



Smart Management of Malnutrition Using Local Foods: A Sustainable Initiative for Developing Countries

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Malnutrition is one of the major challenges the developing world is currently facing, whether it is caused by climate change, terrorism and conflict, or demographic shifts. Poverty is the main cause of malnutrition in this part of the world, and no progress is possible without the alleviation of poverty to reduce malnutrition. Reducing household vulnerability and increasing household resilience is the pathway to sustainable malnutrition management. Malnutrition has been a major threat to the health and development of children in developing countries, presenting as high levels of micronutrient deficiencies, stunting, and global acute malnutrition. The rates of malnutrition of all forms are above the thresholds accepted by the WHO in some regions. To this end, the resilience program on achieving nutrition in a developing country through at-home learning activities for nutritional rehabilitation and dietary promotion (known as FARN) reported, in this case, successful results from both statements from beneficiaries and non-beneficiaries on the reduction and management of malnutrition in their health centers. FARN activity encourages the consumption of locally available foods not only to eradicate malnutrition but also to protect the ecosystem and sustainable nutrition security. This is much like the saying, “Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime” to the vulnerable people; parents’ knowledge of their child’s nutritional status and the use of local-based foods diets showed improvement, which is proof of the impact of the resilience program. It can be concluded that the resilience program through its activities at the level of the selected community significantly affected the factors and degree of persistence of malnutrition and the level of resilience of the populations. Thus, the FARN program showed resounding success in its ability to promote sustainable malnutrition management.

Keywords: malnutrition, FARN, local foods, resilience, vulnerability

INTRODUCTION

Smart food is a concept that teaches others how food should be good for you, good for the planet, and good for the farmer. This requires dedicated effort not just by initially popularizing a couple of smart foods to build value chains for mainstreaming but also by once again focusing on smart foods as staples in developing countries. The concept is meant to provide consumers with the necessary

nutrients throughout the entire meal. In agriculture, smart food is good for smallholder farmers because living in areas with high temperatures often means survival with very little water, and there are several more examples of other climate constraints (Martínez-Ballesta et al., 2018; Kane-Potaka, 2019). That means smart food has to be sustainable to be smart.

Vulnerability refers to the inability to withstand the effects of a hostile environment. Vulnerability is the human view of disasters and is the result of the range of economic, social, cultural, institutional, political, and psychological factors that shape people's lives and the environment that they live in. As far as food security is concerned, vulnerability relates to an outcome, such as hunger, food insecurity, or famine. Put differently, vulnerability is the diminished capacity of an individual or group to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard (Thomas et al., 2019; Spielman et al., 2020; Mbuli et al., 2021).

Malnutrition refers to when a person's diet does not provide enough nutrients or the right balance of nutrients for optimal health. Causes of malnutrition include inappropriate dietary choices, a low income, difficulty obtaining food, and various physical and mental health conditions. Malnutrition, in all its forms, includes undernutrition (wasting, stunting, underweight), inadequate vitamins or minerals, being overweight, obesity, and resulting diet-related non-communicable diseases (Phillips et al., 2020; Amadou et al., 2020). In addition, moderate food insecurity can increase the risk of some forms of malnutrition, such as stunting in children, micronutrient deficiencies, or obesity in adults. People experiencing severe food insecurity have run out of food and, at the most extreme, have gone days without eating (Boliko, 2019). The 2021 edition of UNICEF, WHO, and World Bank Group joint child malnutrition estimates for the 2000–2020 period was released. This shows that stunting prevalence has been declining since the year 2000; more than one in five—49.2 million children under 5—were stunted in 2020, and 45.4 million suffered from wasting. Stunting has declined steadily since 2000, but faster progress is needed to reach the 2030 target. Wasting persists at alarming rates, and the being overweight factor will require a reversal in trajectory if the 2030 target is to be achieved. In addition, about half of all deaths in children under 5 are attributable to undernutrition, which puts children at greater risk of dying from common infections, increases the frequency and severity of such infections, and delays recovery. This joint report represents the most recent global and regional figures, showing that 22.0% of all children under 5 years were stunted in 2020; 13.6 million children under 5 years were affected by wasting in its severe form in 2020, and 5.7% of the same age children in the same were overweight (Akombi et al., 2017; UNICEF, 2018; World Health Organization, 2021; Zagre, 2021). The developmental, economic, social, and medical impacts of the global burden of malnutrition are serious and lasting for individuals and their families, for communities, and for countries. Every country in the world is affected by one or more forms of malnutrition. Combating malnutrition in all its forms is one of the greatest global health challenges. Poverty amplifies the risk of, and risks from malnutrition. People who are poor are more likely to be affected by different forms

of malnutrition. Also, malnutrition increases healthcare costs, reduces productivity, and slows economic growth, which can perpetuate a cycle of poverty and ill-health (Adeyeye et al., 2017; Chatindiara et al., 2020).

