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Impact of dietary Diversification on the nutritional status of children aged 0 to 59 months in the municipality of Tori-Bossito

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Abstract

In order to capitalize on the achievements for the sustainability of the NECDP (Nutrition and Early Childhood Development Project) in the municipality of Tori-Bossito, the impact of the Promotion of Food Diversification (PFD) on the nutritional status of children aged 0 to 59 months was evaluated. Anthropometric data (weight, height, age) in children aged 0 to 59 months and dietary data (consumption of salt with iodine, source of drinking water, the practice of hand washing, frequency and quality of meals served to children aged 6 to 59 months) was collected in the households of beneficiary women. This data was collected from 2019 to 2020 (considered as the period before PFD) and from 2021 to 2023 (considered as the period after PFD) through home visits, quarterly screening sessions, and monitoring and promotion of growth and stimulation and awakening of children from 0 to 23 months on a monthly basis. Significant differences through the analysis of variance were carried out at the 5% threshold according to the Student Newman-Keuls test. It showed from this study that after the PFD, a majority of households practice hand washing (85.12%), use a source of drinking water (80.39%), serve children more than three meals (58.3%) containing the three food groups (97.52%) per day but consumed poor salt in iodine in a proportion of 70.4%. The study also revealed that PFD significantly contributes to reducing the prevalence of all forms of malnutrition among children aged 6 to 59 months (from 3.52% to 1.59% for severely underweight, from 3.34% to 1.97% for severe wasting, and from 7.18% to 3.93% for severe stunting). On the other hand, PFD does not contribute to reducing the prevalence of severe underweight in children aged to 0 to 5 months (from 4.85% to 11.97%). The promotion of Food Diversification stands out as an important activity recommended for food and nutrition projects/programs in the fight against malnutrition in all its forms.

Keywords: Nutritional status, food diversification, children, Tori-Bossito, Benin

Introduction

Malnutrition results in deficiencies, excesses or imbalances in a person's quantitative and/or qualitative intake and manifests itself as "a perceptual or non-perceptual pathological state " (Mudékéréza, 2017; Traoré et *al*., 2020; Camara et *al*., 2021). It also includes non-communicable diseases

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linked to poor nutrition in addition to undernutrition (wasting, stunting and underweight), vitamin or mineral deficiencies, overweight and obesity (WHO, 2021). The most affected targets are children under 5 years old. For this target category, it constitutes the cause of at least half of deaths worldwide, 45% of which are associated with undernutrition (WHO, 2018 & WHO, 2021). In sub-Saharan Africa, the prevalence of stunting is 30.7% higher than the global average of 22% (WB, 2019 & Yasbeck et *al*., 2023). In Benin, malnutrition constitutes a public health problem with an overall prevalence rate of 43% (EDS, 2017-2018). The consequences of malnutrition on the Human Capital Index (HCI) are serious and persistent for individuals and their families, for communities and for countries (Yasbeck et *al*., 2023). The HCI in Saharan Africa is 40% compared to the world average which stand at 57% (WB, 2019). In Benin, the Human Capital Index is 41% (Chabi-Akoha et *al*., 2021). This value of HCI indicates that a Beninese child only realizes 41% of his potential compared to what would have been possible if he had benefited from optimal conditions of health, food, nutrition and parental care. The consequences of malnutrition include death (WHO, 2018 & WHO, 2021), reduced productivity and economic growth of nations (Yasbeck et *al*., 2023), reduced cognitive and physical capabilities, reduced reproductive capacity and holistic development (Walker, 2007 & WB, 2019). With regards to harmful consequences of malnutrition on individual human beings and the community, low-income countries, with the help of financial partners, have for years taken strong and urgent actions to eradicate malnutrition in all its forms. In this perspective, the Beninese State benefited from the support of the World Bank to fight against malnutrition through the implementation of the Multisectoral Food, Health and Nutrition Program (MFHNP) followed by Nutrition and Early Childhood Development Project (NECDP) based on the experiences and achievements of the MFHNP (FNC, 2017). Indeed, Benin in its march towards good nutrition after the consensus workshop held in Bohicon (one of the cities of Benin) in 2007, has institutionalized the national Food and Nutrition Council and its Permanent Secretariat (FNC-PS) for an efficient fight against malnutrition. Thus, forty municipalities benefited from the NECDP at start-up, based on the following criteria; percentage of municipal population spending less than one dollar per day, rate of moderate and severe food insecurity and chronic malnutrition within the municipality (FNC, 2017). The municipality of Tori-Bossito, which did not benefit from any nutrition project or program, was in a critical situation with a chronic malnutrition rate of 25% and a rate of households with insecure food reaching 82.5% (Lokonon et Amoussa, 2019). It was therefore eligible in this category of beneficiary municipalities and was supported by GERME, a Non-Governmental Organisation for the implementation of project interventions. The project's package of activities includes Promotion of Food Diversification, Culinary Demonstration, Home

