QUALITY ASSURANCE

Data entry conditions are not known. However, a preliminary quality control of data has been conducted prior to their exploration to detect possible aberrant data. A trend of outliers from one data entry or data collection officer triggered the records to be re-entered by another officer. The cleaned data baseline is available for possible cross-checking of the results by IMA or FCDO analysts. Prior to submission, all deliverables have been subjected to a thorough quality control in accordance with the quality assurance process as described in the TPM Inception Report to ensure all expectations are met. All deliverables were reviewed after considering and incorporating comments and feedback of IMA and FCDO to ensure high quality reports. Each report is not only subjected to a technical review, but also to a revision process regarding language, spelling, and format.

2.4.2 GENERAL ANALYSIS PROCESS

The collected data were analysed to produce relative frequencies as well as mean and standard deviation, to summarise and describe the collected data. The results were presented in tables and figures. Results related to malnutrition were presented in a general way and stratified by sex of malnourished children. Bivariate analyses, mainly the chi-square test and the Student t-test, were conducted to look for associations between recovery from malnutrition and potential explanatory variables:

1. Malnutrition and the age of breastfeeding cessation
2. The onset of malnutrition and complementary foods at age
3. Malnutrition and mother's age
4. Malnutrition and father's age
5. Malnutrition and pregnancy status of the mother
6. Malnutrition and age of guardian (i.e., <16 or> 16)
7. Malnutrition and number of meals per day c
8. Malnutrition and source of drinking water
9. Malnutrition and type of WC installation (latrine exists, latrine with washable floor etc.)
10. Malnutrition and square meters of garden
11. Malnutrition and crop diversity
12. Malnutrition and the existence of a moringa tree and chaya plants
13. Malnutrition and the existence of papaya trees

The indicators identified as significant were analysed using regression analysis. The associations found were adjusted, using binary logistic regression, to confirm the independence of the associations for the effects of:

1. Vaccination
2. Vitamin A supplement
3. Treatment of intestinal worms
4. Sleeps under a mosquito net
5. Economic indicator
6. Education
7. Treatment with RUTF

Student's chi-square and t-tests for matched data were also used to compare proportions and means between the beginning and end of follow-up, respectively. These are essentially:

1. Changes in feeding practices, including adoption of enriched porridge, and adoption of a 4-star meal (a meal prepared with local products and recipes to feed children without spending a lot of money,

exclusive breastfeeding during the first 6 months, and number of months of continuous breastfeeding, frequency of meals or complementary meals

2. Change in the adoption of gardens (increasing diversity and increasing production)

We used SPSS 23.0 software for this quantitative analysis.

3 RESULTS

The results presented below concern 1,639 households, of which 1,063 with complete data and 576 with partial data. The sample of children was 1,872 malnourished children, 1,144 with complete data and 728 with partial data. It should be noted, however, that several pieces of information were missing from several files, even if they were supposed to be complete. We therefore present these results by specifying, for different variables, the number of available data on which the analyses were based.

The results are presented in sections as follows:

1. Characteristics of parents, children, and the households to which they belong
2. Changes in the nutritional status of malnourished children
3. Results on the different interventions and their effects on changes in nutritional status
4. Determinants of changes in nutritional status

Each section is organised into subsections corresponding to different questions presented in the terms of reference of this study.

3.1 CHARACTERISTICS OF PARENTS, CHILDREN AND THEIR HOUSEHOLDS

3.1.1 WHAT IS THE SOCIO-ECONOMIC-DEMOGRAPHIC PROFILE OR CHARACTERISTICS OF HOUSEHOLDS WITH A MALNOURISHED CHILD?

The households in this study (see Table 1) had an average size of 7.3 ± 5.8 people, were predominantly homeowners (90.9%) who owned latrines (78%) with paved floors (19%). Most of these households did not have a radio (66.2%), a mobile phone (72.3%) or a bicycle (52.7%).

Three-quarters of fathers did not have a level of education higher than primary school. In 72.6% of cases, they had an average age of 35.5 ± 8.9 years and were farmers in 45.4% (Table 2). Mothers had an average age of 28.4 ± 6.4 years with no more than primary education in 90.6% of cases. They were predominantly unemployed (63.7%), married or living in a common-law union (90.9%), non-pregnant (84.3%) (Table 3).

In our study, the malnourished children in North-Ubangi were mostly boys (53.1%), had an average age of 2.1 ± 1.3 years. The mean age of breastfeeding cessation was 15.4 ± 9.1 months and the mean age of starting introduction of complementary food was 4.9 ± 3.1 months. The average age of the caregiver was 21.3 ± 16.5 months. These children were mainly the mother's biological children (93.6%), had been vaccinated against measles (89.8%), had received vitamin A supplementation (90.8%), had received Mebendazole (79.7%), were sleeping under a long-lasting insecticidal net (82%) and had not benefited from integrated management of acute malnutrition (59.3%) (Table 4).

Table 1. Household characteristics of malnourished children in North Ubangi from 2015 to 2019

Variables	Modalities	n	%
Size of household	M (SD)	7.3	(5.8)
Is a tenant	Yes	144	9.1%
	No	1438	90.9%
	Total	1582	100.0%
Existence of latrines	Yes	1228	78.0%
	No	347	22.0%
	Total	1575	100.0%
Latrines with paved floors	Yes	233	19.0%
	No	995	81.0%
	Total	1228	100.0%
Possession of a radio	Yes	195	33.8%
	No	382	66.2%
	Total	577	100.0%
Possession of a mobile phone	Yes	159	27.7%
	No	415	72.3%
	Total	574	100.0%
Possession of a bicycle	Yes	280	47.3%
	No	312	52.7%
	Total	592	100.0%

Table 2. General characteristics of fathers of malnourished children in North Ubangi from 2015 to 2019

Variables	Modalities	n	%
Father's age	M (SD)	35.5	(8.9 years)
Father's level of education	None	249	16.6%
	Primary	845	56.3%
	High school	373	24.8%
	College/University	34	2.3%
	Total	1501	100%
Father's occupation	Unemployed	248	16.6%
	Worker	249	16.6%
	Farmer	680	45.4%
	Independent	144	9.6%
	Teacher	34	2.3%
	Other	143	9.5%
	M (SD)	1498	100%

Table 3. General characteristics of mothers of malnourished children in North Ubangi from 2015 to 2019

Variables	Modalities	n	%
Mother's age	M (SD)	28.4	(6.4 years)
Mother's level of education	None	437	30.0%
	Primary	884	60.6%
	High school	134	9.2%
	College/University	3	0.2%
	Total	1458	100%
Mother's occupation	Unemployed	993	63.7%
	Worker	133	8.5%
	Farmer	348	22.3%
	Independent	70	4.5%
	Teacher	14	0.9%
	Total	1558	100%
Marital status	Married or living in a relationship	1283	90.9%
	Single	128	9.1%
	Total	1411	100%
Is pregnant	Yes	250	15.7%
	No	1340	84.3%
	Total	1590	100%

Table 4. General characteristics of malnourished children in North Ubangi from 2015 to 2019

Variables	Modalities	n	%
Sex	Boys	927	53.1%
	Girls	819	46.9%
	Total	1746	100%
Child's age	M (SD)	2.1	(1.3 years)
Breastfeeding cessation age	M (SD)	15.4	(9.1 months)
Age of introduction of complementary food	M (SD)	4.9	(3.1 months)
Caregiver's age	M (SD)	21.3	(16.5 years)
Biological child of the mother?	Yes	1627	93.6%
	No	111	6.4%
	Total	1738	100%
Is the Child vaccinated against measles (VAR)?	Yes	1566	89.8%
	No	178	10.2%
	Total	1744	100%
Vit A supplementation	Yes	1581	90.8%
	No	160	9.2%
	Total	1741	100%
Mebendazole	Yes	1375	79.7%
	No	351	20.3%

Variables	Modalities	n	%
	Total	1726	100%
Sleeps under LLINs	Yes	1432	82%
	No	314	18%
	Total	1746	100%
Supported through IMAM	Yes	653	40.7%
	No	951	59.3%
	Total	1604	100%

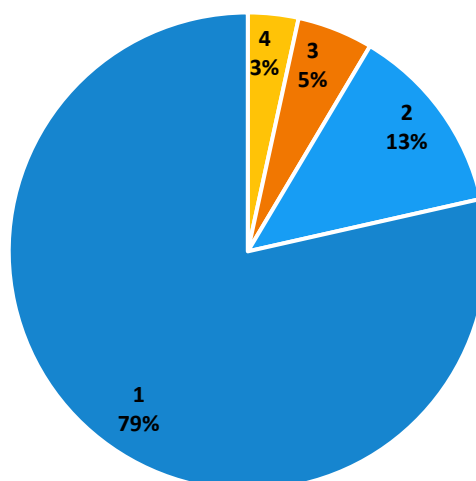
Notes: The specific data on the type of food given under the IMAM are not known

3.2 CHANGE IN THE NUTRITIONAL STATUS OF MALNOURISHED CHILDREN

3.2.1 DISTRIBUTION OF HOUSEHOLDS BY NUMBER OF MALNOURISHED CHILDREN

Most children were the only malnourished children (79%) in the household; about two out of ten households had at least two malnourished children (Figure 1).

Figure 1. Distribution of households by number of malnourished children in North Ubangi from 2015 to 2019



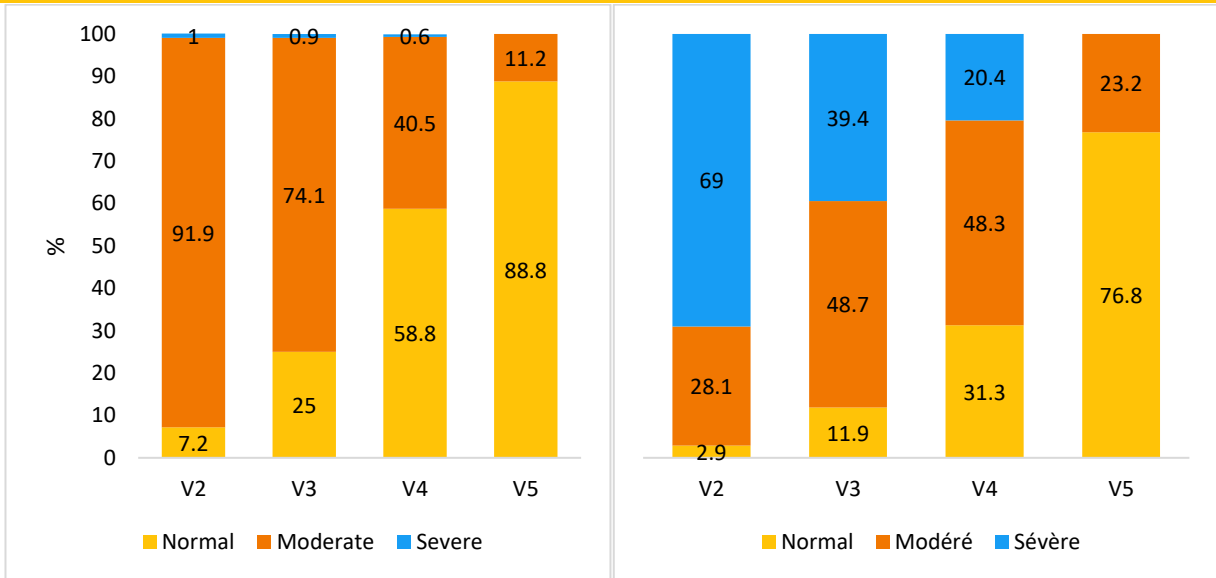
3.2.2 RECOVERY, DROP-OUT AND MORTALITY RATES

The data analysed concerns 1,581 children who had information on MUAC and oedema at the 5th visit. Information on the exit code at the 5th visit is not reported as only data from 549 children with related information were available. However, it should be added that only 6 deaths (out of 549 children) were reported.