Eating a healthy diet is not about strict limitations, staying unrealistically thin, or depriving ourselves of the foods we love. Rather, it is about feeling great, having more energy, improving one's health, and boosting one's mood. There exists much conflicting advice, but healthy eating does not have to be overly complicated. Nowadays, any time an expert says something about certain foods being "good," there is another one saying exactly the opposite. Indeed, there are some specific foods or nutrients that have a beneficial effect on mood, while one's overall dietary pattern is most important. Often said processed food may have an impact on health, though the cornerstone of a healthy diet should be eating food that is as close as possible to the way nature made it. Processing food can be the way toward positive benefits such as the removal of antinutrients (Green et al., 2018; Willett et al., 2019). There is a need to balance one's diet with protein, fat, carbohydrates, fiber, vitamins, and minerals to sustain a healthy body. There is no need to eliminate certain categories of food from one's diet, but we should rather select the healthiest options from each category.

A sustainable food system has been defined as a food system that delivers food security and nutrition for all in such a way that the economic, social, and environmental bases to generate food security and nutrition for future generations are not compromised. In other words, a sustainable food system is a type of food system that provides healthy food to people and creates sustainable environmental, economic, and social systems that surround food (Green et al., 2018). Willett et al. (2019) reported that healthy diets from sustainable food systems showed a global shift toward more plant-based foods that would help feed the world's growing population a nutritious and sustainable diet. Various reports have said that typical food production practices can contribute to air pollution, create non-potable water, and cause land erosion among many other consequences contributing to the global climate crisis. Furthermore, sustainable management of agriculture is key to maintaining and revitalizing our environment. Focusing on sustainable modes of food production can be so important such as regenerative agriculture, to benefit the land that's being grown on, where all the system benefits around the managed land (Jharia et al., 2019; Skaf et al., 2019).

The Secretary General of the UN António Guterres declared during his speech on world environment day on the 5th of June 2021 that "*the man action on the degradation of nature have put 40% of humanity undermining their well-being.*" He furthermore said, "*Luckily, the earth is resilient but she needs our help.*" The major deficits in agricultural production due to climate change have a direct effect on the resilience of vulnerable households, and this can lead to migration and constitute a handicap for food security and sustainable agriculture. Climate change poses a threat to health and nutrition. In the future, we will encounter many challenges and opportunities for harnessing these less-mainstream food crops; we should seek to provide strategic recommendations to enable an environment for the

promotion, production, marketing, and consumption of these foods, assuring healthy diets for the next generation. Thus, instead of focusing exclusively on food production or access to food, resilient food systems integrate an approach that can tackle both at the same time, reinforcing the food security of poor farmers and consumers in the zone (Mudogo, 2017; Kabore, 2019; Béné, 2020). Indeed, resilience is also at the center of a growing body of research, which attempts to understand what properties make a country, community, or household resilient and to determine the principles and processes that strengthen resilience (Manyena et al., 2019). That is why the approach recently suggested is restoring our ecosystem, which will create jobs, generate revenue, and feed the world. Therefore, this chapter wishes to contribute to the general audience this tool of learning for nutritional rehabilitation homes (FARN) through the use of smart local dietary promotion to manage malnutrition of vulnerable populations in developing countries.

VULNERABILITY AND REDUCTION OF MALNUTRITION

The people living in rural areas practice agriculture as their main subsistence activity, but this agriculture cannot meet the food needs of households due to the harmful effects of climate change and natural disasters. Poor agricultural production and the lack of a source of income have exposed the majority of the population of these regions to a situation of food vulnerability (Pahlisch, 2019; Spielman et al., 2020). Poor access to agricultural, pastoral, and fishery products has a negative impact on the nutritional status of the population (Chatindiara et al., 2020). Production from agriculture cannot meet household food needs. The irregular rains and attacks from locusts and other crop pests are also responsible for the food situation in the vulnerable communities. In many cases of vulnerability, the food and nutritional situation has always remained at the top of the list, and this is the case of sub-Saharan Africa, which is extremely vulnerable to famine and food crises (Nurhayati and Lubis, 2021).