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

visit, Learning and Nutritional Rehabilitation Home, Play Practices, Monitoring Promotion of Growth and Stimulation and Awakening of children from 0 to 23 months, Essential Family Practices, Essential Awareness Practices, Promotion of hygiene measures and rules, Screening and management of malnutrition. Overall, the package of activities of this project had a positive impact on the nutritional status of 80% of children aged 0 to 59 months within the beneficiary community (FNC, 2022). However, the evaluation of the impact of one activity in relation to the other within the package of activities for choice of activities to promote for the sustainability of the achievements has remained marginal and very poorly documented. The lack of dietary diversification is the primary cause of all forms of malnutrition (World Food Program, 2008 & Bodjrenou et *al*., 2018). Its implementation is simple, less expensive and adapted to the community whose members are mostly farmers (INSAE-RGPH4, 2016 b). It produces a significant impact in the fight against malnutrition better than the adoption of an adequate diet and the therapeutic treatment of childhood illnesses (pneumonia, malaria, diarrhea, infections, etc.) in a situation of malnutrition (World Food Program, 2008). As part of this study, the Promotion of Food Diversification was carried out through training, support and monitoring of women beneficiaries from households most vulnerable to malnutrition through three key themes: the home garden, small-scale poultry and small ruminant breeding, food processing of cassava tubers and the formulation of enriched flour (complementary feed) based on cereals and legumes or protein-oleaginous crops. The implementation of most of the aforementioned activities constituting the project's package of activities started in 2019 but the Promotion of Food Diversification was implemented from 2021 to 2023, i.e. two years after starting the interventions. Thus, in view of the enthusiasm that this activity has generated and with the aim of capitalizing on the achievements of the project for its sustainability, the present work aims to evaluate the impact of the Promotion of Food Diversification on the nutritional status of children aged 0 to 59 months in the municipality of Tori-Bossito.

Material and methods

Study zone

The municipality of Tori-Bossito is located in the southwest of Benin on the Atlantic coast. Covering an area of 328 km^2 with a density of 136 inhabitants/km^2 (INSAE RGPH4, 2016b), this municipality is characterized by a low plateau relief cut by valleys with marshy depressions which in the rainy season constitutes a real body of water. The subsistence poverty index based solely on the living conditions of households is 41.9% (INSAE-RGPH4, 2016 b). Agriculture, fishing and hunting represent 53.4% of the economic activities. The population is mainly exposed to diseases such as malaria,

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

diarrhea, vomiting and pneumonia (See community relay notebook, 2015). This municipality shelters a Territorial Agricultural Development Agency (TADA) which promotes agricultural advisory support. The component Promotion of Food Diversification through the training and support of women trained on the various themes for the promotion of food diversification within the framework of the NECDP is ensured in synergy with TADA technicians.

Sampling

About three hundred and fifty (350) women were selected from twenty-one villages out of the fifty-eight in the municipality of Tori-Bossito. These different villages are distributed in five (5) out of the six (6) Districts of the municipality. Nine (9) villages in the District of Azohoue-Cada, three (3) in the District of Tori-Bossito, four (4) in the District of Tori-Gare, two (2) in the District of Avamè and three (3) in the District of Tori-Cada were chosen in the descending order of vulnerability. These villages are the most vulnerable in terms of malnutrition and critical food and nutritional insecurity (INSAE-RGPH4, 2016 b). Taking into account the assets and constraints of the beneficiary villages, 22% of women (i.e. 77 women) benefited from support training on home garden, 50% (i.e. 175 women) benefited from support training on small livestock farming and 28% (i.e. 98 women) benefited from support training on the food processing of cassava tubers and the formulation of enriched flour based on cereals, legumes or protein-oilseeds. The women beneficiaries was selected for their status as a priority adult target of the NECDP and their involvement in the nutrition mutual established by the project. They are mothers of children under five years old, breastfeeding women (children under 2 years old) and/or pregnant women. Table 1 presents the support received by women trained and equipped to promote food diversification.