More than eight in ten children (88.8%) had recovered from malnutrition in the groups of children with MAM while this proportion was 76.8 in the group of children with SAM. (Figure 2). The recovery of these malnourished children was similar between girls and boys with a recovery rate of 85% and 83%, respectively (Figure 3).

As for the health zones (HZ), the recovery rate was highest in the Bosobolo (92.9%) and Bili (92.9%) ZS while it was lowest in the Mobayi ZS (71.5%) (Figure 4).

Figure 2. Distribution of malnourished children by recovery rate at different visits



Moderate at baseline

Severe at baseline

Figure 3. Distribution of recovery of malnourished children during the 5 visits by sex

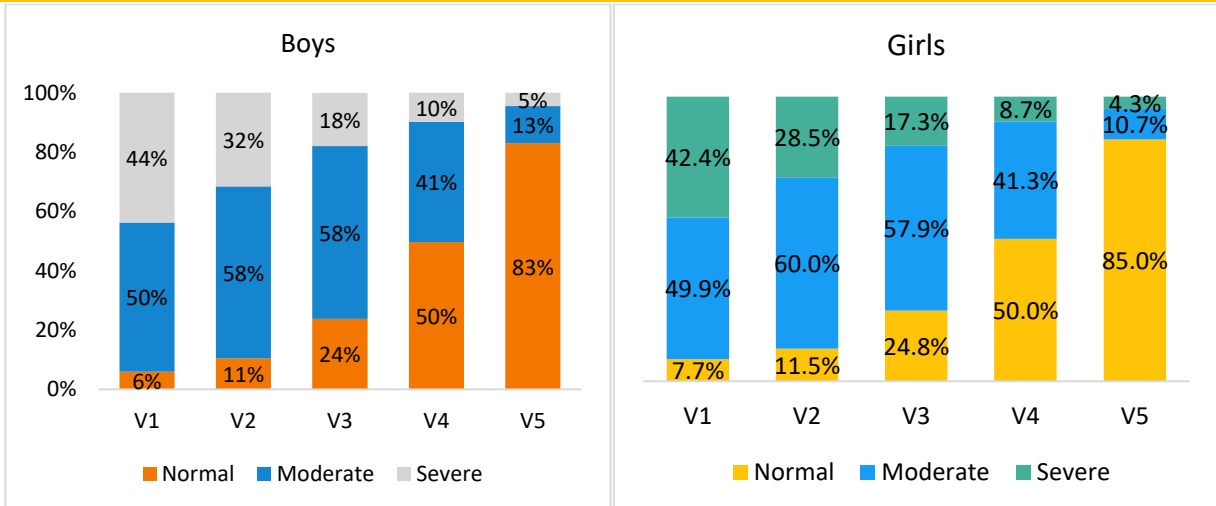
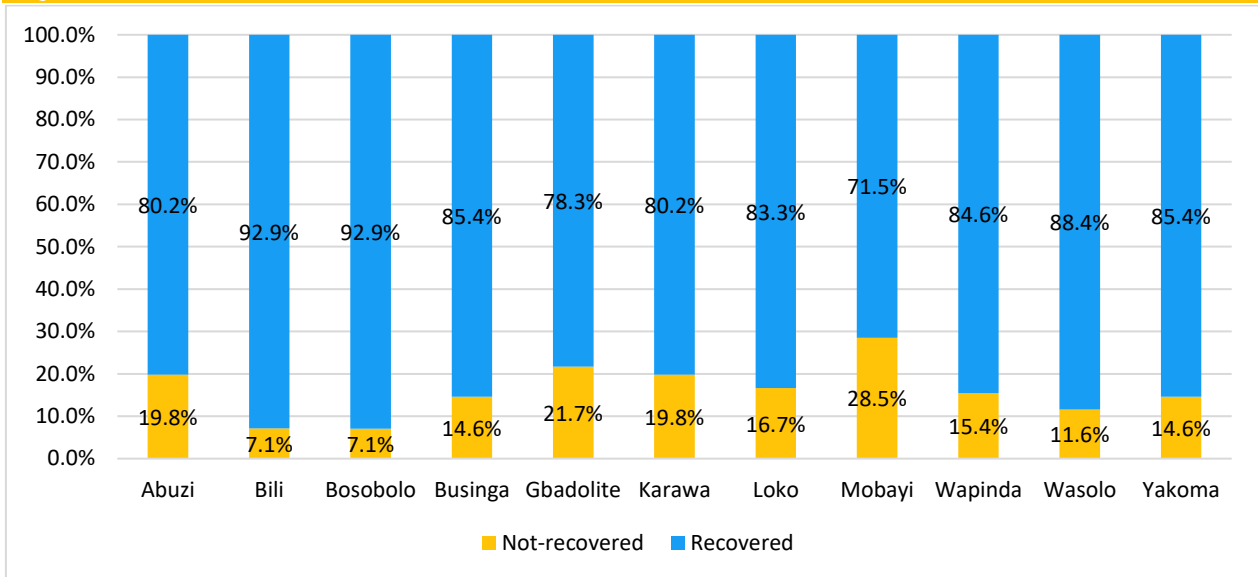


Figure 4. Distribution of recovery of malnourished children by city of origin



3.2.3 AVERAGE TIME BETWEEN THE 5 HOME VISITS

In general, considering all home visits, it was found that the average length of visits was similar ($p=0.407$) among the group of children who recovered and those who did not recover; a total duration of 60 days (Figure 5) with 15 days between visits (Figure 6).

While the duration between visits in the different HZs averaged 15 days, the Bosobolo visit varied from 21 days, 24 days, and 25 days at the first, second, and fourth visit, respectively.

Figure 5. Comparison of average time to recovery or non-recovery for malnourished children

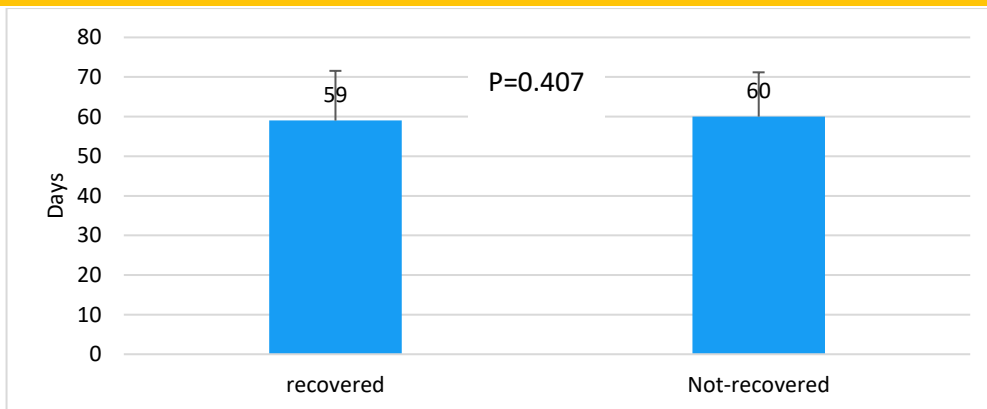


Figure 6. Average time between visits

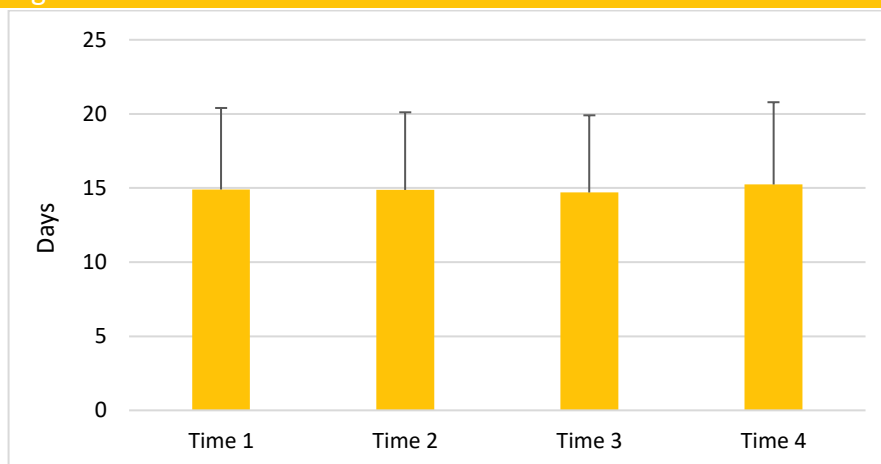
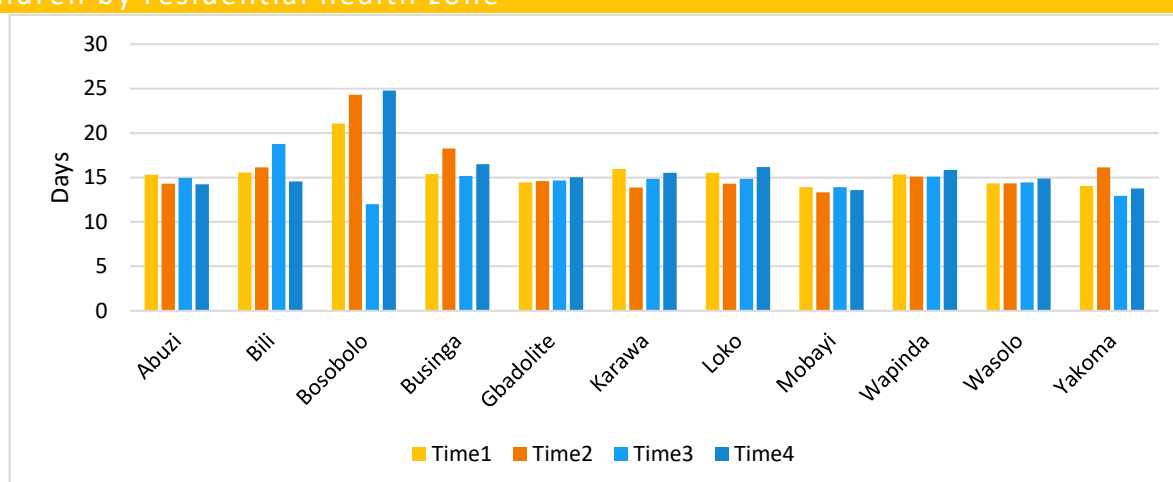


Figure 7. Distribution of average time between home visits of malnourished children by residential health zone



3.2.4 LINKS BETWEEN MALNUTRITION AND FACTORS RELATED TO THE CHILD AND THE HOUSEHOLD TO WHICH THEY BELONG

3.2.4.1 Association between characteristics of households with malnourished children and child recovery

For this analysis, some quantitative variables (age of father, mother, caregiver, introduction of complementary food and cessation of breastfeeding) were transformed into categorical variables. The different categorisation cut-offs were decided following several scenarios to detect possible differences between groups. Results of these analyses show that:

- Father's age was associated with recovery of malnourished children. Children whose fathers were 24 years of age or younger were half as likely to recover from malnutrition (Odds Ratio (OR): 0.48; 95% CI: 0.37-0.9).
- Children who had stopped breastfeeding at 9 months or earlier were half as likely to recover (OR: 0.48; 95% CI: 0.34-0.69).
- The existence of a latrine (86%; OR=1.58; 95% CI: 1.15-2.17) increased the chances of recovery from malnutrition by 50% (Table 5).