Research has shown that insufficient food intake in terms of both quantity and quality can tip a child into malnutrition (Boliko, 2019; World Health Organization, 2021). Malnutrition can be caused by poor dietary practices, and this involves a high rate of eating habits that include consuming processed cereal products and a low rate of use of vegetables, fruits, and legumes (Chan et al., 2014; Amadou et al., 2020). This explains the poverty of a population that gives an economic value to these foods. The factors of persistence of food and nutritional security in the regions identified as vulnerable by the surveying system often set up by NGOs and UN organizations (such as the UNDP, FAO, UNICEF, WFP, etc.) and the government are all linked to poverty and ignorance (Figure 1).

The fight against all forms of malnutrition requires a large-scale implementation of a package of interventions according to an integrated and multisectoral approach to tackle the immediate and underlying causes of malnutrition, especially in children. This must be achieved through the improvement

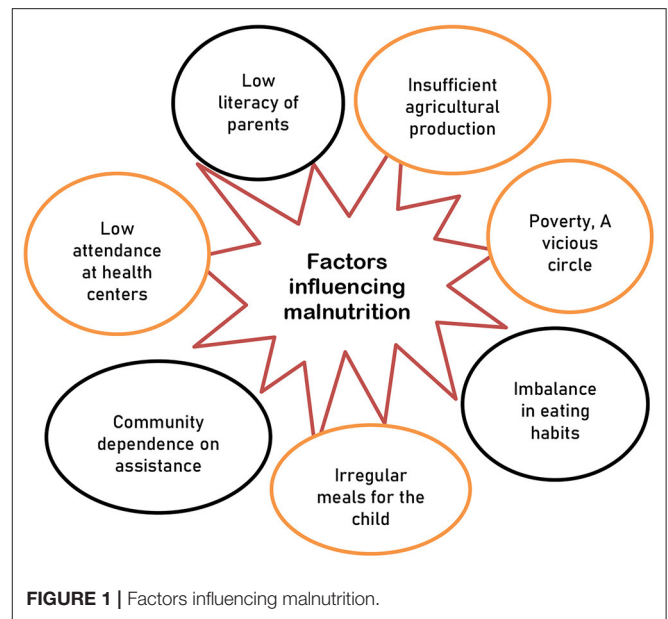


FIGURE 1 | Factors influencing malnutrition.

of family practices essential for the survival and development of the child and better access to health, education, hygiene, and sanitation services on the one hand and the improvement of feeding in infants and young children on the other hand (Onyango et al., 2019; Li et al., 2020; Prieto et al., 2020). Often, this joint program has the objective of strengthening the capacities of the government to monitor and fight against malnutrition and support local interventions aimed at raising public awareness, strengthening capacities and mechanisms to combat insecurity, improve household food sources, and reduce malnutrition (Boliko, 2019; Skaf et al., 2019; Béné, 2020). Action such as introducing activities to increase resilience and nutrition security in some of these vulnerable regions was introduced and showed successful results; such action has had a significant impact, changing the status of households considerably through an increase in the standard of living of families through a reduction in malnutrition (Osabohien et al., 2019; Mary et al., 2020; Lawali et al., 2021).

LEARNING AND NUTRITIONAL REHABILITATION HOMES A NUTRITIONAL SECURITY TOOL FOR RESILIENCE

Nowadays, the term resilience is used for aspects of several disciplines, but it is used more in the field of food security and nutrition, which is a primary topic when discussing development. Indeed, following a series of disasters around the world, resilience is one of the fundamental concepts of Risk and Disaster Management and development. The major challenge that arises is to determine the means of making the system resilient to ensure sustainability for disaster victims (Allam and Jones, 2019; Lemena et al., 2021). The intervention of humanitarian organizations involves various sub-programs, which include