Table 1: Kits allocated to the different categories of trained women

Training themes for women	Kits
Home garden	Watering can, seeds (amaranth, nightshade, tomatoes, peppers), two fruit plants (soursop tree, orange tree or lemon tree)
Small breeding	A doe and a rabbit, 10 kg of feed, a feeder, a drinker, a cage
	Three hens and a rooster, 10 kg of feed, a feeder, a drinker
Food processing	Frying pan, plastic bucket, spatula
	Pot, ladle, 10 kg of corn and 10 kg of soya

Collection of data

Two types of data was collected in this study; these are anthropometric data of children aged 0 to 59 months and dietary data within the households of trained and equipped women.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Anthropometric data includes: height, weight and age of children from 6 to 59 months. For children aged 0 to 5 months, the anthropometric data collected are weight and age.

Dietary data include: the number of meals served to children per day, the quality of the meal (presence of the three food groups: energy food, growth food and protective food), iodized salt consumption, source of supply in drinking water and the practice of hand washing. In accordance with the protocol implemented (MFHNP/NECDP flayers), the distinction between the three food groups is based on the food square, namely: energy food (rich in sugar or lipids), growth food (rich in proteins or proteins) and protective food (rich in vitamins and mineral salts). Two sources of water were considered, namely: drinking water (SONEB tap, well-protected and maintained borehole, human-powered pump) and non-potable water (poorly maintained and unprotected borehole, unprotected traditional wells, surface water, and untreated rainwater) following the intervention implementation protocol (FNC, 2017).

This data was collected from 27 children from 0 to 5 months and 547 children from 6 to 59 months before the Promotion of Food Diversification (period from 2019 to 2020) and 29 children from 0 to 5 months and 529 children from 6 to 59 months after the Promotion of Food Diversification (period from 2021 to 2023). These child targets are considered to be the number of children aged 0 to 59 months who have been screened in the households of the 350 women beneficiaries of training and support for the Promotion of Food Diversification.

This different data was collected through screening, Growth Promotion and Stimulation and Awakening Monitoring (GPSAM) of children aged 0 to 23 months on a monthly basis and Home Visits (HV) to households covered by the survey study. Screening is a quarterly activity and HV and GPSAM are routine activities

Material

For the collection of anthropometric data, the personal scale (type: Seca gmbh & co.kg, designed in Germany Made in China, Max: 150 kg, d1=0.1 kg) with a tare function and the measuring rod (Brand Shorren lying position for children under 2 years (Maximum height: 197.5 cm, d2= 0.1cm) were necessary. Weight was determined using the scale and height using the height chart. The age was determined from official documents (birth certificate, declaration form, RAVIP receipt or secure birth certificate) which bear the date of birth.

Dietary data was collected through Home Visits (HV) of the targets and iodized salt consumption was carried out using the iodine test (MBI kits international 85, G.N. Chetty Road, Nagar, and Chennai-600 017 INDIA).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Data processing and analysis

Anthropometric data have been expressed in accordance with the WHO protocol, namely: weight in kilograms (kg), height in meters (m) and age in months. WHO Anthro software version 2.0.4 was used to assess z-scores and prevalences of wasting (Weight/Height), stunting (Height/Age) and underweight (Weight /Age) in children. The figures present the Z-score scales (Weight/Age) for girls and for boys from 0 to 59 months for illustrative purposes.

Dietary data and average prevalences were processed using Microsoft Excel version 2010. SPSS v 16.0 software was used for analysis of variance (ANOVA).

Results

The consumption of iodized salt, the source of drinking water and the practice of hand washing in the monitored households are presented in Table 2. The majority of households use salt low in iodine (iodine content ≤15 ppm), i.e. 74.6% before and 70.40% after the Promotion of Food Diversification. Most households use drinking water (tap water, maintained and well-protected borehole and human-powered pump), i.e. 81.44% and 80.39% respectively before and after the PFD. For hand washing, around 96.48% of households do not use the HWD before the PFD and 85.12% use it after the PFD.