Table 5. Association between certain characteristics of the household, father, mother and child with the recovery of malnourished children in Nord-Ubangi from 2015 to 2019

Variables	Modalities	Recovery		Total	OR	CI 95%	
		Yes	No			Lower	Upper
Father's age (categories)	≤ 24 years	82 (77.4%)	24 (22.6%)	106 (100%)	0.48	0.37	0.9
	≥ 25 years	1177 (85.3%)	203 (14.7%)	1380 (100%)			
	Total	1259 (84.7%)	227 (15.3%)	1486 (100%)			
Mother's age (categories)	≤ 17 years	14 (77.8%)	4 (22.2%)	18 (100%)	0.62	0.20	1.91
	≥ 18 years	1254 (84.9%)	223 (15.1%)	1477 (100%)			
	Total	1268 (84.8%)	227 (15.2%)	1495 (100%)			
	≥ 10 years	675 (83.0%)	138 (17%)	813 (100%)			
	Total	930 (84.4%)	171 (15.5%)	1101 (100%)			
Age of breastfeeding cessation	≤ 9 months	201 (77%)	60 (23%)	261	0.48	0.34	0.69
	≥ 10 months	691 (87.5%)	99 (12.5%)	790			
	Total	892 (84.9%)	159 (15.1%)	1051			
Age of introduction of complementary food	≤ 4 months	607 (82.9%)	125 (17.1%)	732 (100%)	0.73	0.53	1.01
	≥ 5 months	433 (86.9%)	65 (13.1%)	498 (100%)			
	Total	1040 (84.6%)	190 (15.4%)	1230 (100%)			
Pregnant mother	Yes	197 (83%)	41 (17%)	238 (100%)	0.86	0.60	1.25
	No	1098 (84%)	197 (16%)	1295 (100%)			
	Total	1295 (84%)	238 (16%)	1533 (100%)			
Living with both parents	Yes	1054 (85%)	183 (15%)	1237 (100%)	1.33	0.95	1.85
	No	243 (81%)	56 (19%)	299 (100%)			

Variables	Modalités	Recovery		Total	OR	CI 95%	
		Yes	No			Lower	Upper
	Total	1 297 (84%)	239 (16%)	1 536 (100%)			
Living with his/her mother	Yes	1 263 (84%)	232 (16%)	1 495 (100%)	1.12	0.49	2.56
	No	34 (83%)	7 (17%)	41 (100%)			
	Total	1 297 (83%)	239 (17%)	1 536 (100%)			
	No	805 (87%)	119 (13%)	924 (100%)	1.79	1.33	2.40
	Total	1 176 (84%)	217 (16%)	1 393 (100%)			
Existence of a latrine	Yes	1 039 (86%)	173 (14%)	1 212 (100%)	1.58	1.15	2.17
	No	247 (79%)	65 (21%)	312 (100%)			
	Total	1 286 (84%)	238 (16%)	1 524 (100%)			
Existence of a washable latrine	Yes	205 (83%)	41 (17%)	246 (100%)	0.90	0.62	1.29
	No	1 078 (85%)	193 (15%)	1 271 (100%)			
	Total	1 283 (85%)	234 (15%)	1 517 (100%)			

3.2.4.2 Recovery rate of malnourished children who received PCIMA

When we compare malnourished children who recovered and benefited from Integrated Management of Acute Malnutrition (IMAM) with or without Ready-to-use Therapeutic Food (RUTF) with those who did not receive it, we note that the recovery was greater for those who did not benefit from an integrated management of acute malnutrition, $P < 0.0001$ in the group of children suffering from MAM but still benefiting from this treatment. However, no difference was found between children with severe acute malnutrition (SAM) who received or did not receive RUTF (Figure 8). We restricted the analyses to only the Bili and Bosobolo health zones where Plumpy'Nut was used and did not find statistically significant difference in children's recovery whether with MAM or SAM children (Figure 9).

Figure 8. Comparison of the recovery rate between children with and without RUTF in the ASSP intervention in North Ubangi from 2015 to 2019

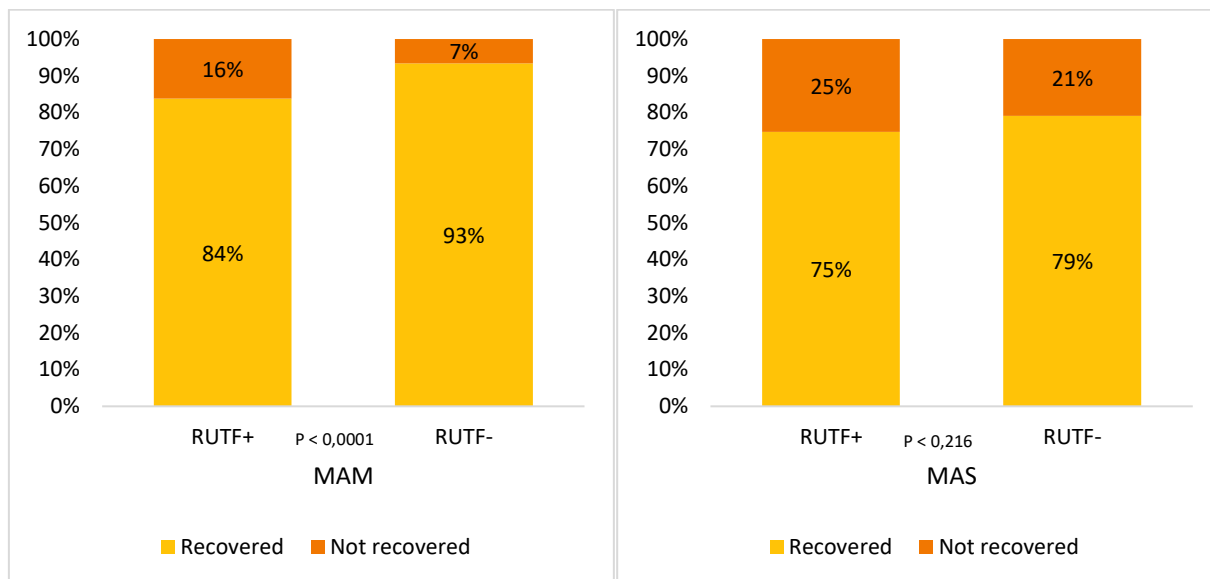
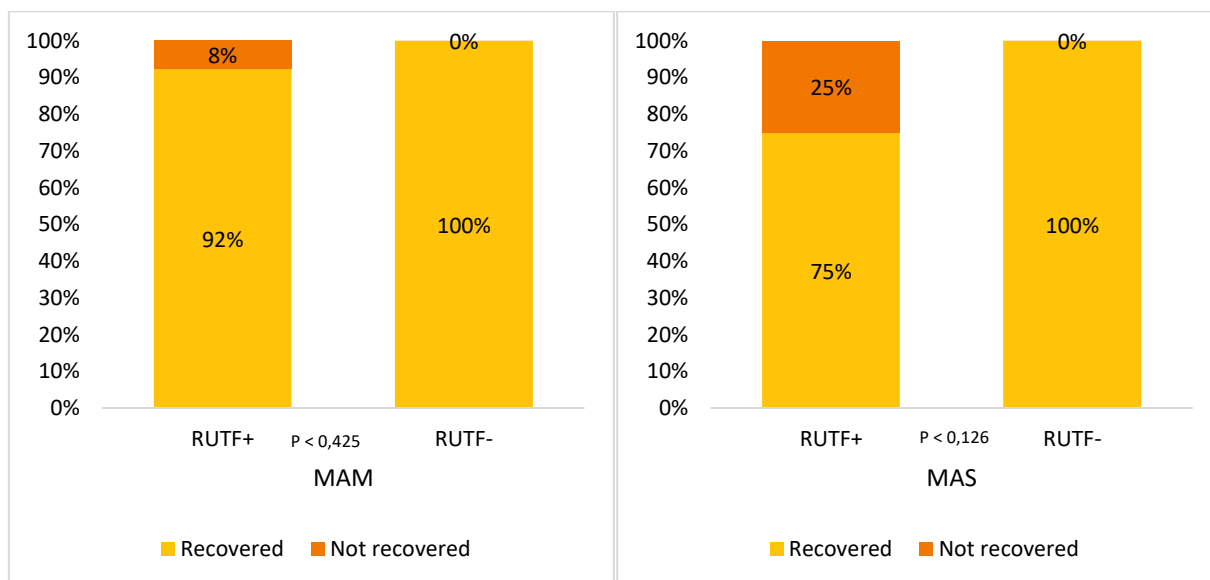


Figure 9. Comparison of the recovery rate between children with and without RTUF in the ASSP intervention the health zones of Bili and Bosobolo from 2015 to 2019



