

Review article

Overview on the impacts of nutrition-sensitive intervention on dietary diversity and nutritional status of women and children in developing countries

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Abstract

Introduction: Globally, two billion people suffer from micronutrient deficiencies, 151 million children under five suffer from stunting, and millions more have impaired cognitive development related to poor nutrition. This is partly due to insufficient consumption of animal-sourced foods, which supply multiple bioavailable nutrients that are lacking in cereal-based diets.

Objective: To synthesize evidence on the impact of nutrition-sensitive intervention on dietary diversity and nutritional status of women and children focusing on developing countries

Methods: The review is based on a systematic search of the published and unpublished literature. No institutional review approval was required for this study as humans were not involved.

Results: It was analyzed to see what previous efforts related to enhancing the dietary diversity of women and children were in place. Based on this, six studies showed that children under 5 years of age suffer from stunting caused by diets of insufficient quality and quantity, improper care and feeding practices in early life. Besides, it was found that the knowledge about the linkages between agriculture and nutrition are still limited. The major gap observed in nutrition-sensitive agricultural interventions is found to be lack of multi-sector collaboration for tackling malnutrition. None of the studies assessed showed whether nutrition-specific interventions should be jointly or separately applied for tackling malnutrition.

Conclusion: It is found that the knowledge about the linkages between agriculture and nutrition are still limited. A multi-sectorial approach is mainly required to tackle nutrition security in general and dietary diversity in particular.

KeyWords: Women of reproductive age, dietary intake, nutrition education, healthy eating, diet diversity

Introduction

According to FAO, WFP, and UNICEF, 815 million people were suffering from hunger in 2016, a 38 million increase compared to the previous year (FAO et al. 2015). Around 155 million children have stunted growth due to poor nutrition. Levels of nutrient deficiencies are also alarmingly high: two billion people suffer from micronutrient deficiencies, also known as “hidden hunger.” Unless urgent and effective action is taken, more than half of the world’s population will suffer from at least one type of malnutrition by 2030 (Mozaffarian et al. 2018).

Worldwide, malnutrition accounts for 45% of child mortality (Black et al. 2013). Africa is the continent that has made the least progress in reducing the prevalence of undernutrition, and after a decline, undernutrition is on the rise again (Pedersen and C.S. 2018). Data indicates that 25% of the world’s under five years children are stunted, and this prevalence increases to 38% in Sub-Saharan Africa (UNICEF et al. 2017). Maternal short stature, a long-term consequence of stunting in girls, is further associated with fetal growth restriction, which can lead to

neonatal death and stunting in the next generation (Katz et al. 2013). Agricultural development aimed specifically at improving the diets of women of reproductive age is crucial, therefore, to ending the intergenerational cycle of hunger and malnutrition, and restoring the bridge between agriculture and health is at the highest importance.

Stunting is a consequence of chronic nutritional deprivation that can begin during and even prior to pregnancy due to maternal malnutrition and other in utero adversities. Child undernutrition is associated with high child mortality and morbidity (Black et al. 2013), poor motor and cognitive development, lower educational attainment, and economic productivity in adulthood (Black et al. 2013). Despite investments in agriculture and gains in productivity of food staples in Africa, the number of children who are stunted due to malnutrition is climbing (Stevens et al. 2012).

Achievements in food security have not been translated to improved nutrition and health at the household level (International Food Policy Research Institute 2015). The scale of malnutrition across the continent continues to be high, with 58 million under

five years of age children too short for their age (stunted), 13.9 million weighs too little for their height (wasted), and 10.3 million are overweight (Covic et al. 2016). An estimated 163.6 million children and women of reproductive age are anemic (Oyedele 2017), while more than 220 million people are estimated to be calorie deficient (FAO et al. 2015). Adult obesity is also on the rise in all 54 African countries, with about eight percent of adults over 20 are obese (Adeboye et al. 2012).