Table 2: Iodine consumption, source of drinking water and hand washing practice in monitored households

Settings		**Proportion of households before PFD (%)**	**Proportion of households after PFD (%)**
Consumption of iodine/iodate	0 ppm	15,35 ± 2,44 [a]	14,45 ± 3,10 [a]
	≤15 ppm	74,60 ± 5,45 [b]	70,40 ± 7,45 [c]
	>15 ppm	10,05 ± 1,88 [d]	15,15 ± 3,95 [e]
Source of drinking water	Drinking water	81,44 ± 4,12 [f]	80,39 ± 5,85 [f]
	Non-Drinking water	18,66 ± 2,48 [g]	19,61 ± 3,84 [g]
Hand washing pratice	Non usage DLM	96,48 ± 4,88 [h]	14,88 ± 2,92 [i]
	Usage DLM	3,52 ± 1,04 [j]	85,12 ± 4,99 [k]

In each column, the means followed by the same alphabetical letters do not present significant differences at the 5% threshold according to the Student Newman-Keuls test. HWD: Hand Washing Device, PFD: Promotion of Food Diversification

The Table 3 present the frequency and quality of meals served to children aged 6 to 59 months in the monitored households. The data in the table indicates that before the PFD within households, the majority of women serve 2 to 3 meals to children aged 6 to 59 months (i.e. 40.51% and 45.68% respectively) while after the PFD, they served at least three meals (i.e. 3 meals in 39.12% of households and more than 3 meals in 58.3% of households). In

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

most households (97.52%) the quality of meals served to children aged 6 to 59 months contain the three food groups (energy food, growth food and protective food) after the PFD while before the foods served mainly contain two food groups (i.e. 90.48%).

Table 3: Frequency and quality of meals served to children aged 6 to 59months in monitored households

Proportion of households	**Frequency of meals**			**Presence of food groups**	
	2 meals per day	3 meals per day	More than 3 meals per day	2 food groups	3 food groups
Before PFD (%)	40,51 ± 4,24[a]	45,68 ± 3,94[c]	14,82± 2,64[e]	90,48 ± 4,14[g]	9,52± 2,20[e]
After PFD (%)	2,58 ± 0,84[b]	39,12 ± 3,42[d]	58,30 ± 4,15[f]	2,48 ± 0,84[h]	97,52 ± 3,19[f]

In each column, the means followed by the same alphabetical letters do not present significant differences at the 5% threshold according to the Student Newman-Keuls test. PFD: Promotion of Food Diversification

Concerning the nutritional status of children in the monitored households, the weight-for-age (W/A) index reflects underweight according to WHO recommendations. Table 4 below presents the average prevalence of underweight children aged 0 to 5 months in the households monitored. The average prevalence of severe underweight (Zscore < -3 (W/A Red)) is low (4.85%) before the PFD and high (11.79%) after the PFD. The average prevalence of moderate underweight (-3< Zscore <-2 (W/A Yellow)) is 7.45% and 7.25% respectively before and after PFD.

Table 4: Nutritional status of children aged 0 to 5 months from monitored households (weight/age index)

	Before PDA		**After PDA**	
Weight index for age of children from 0 to 5 months	**Average number (n=27)**	**Average prevalence (%)**	**Average number (n=29)**	**Average prevalence (%)**
Zscore > -2 (W/A Green)	24,04		23,48	
-3< Zscore <-2 (W/A Yellow)	2,05	7,45 ± 1,04[a]	2,10	7,25 ±1,51[a]
Zscore < -3 (W/A Red)	1,33	4,85 ± 0,98[b]	3,4	11,79 ±2,3[c]

In each column, the means followed by the same alphabetical letters do not present significant differences at the 5% threshold according to the Student Newman-Keuls test. PFD: Promotion of Food Diversification.

Table 5 below presents the average prevalence of underweight children aged 6 to 59 months in the households monitored. The average prevalence of severe underweight (Zscore < -3 (W/A Red)) before and after PFD are 3.52% and 1.59% respectively. The average prevalence of moderate underweight (-3< Zscore <-2 (W/A Yellow)) is 4.88% before and 3.85% after PFD.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Table 5: Nutritional status of children aged 6 to 59 months from monitored households (weight/age index)

	Before PFD		After PFD	
Weight index for age of children from 6 to 59 months	Average number (n=547)	Average prevalence (%)	Average number (n=529)	Average prevalence (%)
Zscore > -2 (W/A Green)	501		500	
-3< Zscore <-2 (W/A Yellow)	26,7	4,88 ± 0,84[a]	20,4	3,85 ± 0,91[b]
Zscore < -3 (W/A Red)	19,3	3,52 ± 0,48[c]	8,46	1,59 ± 0,48[d]

In each column, the means followed by the same alphabetical letters do not present significant differences at the 5% threshold according to the Student Newman-Keuls test. PFD: Promotion of Food Diversification.