3.2.5 RESULTS ON THE DIFFERENT INTERVENTIONS AND THEIR EFFECTS ON THE CHANGE OF THE NUTRITIONAL STATUS

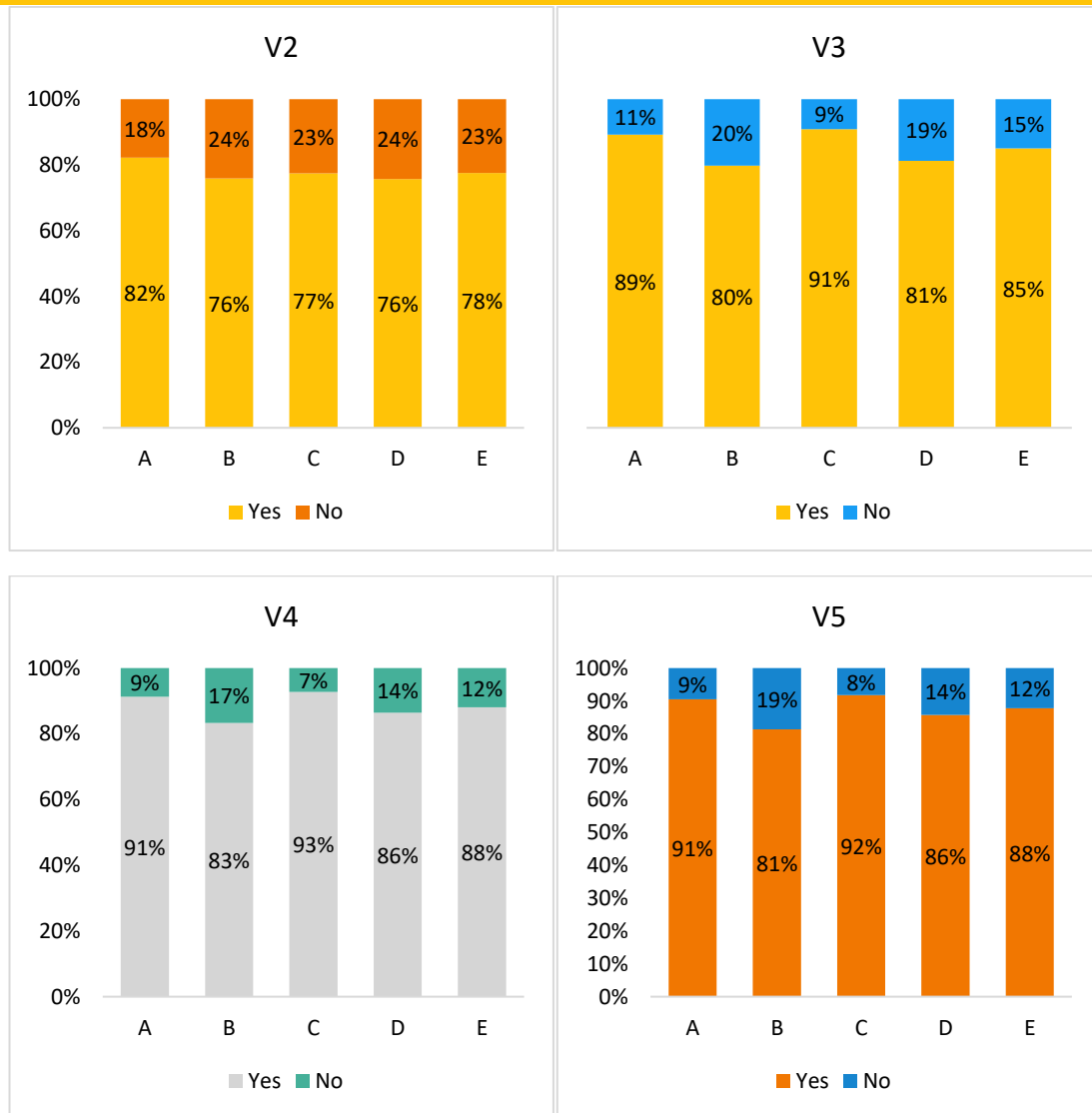
3.2.5.1 NUTRITION MESSAGE

3.2.5.1.1 Which nutrition message was most readily adopted?

Concerning the nutrition message disseminated during the visits: the messages targeted children according to their age groups (A: 0 to less than 6 months; B: 6 to less than 9 months; C: 9 to less than 12 months; D: 12

to less than 24 months; E: to pregnant women) and offered messages on child nutrition that evolved with the different visits (see details on messages in Annex 6.2). Message C (+15%) was the most adopted while message B was less so. The other messages A, D, and E had a similar progression in their adoption; an improvement of at least 10%. By the end of the 5th visit, at least 8 out of 10 women had adopted the different nutrition messages, with messages A and C being the most adopted, with 91% and 92% respectively (Figure 10).

Figure 10. Distribution in percentage of mothers/caregivers of malnourished children who have adopted the different nutrition messages in North Ubangi from 2015 to 2019



3.2.5.1.2 Correlation between nutritional message and recovery

In the group of children with MAM, the children whose households had adopted the nutritional messages were proportionally more likely to recover than those whose households had not adopted this message (90% vs 75%), this difference was statistically significant ($p < 0.0001$). This same observation was also made in the group of children with SAM, children whose households adopted the nutritional messages were proportionally and significantly more likely to recover compared to those whose households did not adopt the message (77% vs. 61%, $p = 0.005$) (Figure 11).

More specifically, considering the different nutrition messages, messages A (84% vs. 45%, $P=0.008$) and D (87% vs. 69%, $P<0.0001$) were significantly more correlated with recovery. The other messages, although showing a tendency towards better recovery, did not show statistically significant results (Figure 12).

Figure 11. Correlation between adoption of nutrition messages and recovery of nutritional status by malnourished children benefiting from the ASSP project in North Ubangi from 2015-2019

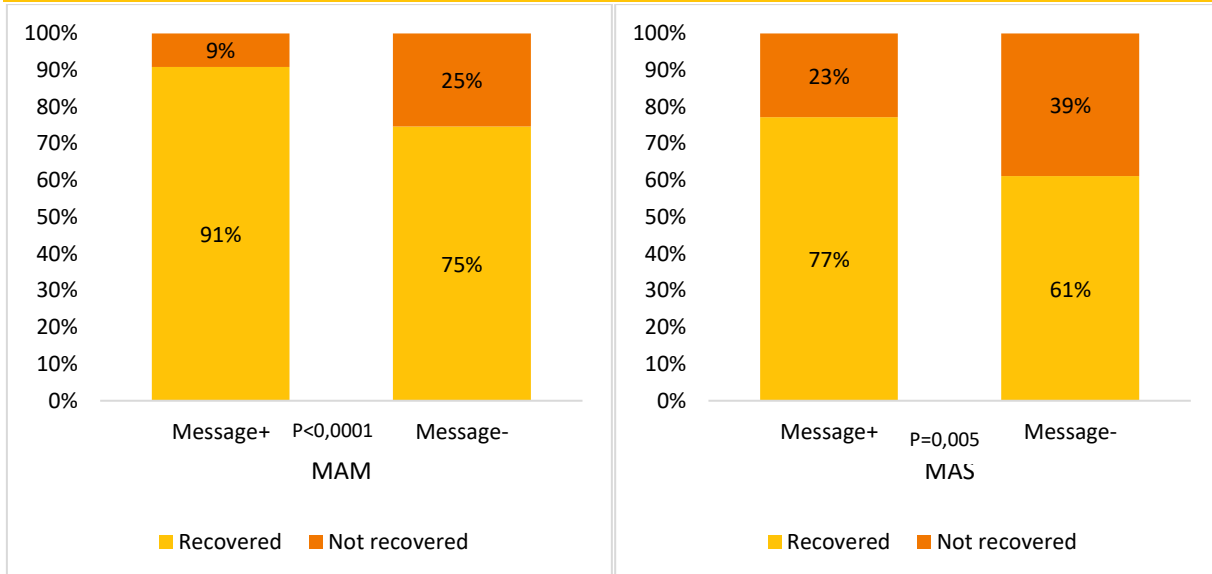
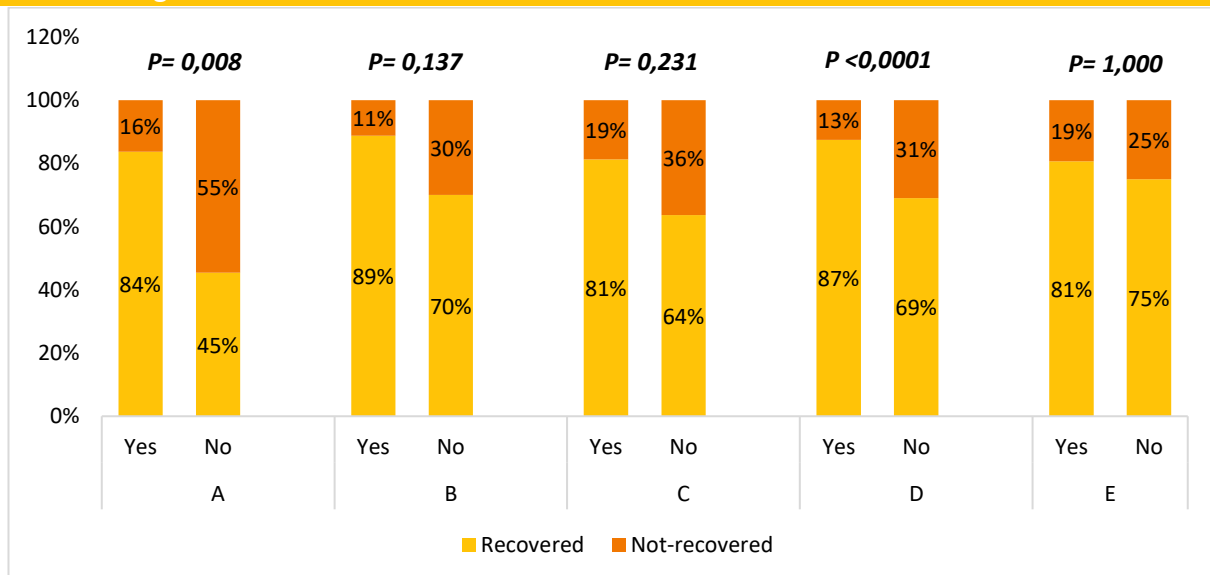


Figure 12. Correlation between different nutrition messages and the recovery of nutritional status by malnourished children benefiting from the ASSP project in North Ubangi from 2013-2020



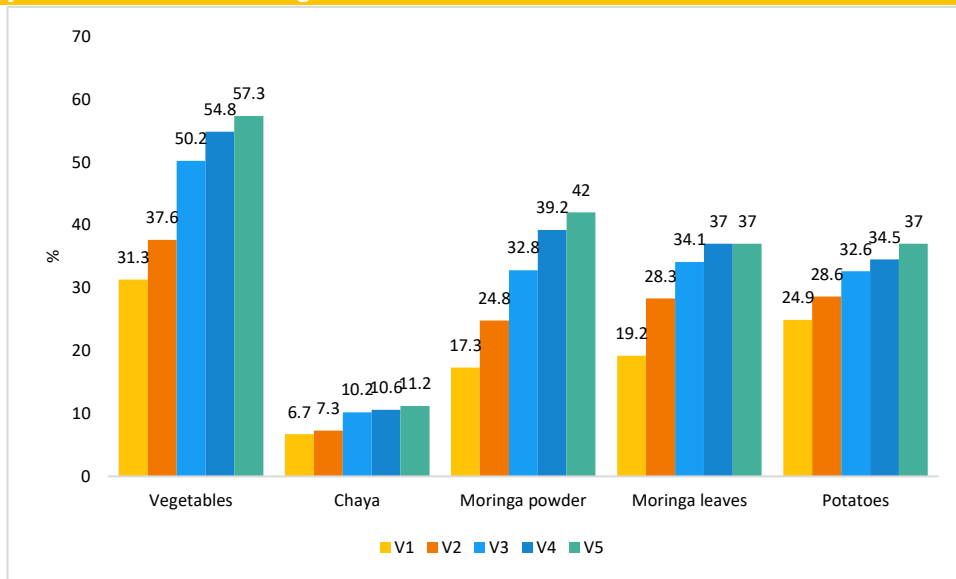
3.2.5.2 GARDENING MESSAGE

3.2.5.2.1 Consumption of foods suggested by the project by beneficiary children during the 24 hours before the various visits

During the five visits made to households, vegetable consumption increased by 26%, followed by consumption of moringa powder (+24.7%). Consumption of chaya, which was already lower at the start, had the lowest increase at 4.7%. Consumption of moringa leaves and potatoes also improved with 17.8% and

12.1% respectively. It is important to note, however, that apart from vegetable consumption (57%), no food exceeded 50% consumption (Figure 13).