The ripple effects of malnutrition extend beyond the affected individuals to the society and economy. Agricultural development initiatives have the potential to improve the nutrition of those most vulnerable to malnutrition, viz. women of child-bearing age and children as well as the general population. However, the initiatives must be specifically designed to address nutritional goals (Ruel and Alderman 2013), with rigorous evaluation of the impact on nutritional outcomes. According to FAO et al. (2018), childhood overweight affected 38.3 million children; with Africa and Asia representing 25 percent and 46 percent of the global total respectively.

Research on the potential impact of interventions in agriculture on nutrition outcomes is of particular relevance in developing countries where agriculture-related activities are a major source of livelihoods for large sections of society and where the population suffers from one of the highest global burdens of malnutrition in all its forms. This literature review aims to assess the strength of the available evidence that agricultural interventions have an impact on intermediate and final nutrition outcomes, especially on the dietary diversity of women and young children.

Materials and Methods

A range of databases, journals and grey literature sources were searched, and papers were included if they explicitly addressed quality assurance within the paradigm. A meta-narrative approach was used to review and synthesise the literature.

Eligibility criteria

Inclusion criteria: Randomized control studies published from 2010 to 2019 designed to evaluate multi-strategy interventions. For the review, women of childbearing age were defined according to the World Health Organization definition of people aged 15–49 years, and developed countries were identified using the World Bank's definition (Vander and Wyns 2018).

Results and Discussion

Literature search: The review was based on a systematic search of peer-reviewed literatures. Two dominant narratives were interpreted from the literatures: the first focuses on demonstrating quality within research outputs; the second focuses on principles for quality practice throughout the research process. The second narrative appears to offer an approach to quality assurance that befits the values of the overview, emphasising the need to consider quality throughout the research process. The literature search conducted on five databases and reference lists of previous literature reviews to identify peer-reviewed studies published between 2010 and 2019, detailing *impacts of nutrition-sensitive agricultural interventions on nutritional outcomes in the form of dietary diversity on women and young children*. The search was broken down by interventions of the following types: *nutrition education interventions; home gardens; consumer behavior; poultry intervention; and animal source food promotion*.

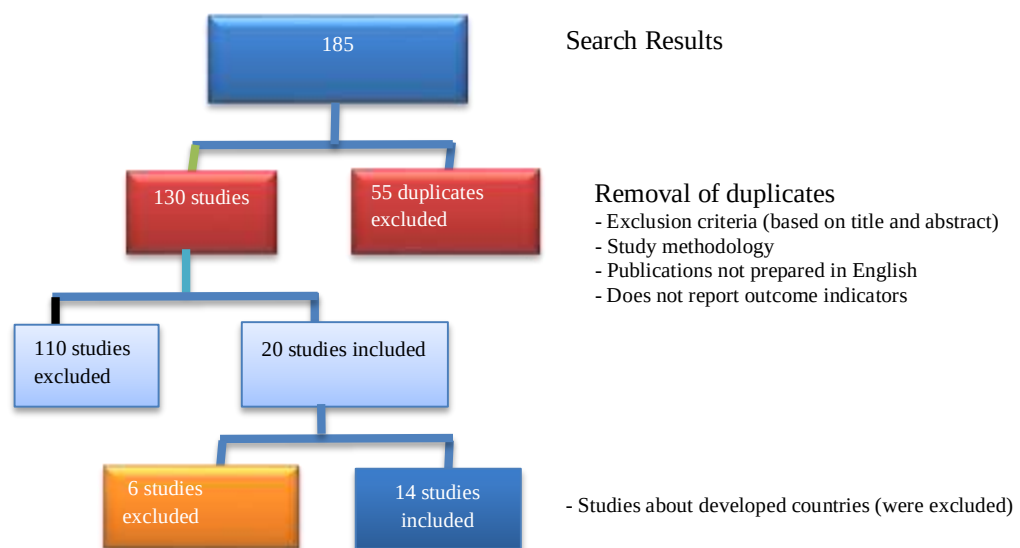


Figure 1: Stages of the screening process

During the search, more than 185 related published articles were found, but only 14 qualified based on set inclusion and exclusion criteria. A program theory of the interventions was outlined, and the efficacy of the interventions on the following four outcome indicators was assessed: nature of intervention; women dietary diversity; children dietary diversity; and children's nutritional status. No ethical approval was required for this study as humans were not involved.