Table 6 presents the average prevalence of wasting or acute malnutrition of children aged 6 to 59 months in the monitored households. The average prevalence of moderate acute malnutrition (-3< Zscore <-2 (W/H Yellow)) is higher before the PFD (8.7%) and lower after the PFD (4.46%). The average prevalence of severe acute malnutrition (Zscore < -3 (W/H Red)) is 3.34% and 1.97% respectively before and after the promotion of food diversification.

Table 6: Nutritional status of children aged 6 to 59 months from monitored households (weight/Height)

	Before PFD		After PFD	
Weight-for-Height index for children aged 6 to 59 months.	Average number (n=547)	Average prevalence (%)	Average number (n=529)	Average prevalence (%)
Zscore > -2 (W/H Green)	481		493	
-3< Zscore <-2 (W/H Yellow)	47,9	8,7 ± 1,2[a]	23,6	4,46 ± 1,01[b]
Zscore < -3 (W/H Red)	18,3	3,34 ± 0,98[d]	10,42	1,97 ± 0,84[c]

In each column, the means followed by the same alphabetical letters do not present significant differences at the 5% threshold according to the Student Newman-Keuls test. PFD: Promotion of Food Diversification.

The average prevalence of chronic malnutrition or stunted growth of children aged 6 to 59 months in monitored households is presented in Table 7 below. The average prevalence of moderate stunting (-3< Zscore <-2 (S/A Yellow)) fell after the PFD (from 8.75% before the PFD to 6.49% after). Likewise, the average prevalence of severe stunting (Zscore < -3 (S/A Red)) increased from 7.18% before the PFD to 3.93% after the PFD.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Table 7: Nutritional status of children aged 6 to 59 months from monitored households (Size/Age)

Size index for age of children from 6 to 59 months	Before PFD		After PFD	
	Average number (n=547)	Average prevalence (%)	Average number (n=529)	Average prevalence (%)
Zscore > -2 (S/A Green)	459,84		474,08	
-3< Zscore <-2 (S/A Yellow)	47,9	8,75 ± 1,05[a]	34,32	6,49 ± 0,52[b]
Zscore < -3 (S/A Red)	39,3	7,18 ± 0,94[d]	20,80	3,93 ± 0,42[c]

In each column, the means followed by the same alphabetical letters do not present significant differences at the 5% threshold according to the Student Newman-Keuls test. PFD: Promotion of Food Diversification.

Discussion

The proportions of households monitored before and after the Promoting Food Diversification (PFD) for the source of drinking water did not show any significant difference. This indicates that the source of drinking water used did not depend on the Promotion of Food Diversification. Indeed, with the promotion of good hygiene practices by field agents within the framework of the Multisectoral Food, Health and Nutrition Program (MFHNP) and Nutrition and Early Childhood Development Project (NECDP), the community understood the need of installing and maintaining boreholes to make it an Income Generating Activity (IGA) which will facilitate the access of drinking water for a large number of households. On the other hand, the difference observed in the proportions of households for the consumption of iodized salt can be explained by the poor conditions of handling salt (exposure to the sun, heat, addition before cooking food). The difference in the proportions of households for the practice of hand washing is justified by the fact that the year of introduction of the Promoting Food Diversification activity coincided with the requirement for hygiene conditions as preventive measures for Covid-19 contamination. Therefore, a crave for the use of Hand Washing Device (HWD) was observed and supported by the Hygiene and sanitation component of the package of activities implemented by field agents. The source of drinking water and the practice of hand washing are important hygiene conditions in the fight against chronic malnutrition as noted by Lokonon and Amoussa (2019) in their study on the profile of food security in the municipality of Tori-Bossito and Dangbo in southern Benin. The result of the high proportions of households using drinking water (81.44% before and 80.39% after the PFD) is different from that of Lokonon and Amoussa (2019) which indicated 85.5% due to the size of households taken into account and the period of the study. These authors carried out their study in 2018 with 104 households before the implementation of the interventions.

The proportions of households monitored showed significant differences in the frequency and quality of meals served before and after the

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

PFD. This difference depend on the training and support provided to women in their households. Indeed, women trained and supported on one of the themes of food diversification (home garden, small livestock and food processing) put into practice the skills and support received to provide food and income to their households jointly with their husband. The income from the activities allowed the trained and supported women to increase their purchasing power and easily obtained complementary foods to bring together the three groups in the dishes served in their households. It appears that the Promotion of Food Diversification contributes to the quality and frequency of meals served to children aged 6 to 59 months in their households. This study can serve as a basis for the food availability, food consumption and food diversification components to assess food and nutritional security within the households of trained and supported women as reported by Lee et *al*. (2016). It could also be used to assess an improvement in food and nutritional security in the municipality of Tori-Bossito after the interventions of the NECDP as Lokonon and Amoussa (2019) had hoped.