Figure 13. Distribution in percentage of consumption of different foods proposed by the project in North Ubangi from 2013-2020



3.2.5.2.2 Sale of vegetables grown by households

The sale of vegetables grown in the gardens by the household increased from 6.8% to 21.8%. Most households that sold their vegetables sold these twice a week (10%). However, it should be noted that this practice of selling garden produce was not followed by about 8 out of 10 households (Figure 14). The number of bundles sold by households increased by 9 bundles after the five visits (Figure 15). The average gains made during RECO visits were 1,450 Congolese Francs (FC), an improvement of 850 FC from the first to the fifth visit (Figure 16).

Figure 14. Change in weekly frequency of sales of vegetables grown by ASSP beneficiary households in North Ubangi from 2015 to 2019

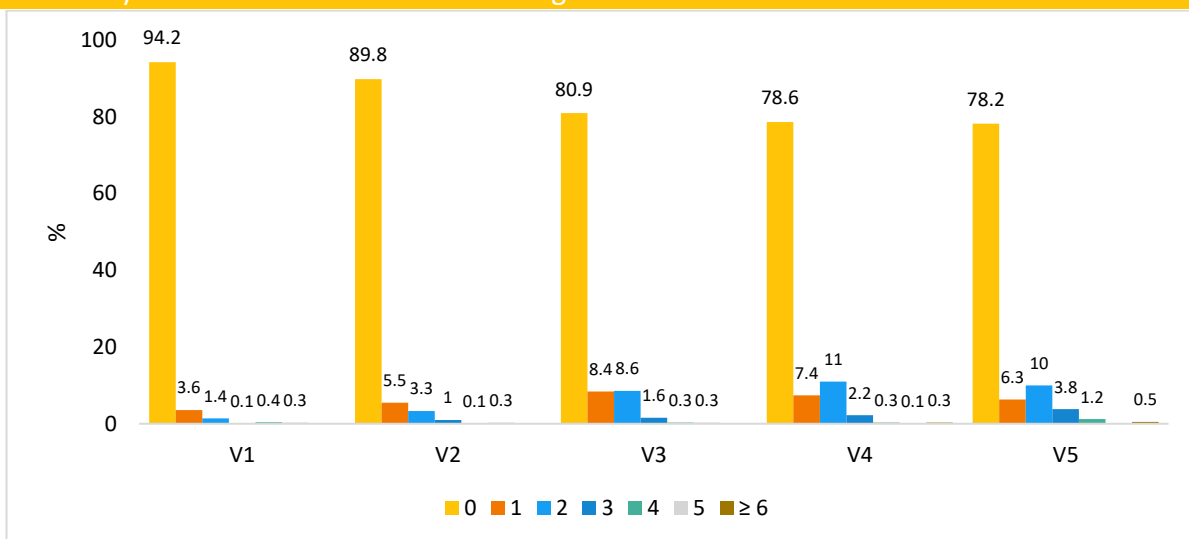


Figure 15. Average number of bundles sold by households growing vegetables in their gardens in North Ubangi from 2015 to 2019

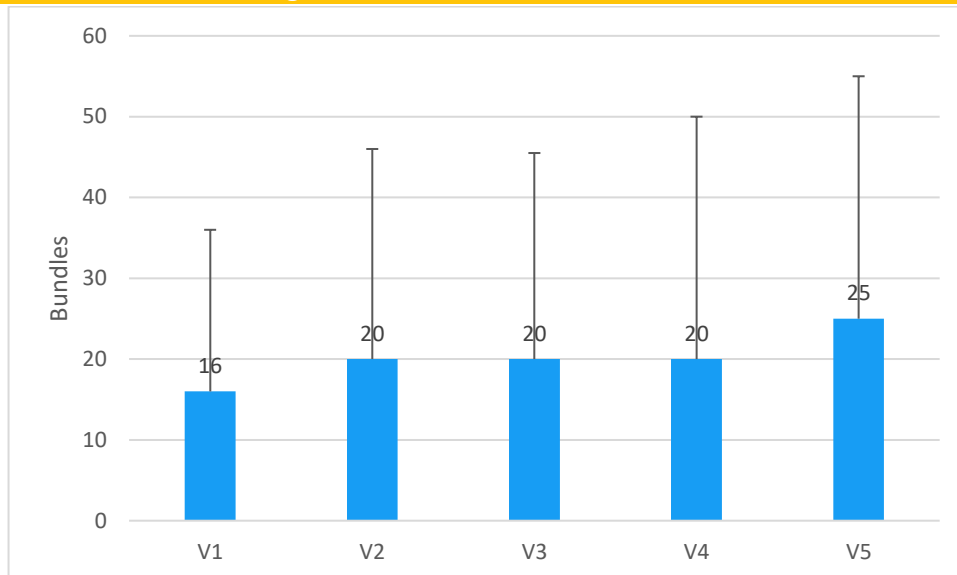
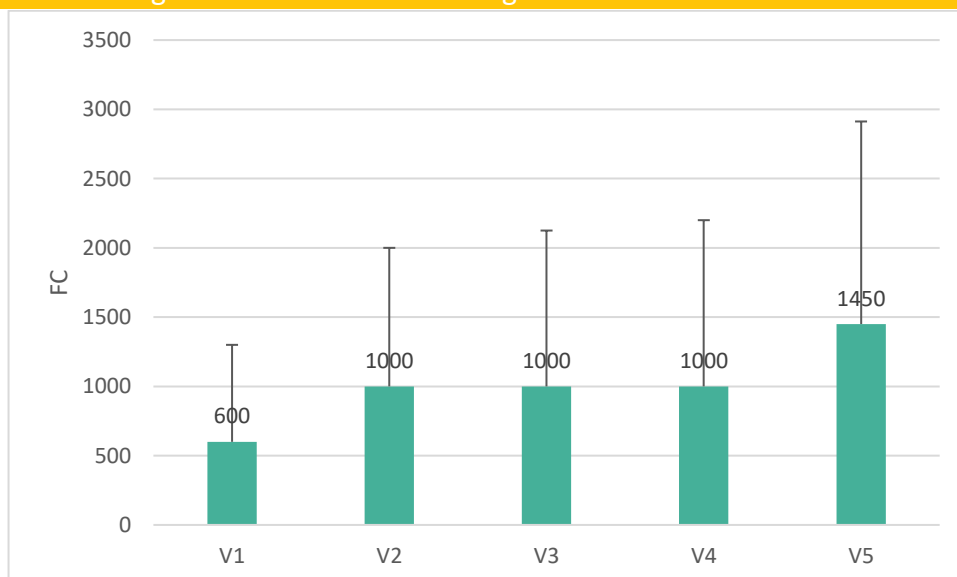


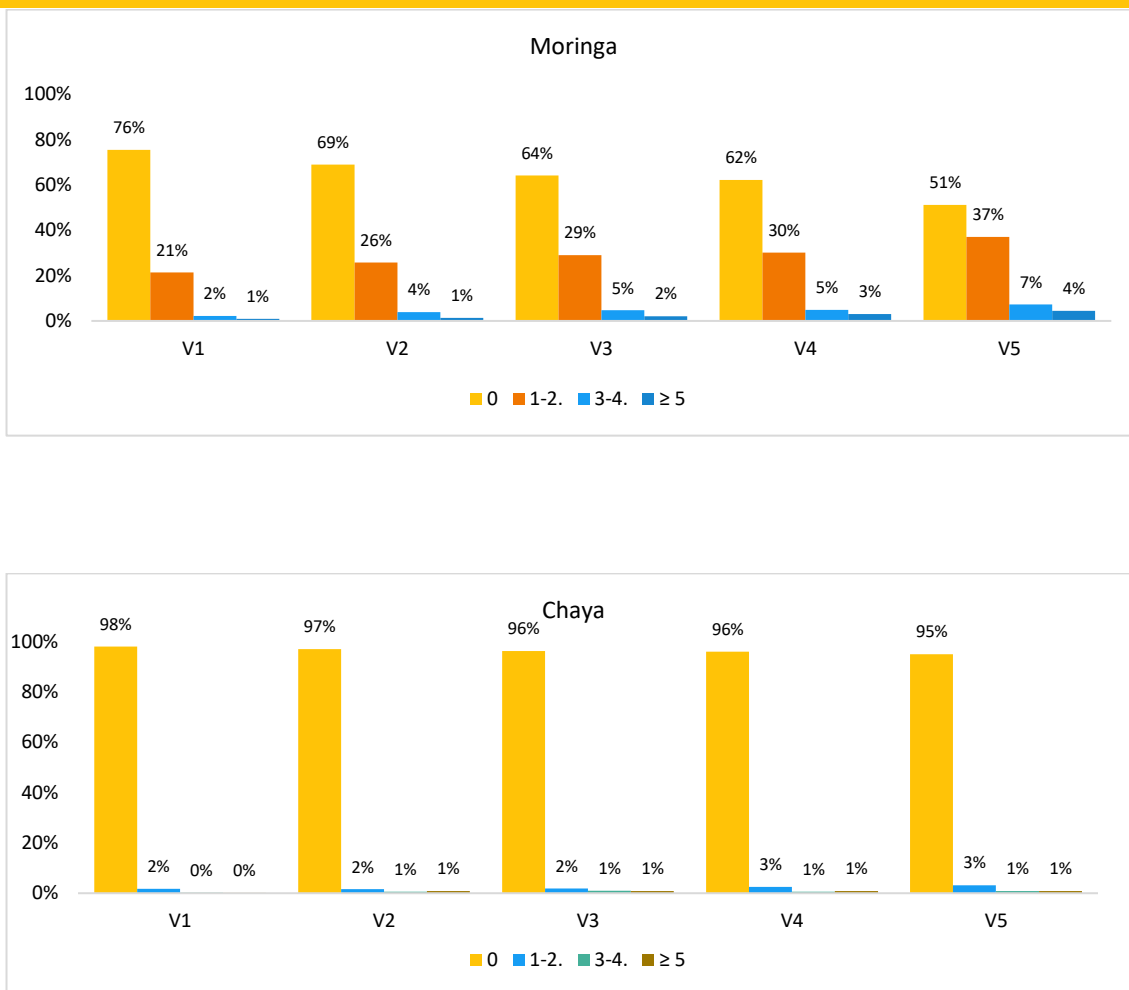
Figure 16. Average gain in sales of vegetable bundles by households growing vegetables in their gardens in North Ubangi from 2015 to 2019