the activity of learning and nutritional rehabilitation homes (FARN). FARN is a gathering place in a community or village, where cooking demonstrations and increasing awareness of good nutrition, health, and hygiene take place. FARN activity is encouraging the consumption of locally available foods not only for eradicating malnutrition but also to protect the ecosystem and sustainable nutrition security. It is much like the saying, “*Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime.*” Trainer moms, called “Mamans lumière” or light mothers, and beneficiary mothers cook balanced and nutritious meals together; that is, they prepare menus based on locally available foods ingredients. The enlightenment mothers come from a household with modest incomes but with well-nourished and healthy children. In addition, the work involves preventing malnutrition in children under 5 years old, rehabilitating moderately malnourished children within their own communities based on available local foods. Products from farms are the driving force behind FARN’s activities. Upstream, a systemic screening of these children is carried out in the vulnerable target areas before the weekly cooking demonstrations, and home follow-ups and FARN inputs are community-based. In addition, it is at the community level that the screening of malnourished children happens with the help of MUAC Tape (Mid-Upper Arm Circumference). Thus, the people who work for FARN consist of the community relays, light mothers, health workers, mothers of children, fathers of children, and supervisors. In addition, there is positive deviance (positive model) among the FARN mothers that leads to reduction and prevention of malnutrition through behavior changes. Indeed, the FARN activity is meant to impact the malnutrition in the community of the vulnerable populations through the use of recipes based on local products. Furthermore, FARN is a community approach to rehabilitation nutrition and changes in dietary behavior (Houngavou and Masquelier, 2018; Kêdoté et al., 2018).

Impacts of Learning and Nutritional Rehabilitation Homes Activities

The impacts of FARN activity on malnutrition according to the beneficiaries and non-beneficiaries of the resilience program set up by NGOs have seen a clear decrease in malnutrition in the communities tested. The changes were, among others, access to health centers, reduction of malnutrition and birth spacing, formulation of recipes based on local products, prevention of malaria, and family planning. This is due to the fact that nutrition activities concern the entire rural population. The mothers report a clear improvement in the nutritional status of their children following FARN’s activities, which use recipes based on local products at home. FARN had an extended positive effect even on the non-programmed tested populations; we noted the development of a community contribution fund initiative to support FARN activity in their communities, which encourages income-generating activities. The use of recipes based on local food products at home had improved significantly the behavior of mothers for the benefit of the nutritional status of their children. It was noticed that a recipe was prepared every week

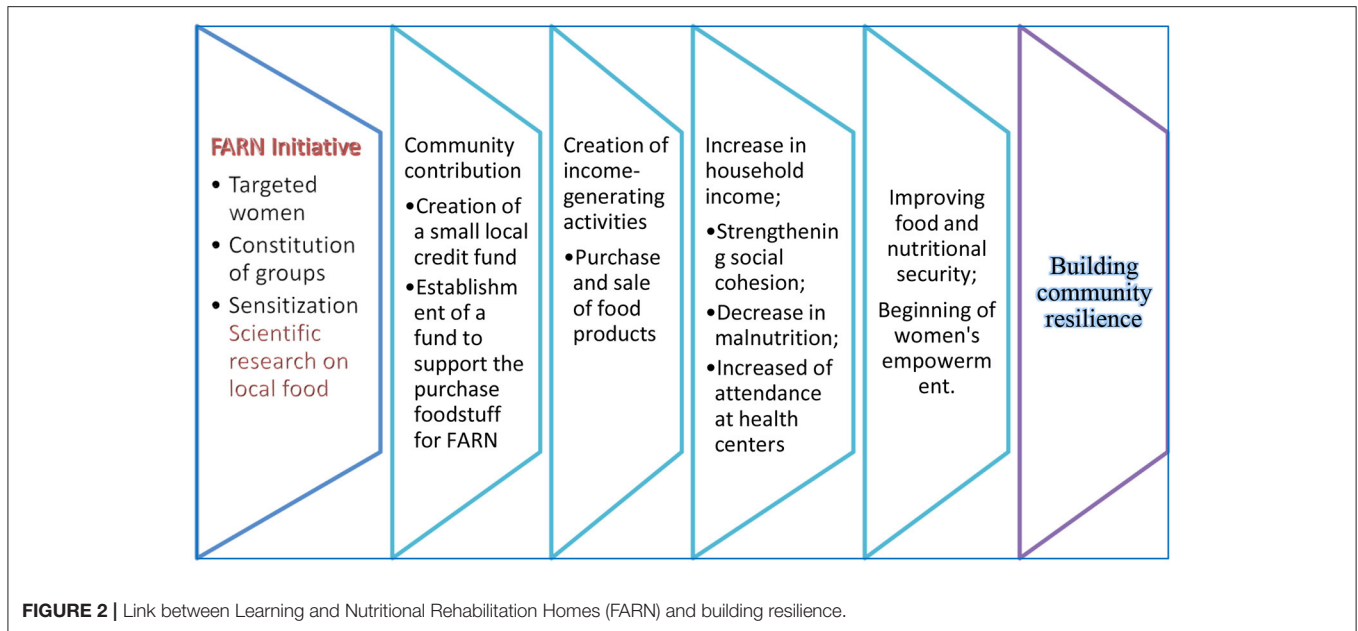
during the FARN activities using the sample recipe guide, and when the demonstrations were taking place, a FARN “Maman lumière” (or light mother) explained the recipe to the mothers. Indeed, a light mother is defined as a mother identified in the community who has successfully fed her children with her limited means using locally available foods. An interview with a FARN witness of a rural community in the Maradi, Niger, said, “Before the opening of this center, we encountered a lot of malnutrition problems that dangerously undermine the growth of our children. Today, thanks to what we have learned, malnutrition has almost disappeared from the village, because it is from local food products that we feed our children.” This shows the impact FARN activities have on the community (Amadou et al., 2020; Lawali et al., 2021).