The mean prevalence of moderate underweight did not show any significant difference. On the other hand, the difference in the mean prevalence of severe underweight in children aged 0 to 5 months can be explained by the judicious implementation of Essential Family Practices (compliance with the vaccination schedule, Exclusive Breastfeeding, Early Breastfeeding) by the breastfeeding woman as advice was given by field agents. Indeed, children aged 0 to 5 months are not allowed to feed directly on other foods (neither water nor herbal tea) than breast milk during the first 6 months after birth for good development of the brain, the immune system and important physiological functions. Thus, when the Promotion of Food Diversification contributes to Food and Nutrition Security as reported by Lele et *al*. (2016), it is not sufficient to guarantee the ponderal index of children aged 0 to 5 months. This result confirmed the analysis of Camara et *al.* (2021) according to which vaccination and Exclusive Breastfeeding contribute better to the well-being of children aged 0 to 5 months. These results indicate that the Promotion of Food Diversification did not contribute to the weight index of children aged 0 to 5 months in their households.

Regarding the average prevalence of underweight children aged 6 to 59 months, the results showed a significant difference and indicated a decrease in the average prevalence of underweight after the Promotion of Food Diversification. This may depend on the training and support provided to women for the Promotion of Food Diversification. Indeed, in addition to the training and support for the formulation of complementary foods (enriched flour based on the three food groups), the promotion of home garden (supply of fruits and vegetables rich in minerals and vitamins) and small-scale poultry and small ruminant farming (supply of eggs and meat) to strengthen the

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

nutritional status of children from 6 months, field agents organized restitution sessions (peer training) to share the knowledge received within the community. In addition, some beneficiary women developed income-generating activities based on the training and support received. This allowed children aged 6 to 59 months from households with low purchasing power to have access to a rich and balanced complementary food. These results were consistent with those obtained by Bodjrenou et *al*. (2019) who indicate an improvement in the ponderal index following the introduction of complementary food into the diet of children aged 6 to 12 months in Sub-Benin. On the other hand, these results did not comply with those obtained by Marinda et *al*. (2023) through the assessment of dietary diversity and the nutritional status of children aged 6 to 59 months from rural fishing and non-fishing communities in Zambia. Indeed, the improvement in dietary diversity did not lead to a significant development of the ponderal index in children aged 6 to 59 months.

The average prevalence of moderate or severe acute wasting showed a significant difference and indicated a decrease after the Promotion of Food Diversification (PDA). These observed differences can be justified by the Promotion of Food Diversification in their households. Indeed, the training and support provided to women allowed them to ensure the availability and quality of meals served to children aged 6 to 59 months through products from the home garden (contribution of fruits and vegetables rich in minerals and vitamins) and small poultry and small ruminant farming (contribution of eggs and meat). In addition, the fact that some women use the training and support received to develop income generating activities, allowed them to provide first health care to children as quickly as possible to avoid complications. The benefits of income generating activities also allowed women to put into practice the acquired technologies for processing and formulating rich foods that meet the nutritional needs of children during cooking sessions. Thus, Promoting Food Diversification helps strengthen the capacity of women in their households to ensure optimal feeding, health and nutrition conditions for children aged 6 to 59 months. This same observation was made by Camara et *al*. (2021) through their study on severe acute malnutrition with complications in children aged 0 to 59 months in Guinea Conakry. These authors reported that when breastfeeding women or mothers of children have alternative sources of income to help the family, food and nutritional coverage for children is better ensured. Taha et *al*. (2014) had also highlighted socio-economic factors and dietary practices in the increase of the prevalence of malnutrition in all its forms. However, these results contradict those obtained by Marinda et *al*. (2023) who did not indicate any link between socio-economic status, dietary diversity of communities and the prevalence of acute malnutrition or wasting. Anchamo (2022) also reported other factors such as

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

large family size, age of children, diarrhea and household insecurity as determinants of the prevalence of severe acute malnutrition. It is evident from the present study that the Promotion of Food Diversification reduces the prevalence of wasting.