3.2.5.2.3 Increase in the cultivation of plants and trees proposed by the project

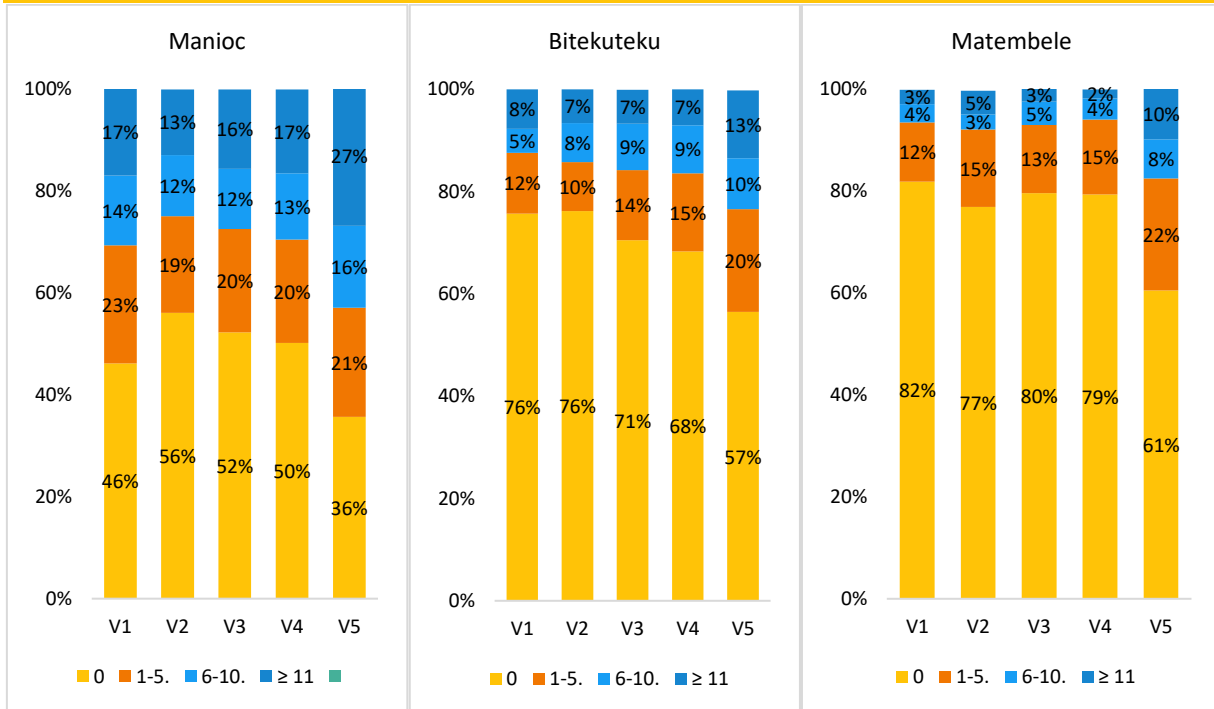
The number of trees of the moringa crop increased by at least one tree during the visits from 24.5% during the first visit to 49.9% during the fifth visit. However, the chaya crop experienced a modest increase of no more than 3% of households that increased the cultivation of this plant by at least one tree. More generally, less than half of the households adopted the cultivation of these plants (Figure 17).

Figure 17. Changes in the number of perennial plants by households with malnourished children benefiting from the ASSP project in North Ubangi from 2013-2020



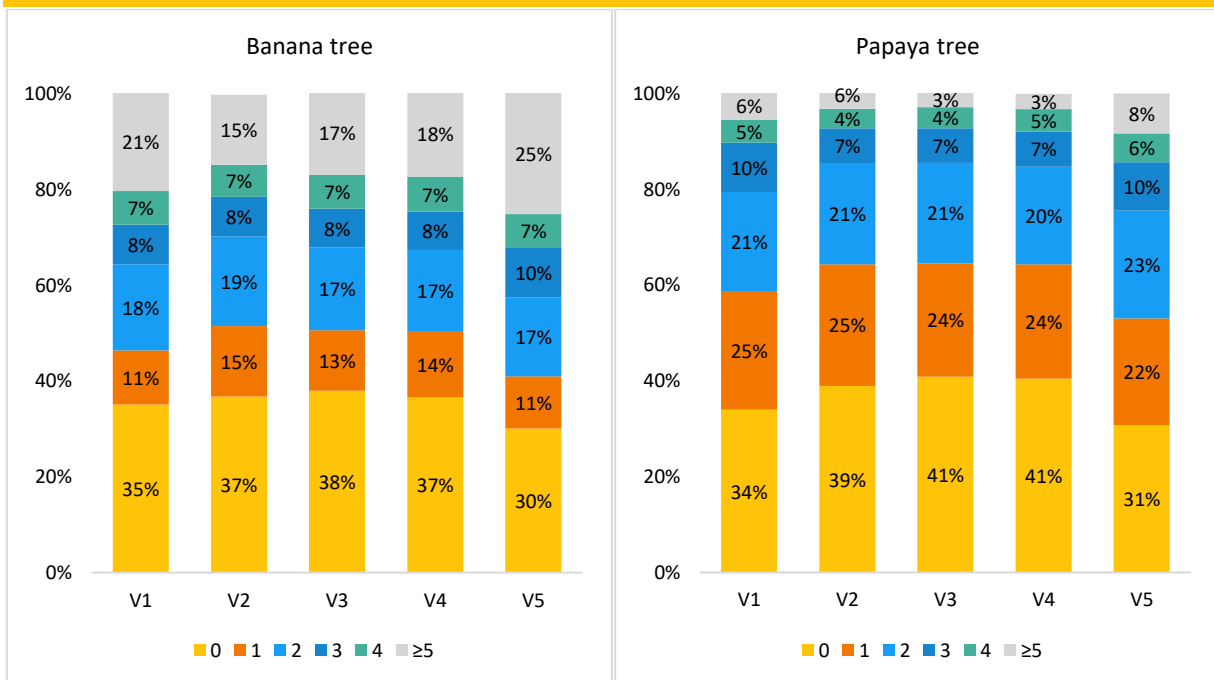
In terms of changes in the number of square meters of vegetable strips, the cultivation of matembele, bitekuteku and cassava increased by 21%, 19% and 10%, respectively, of households that increased the cultivation of these vegetables by at least one flowerbed. However, we note that less than half of the households had planted matembele and bitekuteku by the end of the fifth visit. At least one square meter of bitekuteku (43.5%) and matembele (39.5%) had been found during our fifth visit to the households by the RECOs, compared to 24.3% and 18.1% respectively during the first visit (Figure 18).

Figure 18. Change in the number of square meters of vegetable flowerbeds by households with malnourished children benefiting from the ASSP project in North Ubangi from 2013-2020



The number of fruit trees planted changed slightly by 5% and 3% for banana and papaya, respectively, from the number of households that planted at least one fruit tree (Figure 19).

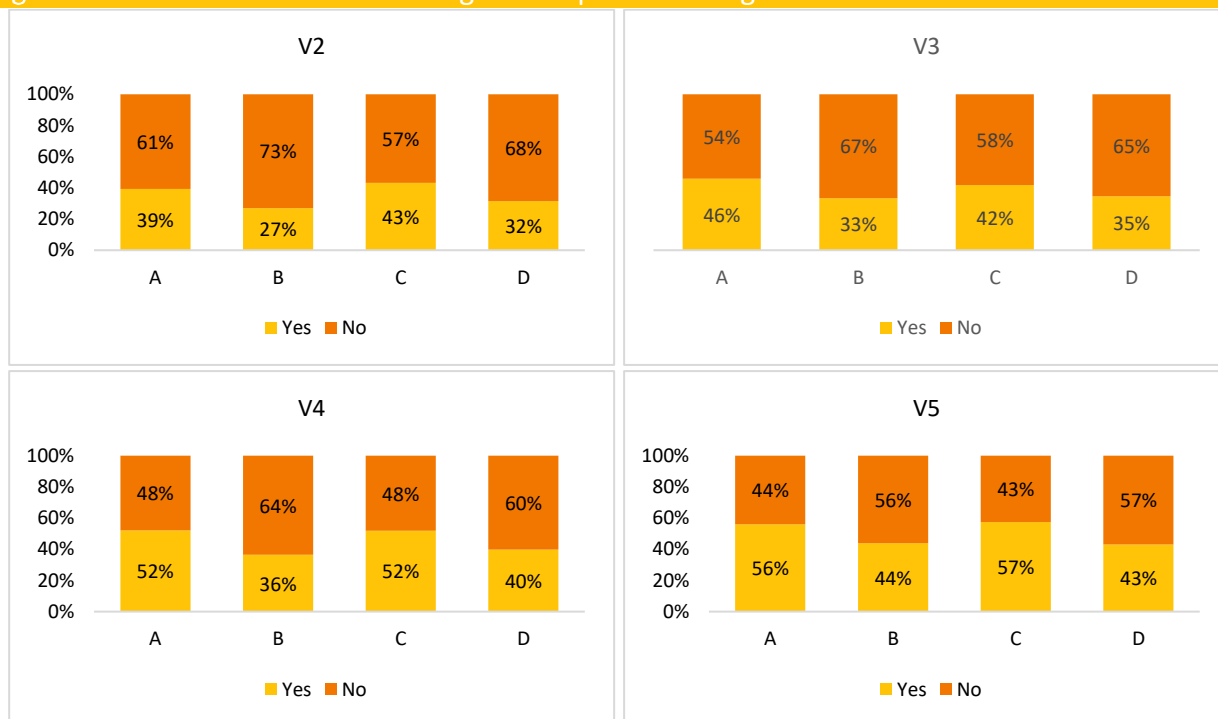
Figure 19. Change in the number of fruit trees planted by households with malnourished children benefiting from the ASSP project in North Ubangi from 2013-2020



3.2.5.3 MOST EASILY ADOPTED GARDEN MESSAGES

More specifically, among households with no limiting factors (A), message adoption increased from 39% to 56% (+17%). For the others where at least one limiting factor was found, message adoption increased by 17%, 14%, and 11% respectively for households that lacked space to grow crops (B), water (C), or both (D) (see annexes for details on messages). Regardless of the situation, adoption of the messages did not exceed 60%, so at least 40% of households with malnourished children had difficulty adopting the various gardening messages (Figure 20). Details on the messages are presented in Annex 6.2.