Impacts of Scientific Research on Local Food

Science and technology be a major contribution through the provision of practical solutions. Recently, science and development have promoted local food as a primary block of for the demand of local food. Many practices are optimized and scaled up to advance adaptation throughout the food system. This has occurred mostly in rural areas and developing countries practicing sustainable agriculture through indigenous crops promotions with scientific research evidence (Beddington, 2010; Turner et al., 2018). It is a fact that consumption of healthy and sustainable diets presents major opportunities for the local food system. The global population will grow to around 9 billion by 2050, and this will mean a corresponding increase in the global food demand, putting additional pressure on the food system. The future food cannot bypass local food production and processing, and challenges in resolving food security and nutrition must be solved through research. The result of new and endogenous food has shown its efficiency in increasing the resilience of the local population in many developing countries (Willett et al., 2019; Jia, 2021). Despite climate change and extreme weather challenges, scientific research has come up with solutions to contribute to global food security and tackle malnutrition around the globe, including techniques and technologies from many disciplines, ranging from biotechnology and engineering to newer fields such as nanotechnology (Meyerding et al., 2019). Indeed, during a United Nation’s conference on the role of science, technology, and innovation in ensuring food security by 2030, it was stipulated in their second goal that only adopted measures can ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information on items such as food reserves to tackle extreme food price volatility (Jia, 2021; Kane-Potaka et al., 2021).

Evidence of Building Resilience in Communities

The concept of community resilience describes well how a social group can recover from the aftermath of a disaster (Bankoff, 2019). Furthermore, a community can be defined as an entity with geographical borders and as sharing a fate—a destiny.



However, community resilience is not the sum of these parts; it is not because individuals are resilient that the group will be adequately resilient (Townshend et al., 2015). Resilience is considered “the intrinsic capacity of companies, organizations, and communities to regain a state of equilibrium (Allam and Jones, 2019).” When facing a very low production that does not cover the food needs of the household, the population practices adaptation strategies to cover the food needs of the households. According to the surveillance of the vulnerable regions, households generally adapt to the following different strategies to meet their needs: consumption of less preferred foods, reduction of the daily dietary intake, purchase of food on credit, reduction of daily meals in number, borrowing food, leaving more assets than usual, and withdrawing children from school (Caiafa et al., 2019; Mary et al., 2020). Indeed, the causes of disasters are not simply beyond human control and impossible to eliminate through technical solutions only, but it is essential for building resilience to disasters to address socio-economic factors as well as policies that put populations at risk (Meybeck and Gitz, 2017; Manyena et al., 2019; Loconto, 2020). A new framework to build community resilience for children and families was created; a community is said to be resilient when its members have put into practice early and effective actions that can help them to respond to adversity in a healthy manner (Ellis and Dietz, 2017).

To tackle malnutrition, the increase in production helped manage the malnutrition of children from 6 to 59 months of age significantly at the community level through the use of available local food products. Furthermore, the income-generating activities (IGAs) and socioeconomic class change also helped. The IGAs helped due to the community contribution being considered as a strategy developed by the population concerned to ensure their empowerment and to be more resilient. This has resulted not only in improving the living conditions of the households but also contribute to reducing the rates of

malnourished children. Such success can be explained by acts of raising awareness and the ability to be autonomous (Abraham et al., 2019). Lemena et al. (2021) underline the importance of the participatory peasant approach during risk assessment in terms of building resilience in the communities. **Figure 2** shows evidence that the learning and nutritional rehabilitation home approach contributed to building resilience in communities.