Challenges in consumption and consumption behavior:

Popovic and Bossink (2019) pointed out that although consumers do value sustainable products in the sense of being, e.g. environment friendly or otherwise 'ethical', daily purchasing behavior is often not consistent with this. These results indicate that public policies need to use a mix of instruments from market-based instruments such as taxes and labeling to so-called command and control mechanisms (legislation and other regulation) over information instruments (e.g. educational campaigns). While consumption behavior is one of the determinant factors for malnutrition and still the world currently produces enough food to feed everyone, over a billion men, women and children go to bed hungry every night. As of 2010, a total of 925 million suffered from chronic hunger: 578 million people in the Asia Pacific region, 239 million in Sub-Saharan Africa, 53 million in Latin America, 37 million in North and North East Africa, and just a little over 19 million in the developed countries (Shah 2013).

Beckline and Kato (2014) analyzed data and concluded that there was a substantial modification in consumer food preferences within the past five years or after the 2008 food riots. These factors included but were not limited to cultural background, age and seasonal variation, gender, purchasing power, palatability, and nutrient content. Cultural background, seasonal changes, age, purchasing power, gender, and time frame are more potent factors than palatability and nutrient content (Beckline and Kato 2014). Consumers have been given an important role in pursuing sustainable development, but progress in terms of changing consumption patterns has been small. This is often ascribed to a lack of appropriate knowledge and information (Gjerris et al. 2016).

Past efforts on enhancing dietary diversity of women and children:

Children under five years of age suffer from stunting caused by diets of insufficient quality and quantity, improper care and feeding practices in early life, and high rates of infectious disease during infancy and childhood. One of the World Health Organization's recommendations to prevent chronic malnutrition is to promote the consumption of nutrient-dense, diverse, locally available foods.

However, this can be a challenge for families in poor communities who earn very little income, have limited access to fertile land and safe water for food production, and have many dependents to feed (Picchioni et al. 2017). Childhood undernutrition is associated with over a third of child mortality globally (Shetty 2018). Nutrition-sensitive, multisectoral programs have therefore received increasing attention. Nonetheless, the knowledge about the linkages between agriculture and nutrition is still limited (Picchioni et al. 2017).

Zaba et al (2014) argued that healthy diets are often less affordable than unhealthy diets, and high prices for nutritious foods (e.g. fruits, vegetables, and animal-source foods) are one of the main barriers that prevent vulnerable populations from adopting healthy food choices. An unhealthy diet is one of the most critical risk factors that need to be addressed to tackle the triple burden of malnutrition and diet-related diseases (Zeba et al. 2014). To meet the minimum requirement for a healthy diet, women should obtain more than or equal to five food groups (FAO et al. 2016). Jckes et.al (2017) undertaken a 10-week nutrition education and supplemental feeding program and concluded that the weekly education and supplementary feeding program benefited children in terms of dietary diversity and frequency of meals, and caregiver knowledge of feeding one to two months after program completion (Ickes et al. 2017).

Role of nutrition-sensitive agriculture in enhancing dietary diversity

Importance of nutrition education on dietary diversity: Nutrition education helps people to improve their diet through discussion, demonstration and practice. It usually targets the community to enhance caregiver feeding practices and children's dietary diversity and the frequency by which they are fed (Kulwa et al. 2014). Nutrition education as one form of nutrition-sensitive interventions addresses the underlying causes of maternal and child malnutrition; such as food security and access to health services and resources at the maternal, household, and community levels for caregiving and include specific nutrition goals and actions (Reinhardt and Fanzo 2014).