Figure 20. Distribution of messages adopted during the different visits



3.2.5.3.1 Correlation of gardening and recovery messages for malnourished children

In general, in both children suffering from MAM and SAM, those who recovered were more likely to be found in households that adopted the gardening message, although this did not reach statistical significance (Figure 21).

More specifically, gardening message C (details of the messages are presented in Annex 6.2.) showed a statistically significant correlation with recovery (95.6% vs. 75%, P=0.010) (Figure 22).

Figure 21. Correlation between adoption of the gardening message and child recovery

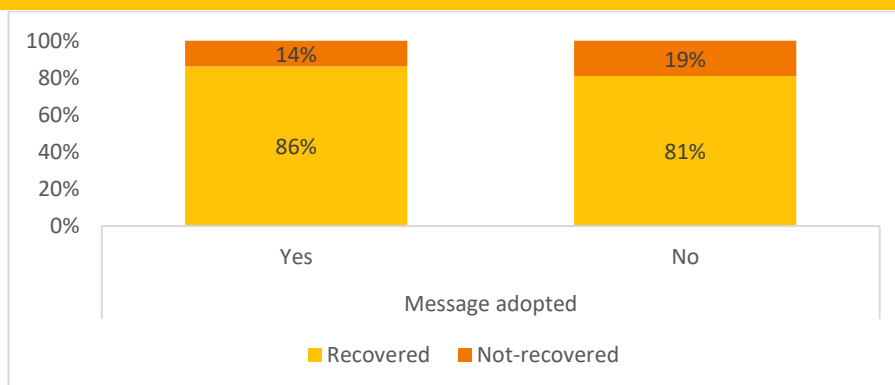
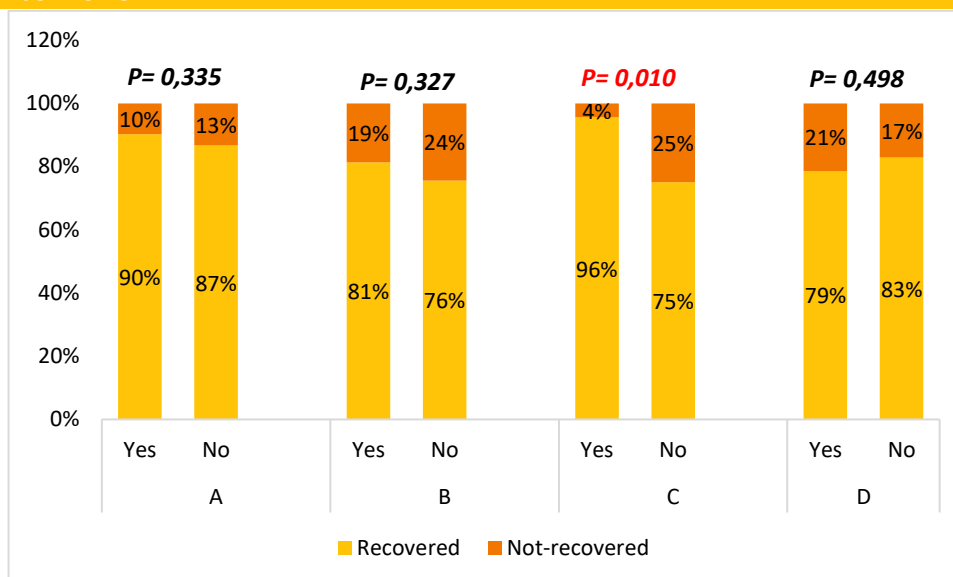


Figure 22. Correlation between adoption of gardening messages and recovery of malnourished children benefiting from the ASSP project in North-Ubangi province from 2015 to 2019



3.2.5.3.2 Recovery rate as a function of the intensity of the increase in square meters of production

As shown in this table, after multivariate analyses that the increase in square meters of production of moringa (92%; OR=2.4), cassava (90%; OR=2.0), manioc (92%; OR=2.5) and banana plants (90%; OR=2.0) are the changes demonstrating a significant association with recovery. Cultivation of each of these foods increased the probability of recovery for malnourished children at least twice (Table 6).

Table 6. Association between the cultivation of different foods and the recovery of malnourished children according to the increase in square meters of production

Variables	Modalities	Recovery		Total	OR	CI 95%	
		Yes	No			Lower	Upper
Chaya	Yes	32 (97%)	1 (3%)	33 (100%)	5.9	0.8	43.5
	No	663 (84%)	122 (16%)	785 (100%)			
		695 (85%)	123 (15%)	818 (100%)			
Moringa	Yes	238 (92%)	21 (8%)	259 (100%)	2.4	1.5	4.0
	No	497 (82%)	106 (18%)	603 (100%)			
		735 (85%)	127 (15%)	862 (100%)			
Manioc	Yes	332 (90%)	37 (10%)	369 (100%)	2.0	1.3	3.0
	No	508 (82%)	113 (18%)	621 (100%)			
		840 (85%)	150 (15%)	990 (100%)			
Biteku	Yes	186 (88%)	26 (12%)	212 (100%)	1.3	0.8	2.1
	No	517 (84%)	95 (16%)	612 (100%)			
		703 (85%)	121 (15%)	824 (100%)			
Matembele	Yes	135 (92%)	11 (8%)	146 (100%)	2.5	1.3	4.8
	No	389 (83%)	79 (17%)	468 (100%)			

Variables	Modalities	Recovery			OR	CI 95%	
		Yes	No	Total		Lower	Upper
		524 (85%)	90 (15%)	614 (100%)			
Banana trees	Yes	234 (90%)	25 (10%)	259 (100%)	2.0	1.3	3.2
	No	461 (82%)	99 (18%)	560 (100%)			
		695 (85%)	124 (15%)	819 (100%)			
Papaya trees	Yes	170 (87%)	25 (13%)	195 (100%)	1.1	0.7	1.8
	No	672 (86%)	113 (14%)	785 (100%)			
		842 (86%)	138 (14%)	980 (100%)			

In red: changes showing a significant association with recovery

3.2.5.3.3 Recovery rate based on crop diversity intensity

Crop diversity of at least 2 plants increased the probability of recovery by at least 2 times (Table 7).

Table 7. Association between crop diversity and recovery of malnourished children

Variable	Modalities	Recovery			OR	IC 95%	
		Yes	No	Total		Lower	Upper
Crop diversity	At least 4 plants	84 (88%)	11 (12%)	95 (100%)	2.27	1.12	4.61
	2-3 plants	111 (96%)	5 (4%)	116 (100%)	6.59	2.54	17.11
	1 plant	68 (85%)	12 (15%)	80 (100%)	1.68	0.84	3.37
	None	155 (77%)	46 (23%)	201 (100%)			
Total		418 (85%)	74 (15%)	492 (100%)			

In red: changes showing a significant association with recovery; the CI not overlapping the value 1

3.3 DETERMINANTS OF RECOVERY OF MALNOURISHED CHILDREN

The multivariate analysis reported factors with an independent association with the following recovery (Table 8):

- **Father's age:** Children whose fathers were 24 years old or younger were 2.6 times less likely to recover.
- **Breastfeeding cessation:** Stopping breastfeeding at 9 months of age or less reduced the chance of recovery by 2.3 times.
- **Mebendazole supplementation** increased the chance of recovery from malnutrition in children by 2.8 times.
- **Benefiting from PCIMA** reduced, paradoxically, the chance of recovery by 2 times.
- **Adopting the nutrition message** increased the chance of recovery from malnutrition in malnourished children by 2.5 times.
- **The severity of the nutritional status at baseline** was the strongest factor influencing the child's recovery. Moderately malnourished children were 2.6 times more likely to recover.

It is important to note, however, that this model was calculated on a set of 493 children for which all data were available. The present model, using Nagelkerke's pseudo R², explained only 18% recovery in children.

Table 8. Determinants of recovery for malnourished children

Variables	Exp(B)	IC95%		P
	OR	Lower	Upper	
Father's age	0.38	0.15	0.96	0.041
Caregiver's age	0.95	0.50	1.80	0.865
Age of breastfeeding cessation	0.46	0.26	0.82	0.008
Existence of latrine	1.36	0.70	2.64	0.364
Biological child	0.53	0.12	2.43	0.413
Measles vaccine	1.21	0.33	4.41	0.771
Vit A supplementation	0.17	0.02	1.51	0.112
Mebendazole	2.22	1.00	4.93	0.049
Slept under a mosquito net	0.90	0.41	2.00	0.796
Has benefited from a PCIMA	0.53	0.31	0.91	0.021
Adopted the nutrition message	2.54	1.13	5.72	0.024
Adopted the gardening message	0.77	0.43	1.39	0.385
Severity of malnutrition at baseline	2.64	1.53	4.55	<0.0001

4 CONCLUSION

The objective of this study was to demonstrate the effect of different interventions in the ASSP project on the outcomes of malnourished children in beneficiary households. The following lessons emerged:

On the characteristics of the households to which the children belong and their parents

Beneficiary households are generally poor, as evidenced by the possession of certain assets including a radio, bicycle, and telephone. These households often live in a state of food insecurity marked by a problem of access to food in sufficient quantity and quality to meet the needs of household members. Among these, the most vulnerable are children (Kadam, 2007).

The parents' level of education was also low. This has been shown to be one of the underlying factors of malnutrition, which can be explained by the parents' poor ability to make good choices in terms of food and health for their children. Another reason would be the fact that low education is often linked to unemployment and thus to the significant financial resources for child nutrition (Akombi et al., 2017).

It is also important to note that this study did not demonstrate the cluster nature of malnutrition. The majority of malnourished children were the only children suffering from malnutrition in their households. This does not exclude that other children in these households are at risk of suffering from malnutrition as well. Since the characteristics (especially anthropometric characteristics) of these children are not known, we cannot exclude this probability. It seems very likely that the other children in the household, living in a food insecure situation, are also at high risk of malnutrition.

On the recovery rate of children

Our study showed that, based on the evolution of the MUAC and that of the edemas, eight out of ten children were able to develop well during this intervention. It is difficult to compare the recovery rate of such a study with other studies published on this subject as the selection criteria and the content of the interventions are different. The recovery rate varies from 28% to 83.3% (Lenters, Wazny, Webb, Ahmed, & Bhutta, 2013; More, Waingankar, Ramani, Chanani, & Souza, 2018). This makes us say, despite these reservations, that this intervention was a success with this high recovery rate.