The different values of average prevalence of stunting showed significant differences. This can be explained not only by the Promotion of Food Diversification but also by better hygiene practices (hand washing and source of drinking water). Indeed, when trained and supported women put into practice the skills received, they bought products from the three food groups and earned income from the sale of the products (fruits and vegetables, eggs, animals and enriched flour) to meet the other vital needs of their children (child care and hygiene practices) even before the support of their spouse. Thus, when women manage to meet the needs of their children first, they more easily applied the advice given them by field agents on hygiene (installation of the Hand Washing Device, maintenance and use of the device, purchase of water from sources recognized as drinkable) and the use of the First Reference Health Center (FRHC) in the event of signs of danger of diseases (persistent diarrhea, pneumonia and malaria) to avoid chronic malnutrition. These results confirmed those of Lokonon and Amoussa (2019) who indicated a strong correlation between hygiene practices (hand washing and portable water source) and chronic malnutrition but did not focus on the resources needed to apply hygiene practices. On the other hand, the studies of Ahmad et *al*. (2018) and those of Marinda et *al*. (2023) established a strong correlation between lacks of dietary diversity and stunting in children aged 6 to 23 months on the one hand and in children aged 6 to 59 months on the other hand. In addition, the prevalence of moderate (6.49%) and severe (3.93%) stunting obtained in the present study are different from those obtained by Rahimov et *al*. (2019) respectively 14.6% and 4.8% through their study on the evolution of the nutritional status of children under 5 years in northwest Syria. Nevertheless, these results confirmed a predominance of the prevalence of moderate stunting compared to that of severe stunting in children aged 6 to 59 months. Furthermore, these authors did not highlight the correlation between hygiene practices and stunting but stated causes related to the increase of food insecurity, lack of access to health services and loss of livelihoods. These results indicated that training and support for women for the Promotion of Food Diversification contributed to reducing the prevalence of stunted growth in children aged 6 to 59 months in the households of beneficiary women.

Conclusion

The evaluation of the impact of the Promotion of Food Diversification as one of the activities in the package of activities of Nutrition and Early Childhood Development Project interventions in the municipality of Tori-

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Bossito was the opportunity to know that the households monitored mostly adopt better hygiene practices (hand washing practices and consumption of drinking water). Most of these households consumed salt low in iodine (content <15 ppm). The Promotion of Food Diversification has contributed to food availability and the quality of meals served (more than three meals served per day containing the three food groups: energy food (rich in sugar or lipids), growth food (rich in proteins) and protective food (rich in vitamins and minerals)) for children aged 6 to 59 months in their households. In addition, the Promotion of Food Diversification has contributed to reducing the prevalence of all forms of malnutrition (from 3.52% to 1.59% for severe underweight, from 3.34% to 1.97% for severe wasting and from 7.18% to 3.93% for severe stunting) in children aged 6 to 59 months. On the other hand, the study revealed that the promotion of dietary diversification does not contribute to the reduction of underweight among children aged 0 to 5 months. This activity is therefore important and recommended in food and nutritional intervention projects and programs in community settings to eradicate malnutrition in all its forms.

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References:

1. Ahmad, I., Khalique, N. & Khalil, S., 2018. Dietary diversity and stunting among infants and young children: a cross-sectional study in Aligarh, Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine 43 (1) (2018) 34.
2. Anchamo A., 2022. Severe acute malnutrition and associated factors among children under-five years: A community based-cross sectional study in Ethiopia. 10.1016/j.heliyon.2022.e10791 ;
3. WB, World Bank, 2019. The African Humain Capital Plan: boosting Africa's potential by investing in people, 16p ;
4. Bodjrenou, F. S. U., Amoussa Hounkpatin, W., Houndji, S., Lokonon, J., Kodjo, M. A. D. R. & Aïtondji Dossa, L.A., 2019. Réduction de la

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

malnutrition chronique par une approche alimentaire : une étude pilote en milieu rural au Sud Bénin. Annales des sciences agronomiques 22 (1) : 133-150, 2018 ISSN 1659 – 5009 ;