CONDITIONS FOR THE DURABILITY OF FARN

The High-Level Panel of Experts on Food Security and Nutrition (HLPE) said that “a sustainable food system is a food system that guarantees food security and nutrition for stated everyone without compromising the economic, social and environmental requirements for food security and the nutrition of future generations.” Food and agriculture are part of the global concept, driven by consumption, which refers to the integrated implementation of food production and consumption models, respecting the support capacities of natural ecosystems. Agro-food systems thrive within limited and sometimes shrinking resources. The growth of agro-food systems must be inclusive, must target objectives beyond production, including efficiency along the food chain; and should promote sustainable dietary practices and diets. This involves the use of natural resources in an environmentally, economically, socially, and culturally sustainable manner to conserve the ecosystem (Singh and Singh, 2017; Reid et al., 2019).

FARN is a tool for managing malnutrition in communities vulnerable to food and nutrition insecurity crises. In addition to this, there is the problem of hygiene and healthcare of mother and child, which can be caused by dehydration, a heavy expenditure, and a loss of nutrients and energy in the body of the victims. It

is recognized that micronutrient deficiencies constitute a public health problem by promoting chronic malnutrition. This type of insecurity is explained not only by the lack of food resources, but it is also linked to the low-level income of households and difficulties to access the basic community resources, such as land, livestock capital, water, cash-generating activities, etc. (Eika et al., 2019; Lawali et al., 2021). Indeed, factors such as the status of women in society and their access to education influence the process of improving children's nutrition (Ogundari and Awokuse, 2018; Sajid et al., 2021). So, to sustain these gains, an educated parent is easily better informed about the care and proper nutrition for their children. This is better for respecting messages of prevention and protection of children against disease and malnutrition as well as for the preservation of a clean and more hygienic environment. This type of parent thinks that health and nutrition education will have to be promoted more widely to guarantee the future of their child (Ruton et al., 2018). Eating is one of the favorite activities of a child right from birth not only because they need it but also because it constitutes a tender moment of exchange with their mother. Breast milk is then the ideal food, but "infant formula" can be chosen. For instance, the activity of FARN in the situation of vulnerability proved to be important for the management of malnutrition in the communities using local food products (Amadou et al., 2020).

Achieving the sustainable development goal of ending hunger and achieving food and nutrition security by 2030 seems difficult, especially following the COVID-19 pandemic (Kansiime et al., 2021). The world population is increasing quite quickly, having a more elevated rate in developing countries, and family farming or traditional agricultural systems are coming under pressure and fail to provide adequate food and income for people (Adhikari et al., 2019; El Bilali et al., 2019). There are several factors that lead to major deficits in agricultural production; yet, climate change has a direct effect on this—a huge trait that led people to migrate, causing a lot of handicaps for food security threatening their health and nutrition. Nowadays, farmers are gradually abandoning the cultivation of their local food crops and replacing these with cash crops such as cotton, mustard, fruits, cocoa, coffee, etc. Adhikari et al. (2019) stated in their study that in Nepal and Bangladesh local crops contributed only to 3 and 7% of their energy intake, respectively. The analysis of local crops

showed these to be sustainable foods for the future due to their acceptability by society, their high nutritional values, good and resilient for farming systems. Indeed, they have the potential to improve farmers' income and efficiency for a sustainable economy (Olayide and Alabi, 2018; Eika et al., 2019). The more sustainable the agriculture system the better the availability of local food products for local consumption is; thus, the better the FARN activity is for the sustainable management of malnutrition in the developing countries.

CONCLUSION

The activities carried out by the humanitarian organizations on the resilience-building programs in various developing countries have brought about significant changes to the socio-economic life of the beneficiaries, as their status has changed from vulnerable to less vulnerable. Indeed, the implementation of FARN—the use of local foods—is a model that has proven effective for the prevention of malnutrition in children and the sustainability of food production in these communities. To make this acquired FARN approach a sustainable solution there is a need to revolutionize the local farming systems for a behavior change on the parts of both farmers and consumers, highlighting the importance of the environment and public awareness. However, the ignorance of the population is the first factor that hinders the development of communities on the social level because it has a direct impact on the education of children, attendance at health centers, and the behavior of the rural population. Therefore, we must take into account all the socio-cultural realities in developing countries that will help improve the development of structure activities of resilient vulnerable communities. For this, it is necessary to strengthen the awareness of this type of community in order to lead to a change in favorable behavior to the consumption of local foodstuffs and to popularize FARN on a large scale.

AUTHOR CONTRIBUTIONS

IA and SL designed and planned the work and approved the work and decided to submit it. IA wrote the manuscript. Both of us agree to be accountable for the content of the work.

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