On the intervention

The project proposed as interventions a regular follow-up of malnourished children and their households by the RECOs with anthropometric parameters, advice and support on nutrition and gardening. This approach proved very early on to be effective in solving malnutrition problems in the different communities. It allows to address the underlying causes of malnutrition, namely the problem of access to food and the lack of knowledge about good nutrition. To this end, it offers community-based solutions that are easy to adopt and therefore easy to sustain (Gupta & Shah, 2010; Lenters et al., 2013; UNICEF, 1998; Yeo, OUATTARA, & KONE, 2018).

About nine out of ten women adopted the nutrition messages at the second visit. Promotion of breastfeeding and fortified meal preparation showed an association with recovery. The increase in the number of meals and consumption of products promoted by the intervention was also shown to be associated with recovery from malnutrition. This helped to correct to some degree the problem of accessibility to sufficient and quality food for children.

As for breastfeeding, its importance is unanimously recognised. Breast milk is the most complete food for the child's nutrition during the first six months after birth and it is difficult to find a substitute. Indeed, breast milk is sterile and allows the transmission of antibodies from mother to child, which limits the prevalence of diarrhoea and other diseases in children, especially during the first six months of life. It has been shown it

prevents malnutrition compared to other types of diets for children of the same age (Akombi et al., 2017; Kadam, 2007; Oumar, 2001)..

Paradoxically, IMAM has shown an inverse association with the recovery of malnourished children. Since the content of this treatment is unknown (except for the health zones of Bili and Bosobolo, which did not show any difference) as well as the adherence of beneficiary households, we cannot explain this result. This does not call into question the importance of RUTF. In fact, RUTF is nutrient-rich food that has been developed for the management of severe acute malnutrition without complications. They offer some advantages namely: they are balanced, easy to handle at home and well protected against bacterial contamination (Schoonees, Lombard, Musekiwa, Nel, & Volmink, 2019).

The other component of the intervention is the promotion of perennial plant, vegetable and fruit tree cultivation. It is known that crop promotion contributes to household food security directly through the availability and accessibility of market garden produce. But also indirectly through the income generated which allows the purchase of food and variation of the household's diet (Yeo et al., 2018). Even if the adoption of the cultivation of these plants did not exceed 60%, some have nevertheless demonstrated an association with the recovery of malnutrition. These include moringa, cassava and bitekuteku.

Moringa, or *moringa oleifera*, contains a higher proportion of vitamins C and A, calcium, potassium, iron and protein than those found in other food products such as oranges, carrots, milk, bananas, yogurt and spinach, respectively. Nutritionally, it has been widely used to combat malnutrition in infants, pregnant women and lactating mothers and to increase milk production in lactating mothers (Falowo et al., 2018).

The amaranth leaf vegetable consists mostly of water, up to 90%. Seeds and leaves, with a carbohydrate composition of 56.8% and 4.11% respectively, are a high energy food with a high protein content of 15.8% and 2.11%. Compared to other leafy vegetables, the dietary value of amaranth is higher and compared to quinoa seeds (12.9 - 16.5%) and other common cereals, the protein content of seeds is much higher than that of maize (10.20%) and comparable to that of wheat (14.30%) (Sitiraka, 2020).

Consumption of cassava leaves and roots is widespread throughout the country. When the cassava root is an important source of calories, its leaves contain significant amounts of protein (17.7% to 38.1% by dry weight). They are also rich in vitamins B1, B2 and C, as well as carotenoids and minerals. The total amount of essential amino acids present in the protein of cassava leaves is similar to that of a chicken's egg and higher than that of spinach leaves, soy, oats or rice (Latif, 2014).

The consumption of chaya was low and its culture the least adopted. The reasons for this low adoption are still to be explained but it is a new plant recently introduced for the first time and still unknown by the population. The distribution of cuttings was also slow. Moringa, meanwhile, had been introduced in the DRC since the 1990s. It was therefore predictable that more people would know about it than chaya. The chaya was introduced for its nutritional value per 100g fresh leaf, i.e. 6.2 - 7.4 g of protein, 250 mg of calcium, 9.3 - 11.4 mg of iron, 1357 IU of Vitamin A and 165 - 205 mg of vitamin C. The plant is also drought tolerant and can be produced even in the dry season.

Apart from the intervention, other factors also showed an association with the children's recovery. For example, the young age of the father was found to reduce the children's chances of recovery. In this context where under-education is widespread, this association would rather reflect either the problem of financial poverty or the immaturity often shown by young fathers. The father's role in the child's nutrition is attracting more and more attention. It has been shown that his involvement goes beyond financial involvement alone. The father can also play the role of moral support for the woman. Improving his knowledge makes it possible to strengthen the acquisition of good nutritional practices in the household. He also plays a role in the prevention and treatment of certain childhood diseases and thus prevents malnutrition (Catholic Relief

Services, 2016; Mengesha Bilal, 2015). This study shows the value of targeting young fathers who seem to have not yet acquired these capacities.

Deworming with Mebendazole has also shown an influence in the recovery of malnourished children. Although this result has not always been demonstrated by different studies, an experimental study has however confirmed its role in the recovery of malnourished children (Adimasu, Sebsibie, Abebe, Baye, & Abere, 2020). The role of this drug in reducing parasite load is also widely known. These helminthiases are known to be responsible for protein-energy malnutrition, anaemia, and cognitive impairment in children (Stephenson, Latham, & Ottesen, 2000).

There are, however, some limitations to this study. The quality of the data was not optimal. Many data were missing, and some were reported with several errors that were conscientiously and thoroughly cleaned up to reduce these imperfections. Also, the data were collected by RECOs who, although trained, are not necessarily from the medical field. Thus, measurement bias cannot be ruled out regarding anthropometric measurements, the assessment of oedemas, etc. Prevarication bias cannot be ruled out either, as it is highly probable that some in the population being monitored gave "socially acceptable" answers in order not to "lose face".

In conclusion, we can say that the ASSP intervention was effective because it provided solutions that were easy to adopt and sustainable by the beneficiary communities.

5 RECOMMANDATIONS

On the intervention

- Conduct qualitative studies on the acceptability of certain products proposed that are not commonly consumed by beneficiary communities. These include chaya and moringa.
- Strengthen measures for children suffering from more severe forms of malnutrition.
- Put in place interventions targeting capacity building for fathers, especially the youngest fathers, in child nutrition.
- Propose other interventions including those related to water, hygiene and sanitation to enable community members to know how to manage waste.
- Conduct a study on the recovery rate of children who have benefited from integrated management of acute malnutrition (PCIMA) with a ready-to-use therapeutic food (RUTF) and those who have not benefited from it and between Plumpy'Nut and locally prepared RUTF. This will allow a better understanding of the impact of these different products on the improvement of the nutritional status of children.

On data collection

- Refresher of RECOs on data collection.
- Involve health personnel in the collection of other anthropometric parameters such as height and weight.
- Set up a mechanism for regular monitoring and supervision of activities.

6 ANNEXES

6.1 Annex 1 - References

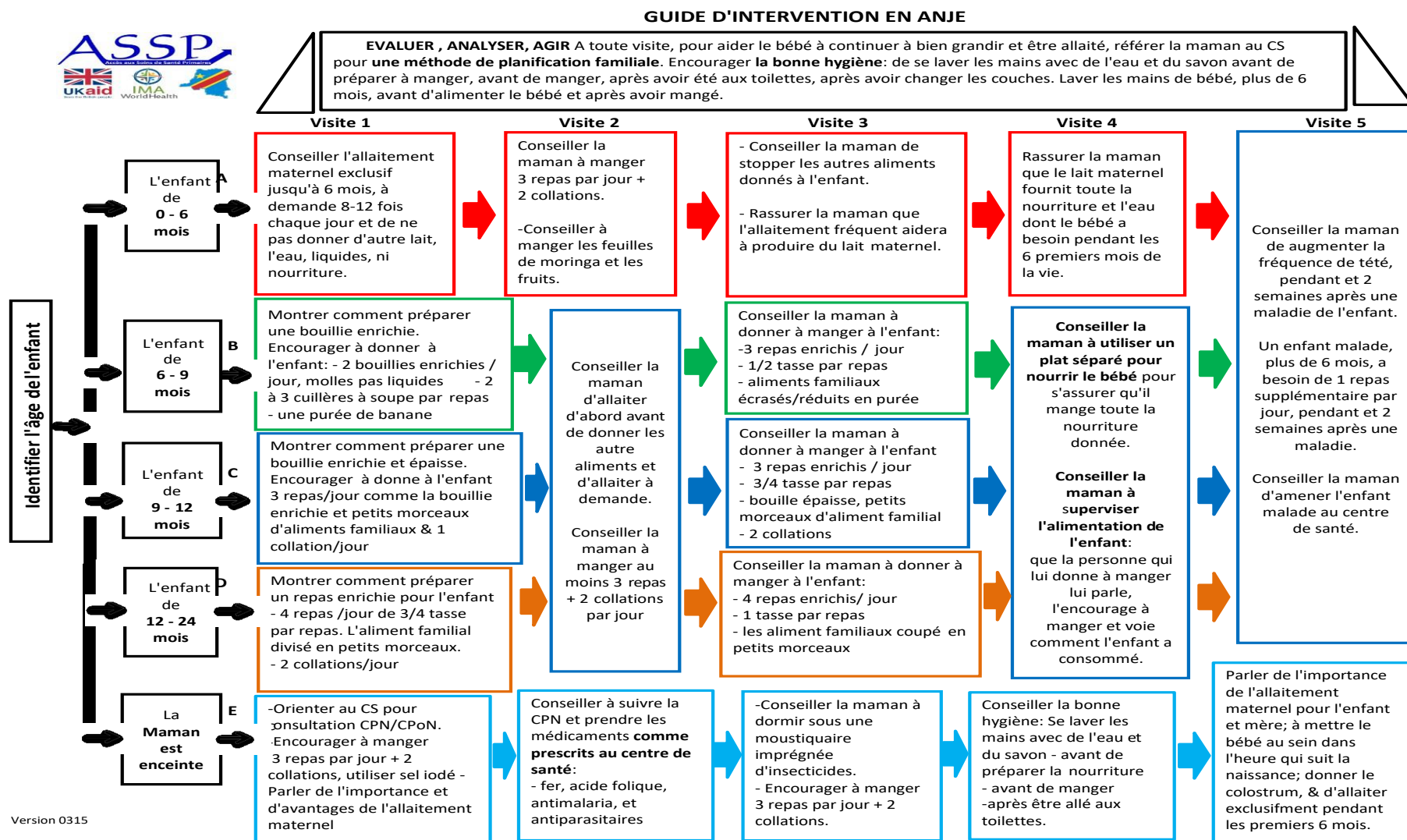
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6.2 Annex 2 – IYCF message



6.3 Annex 3 – Gardening guidelines