5. Camara, E., Diop, M. M., Barry I. K., Conde, I, Barry, A., Bah, M., Diallo, S. B., & Bah, M.A., 2021. Malnutrition Aigüe Sévère avec Complications chez les Enfants de 0 à 59 Mois: Aspects Épidémiologique, Clinique et Thérapeutique au Service de Pédiatrie de Labé, Guiné Conakry. The Journal of Medicine et Biomedical Sciences, Health Sci. Dis: Vol 22 (7) July 2021 Available free at www.hsd-fmsb.org;
6. NFC, Food and Nutrition Council., 2022. Workshop to review intervention and develop monitoring and evaluation tools as part of the Nutrition and Early Childhood Development Project in Benin. Final report, Dassa, Benin p 50 ;
7. Chabi-Akoha, E., Agassounon, C., Aguemon, F., Gandonou, M. & Houensou-Idrissou, M., 2021. Support de formation du module stimulation et éveil, Bohicon, le 29-30 juillet 2021, CAN-Projet 57 NDPE, 57p CAN, Conseil de l'Alimentation et de la Nutrition, 2017. Plan Stratégique de Développement de l'Alimentation et de la Nutrition, 2017, 80 p ;
8. EDS, 2017-2018. Enquête Démographique et de Santé, Bénin ;
9. INSAE, 2016b: Recensement Général de la Population et de l'Habitat (RGPH-4, 2013) : cahier des villages et des quartiers de villes du département de l'Atlantique, Août 2016, p42 ;
10. Lele, U., Masters, W.A., Kinabo, J., Meenakshi, J., Ramaswami, B., Tagwireyi, J., Bell, W. & Goswami, S., 2016. Measuring Food and Nutrition Security: An Independent Technical Assessment and User's Guide for Existing Indicators. Measuring Food and Nutrition Security Technical Working Group. Rome : Food Security Information Network. Available at http://www.fsincop.net/topics/fns-measurement.;
11. Lokonon, J. H.F. & Amoussa Hounkpatin, w. B. A., 2019. Profil de la sécurité alimentaire et nutritionnelle des communes de Dangbo et de Tori-Bossito au Sud-Bénin, Annale de l'Université de Parakou, Série « sciences naturelle et agronomie », juin 2019, Vol.9 (No.1) : 21-32 ;
12. Marinda, P., A., Chalula, F., Khayeka-Wandabwa, C., Audain, K. & Thilsted, S., H., 2023. Dietary diversity and nutritional status of children aged 6–59 months from rural fishing and non-fishing communities in Zambia, Scientific African 19 (2023) e01527 ;
13. Ministère de la Santé., 2015 : Cahier du relais communautaire, version juin 2015, 134 p ;

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

14. Mudékéréza M. 2017. Malnutrition chez l'enfant de moins de 5 ans à Lubumbashi et ses environs : Approche épidémio-clinique et biochimique dans un milieu minier. [République démocratique du Congo]: université de Lubumbashi; 2017 p207;
15. WHO, World Health Organization, 2018. The state of food and nutrition security in the world 2018. Report 2018. https://www.who.int/fr/news-room/detail/11-09-2018-global-hunger-continuesto-rise---new-un-report-says consulté le 15/01/2024 ;
16. WHO, World Health Organization, 2021. ''Nutrition'' https://www.who.int/fr/health-topics/nutrition;
17. World Food Program. (WFP), 2008. The main types of malnutrition and micronutrient deficiencies, Nutrition Directorat, 32p ;
18. Rahimov B., Mekkawi, T. & Tyler, V. 2019. Evolution de l'état nutritionnel des enfants de moins de 5 ans dans le nord-ouest de la Syrie(www.ennonline.net) ;
19. Taha, H., M., Hassan, H., M., Elrasheed, A., A., Nazik, E., M., 2014. Prevalence of malnutrition among children under five years old in Khartoum State, Sudan. Polish Annals of Medicine, Volume 21, Issue 1, June 2014, Pages 1-7, https://doi.org/10.1016/j.poamed.2014.01.001Get rights and content ;
20. Traoré F. D., Traoré F. & Sacko K., 2020. Malnutrition, physiopathologie et prise en charge, 8 p ;
21. Walker, S. P., Wachs, T. D., Meeks G. J., Lozoff, B., Wasser-man, G. A. & Pollitt, E., 2007. Risk factors for ad-verse outcomes in developing countries. *Lancet* 2007 Jan; 13(369):145-56 ;
22. Yasbeck, A.,Twinomugisha, A., Devercelli, A., Bakilana, A., Lee, C., Massiah, E., Ade, F., Naqvi, F., Kidwai, H., Haq, I. U., Feda, K., Shrestha, M., Tuoane, M., Gracheva, M., De Simone, M., Mulatu, M., Jelil, M., Dsouza, R., Chase, R., Ahiko, R., Al-Samarrai, S., Troiano, S., Powers, S., Bajaj, S., Udahemuka, S., Jagannathan, S., Belay, T. & Mekonnen, Y., 2023. Approche intégrée pour améliorer la santé et la nutrition, série de notes techniques sur le capital humain en Afrique, 3p. (www.worldbank.org/en/events/2023/07/25/africa-human-capital-heads-of-state-summit)