According to Ruel et al. (2013), examples of nutrition-sensitive interventions or programs include agriculture and food security programs; social safety nets; early child development; women's empowerment; schooling; water, hygiene, and sanitation; and health and family planning services (Ruel et al. 2013). Nutrition education programs are usually targeted at highly vulnerable segments, such as those who live in lower socioeconomic status, lower nutritional status and low educational level. During the past decade,

several educational intervention programs have been published and added new evidence for the effects of educational intervention on children's growth and nutritional status. Nutrition knowledge can enhance the impact of production and income in rural households, especially crucial for women and young children. It can increase the demand for nutritious foods in the general population (Ruel et al. 2013).

Increasingly recognized as an essential catalyst for the success of food security and nutrition interventions, effective nutrition education ensures that increased food production/income translates into improved diets and improved nutrition status. According to Uccello et.al (2017) attitudes and practices influenced by education can be causes of poor nutrition. The authors further elaborated that education can influence the attitude people have towards fruit and vegetable consumption. This can be improved if the attitude towards food taboos, long-established dietary and snacking habits, agricultural production decisions, food distribution in the family, ideas about child feeding, misleading food advertising, ignorance of food hygiene is improve.

As Murendo et.al (2018), promoting consumption of iron-rich foods, hygiene, preservation, and nutrition gardens which are the entry points for behavioral change communications improves household members' nutrition knowledge especially for women. The improved nutrition knowledge boosts women's decision making and household members' nutritional status (Murendo et al. 2018). Nutrition education as one package for behavioral change communications is considered as important for smoothing the dietary transition to cheap processed foods rich in sugar, fat, and salt.

Trends and practices in nutrition-sensitive agriculture interventions: Unlike nutrition-sensitive interventions, nutrition-specific interventions address the immediate determinants of undernutrition in the form of micronutrient deficiencies either through dietary supplementation or by fortifying the commonly consumed food items with micronutrients (Shetty 2018).

However, nutrition-specific interventions alone, even if implemented at scale, will not meet the global targets for improving nutrition unless it is jointly implanted with nutrition-sensitive interventions (Bhutta et al. 2013). Nutrition-sensitive agriculture is a concept that aims to narrow the gap between available and accessible food and the food needed for a healthy and balanced diet for all people. It explicitly incorporates nutrition objectives into agriculture and addresses the utilization dimension of food and nutrition security, including health, education,

economic, environmental, and social aspects. As stated by Hodge et al. (2015), nutrition-sensitive interventions that incorporate agriculture when properly aligned with nutrition-specific approaches can help to address nutrition security and minimize the impacts of undernutrition on women and children. Research findings showed that increasing either food production or income is not sufficient to improve nutrition status: education or behavior change communication (BCC) was cited as an important factor in encouraging dietary diversity.

One of the current practices of nutrition-sensitive intervention in Africa is the importance of women's empowerment pathways as a key to influencing children's nutritional status. This is because, gender is described as "a very important bridge" between agriculture and nutrition. Jaenicke and Virchow 2013(2013) indicated that the current global agro-food systems, which are predominantly based on grain production, will not be able to satisfy the increased demand for food quantity and quality in the decades to come unless more flexible, locally adapted systems are in place that provide food and nutrition security despite increased climate variability, social insecurity, land ownership shifts, and resource degradation. Nutrition-sensitive agriculture puts a specific "nutrition lens" on agriculture intending to sensitize the agricultural sector to the importance of nutrition and health aspects within the food security and to better connect agriculture, health and nutrition sectors within the agro-food system.

Major gaps in nutrition-sensitive agricultural interventions: Interventions in South Asia have to-date mainly targeted the improvement of dietary quality through enhancing dietary diversity and the consumption of animal-sourced foods (Bird et al. 2019). Bird et.al. (2019) further underscored that these days there has been a growing interest in tackling the micronutrient deficiencies by introducing micronutrient-biofortified crop varieties that, for example, have had success in improving micronutrient status in Africa (Bird et.al. 2019). Sustainable improvements in the nutritional status of women and their children will only be possible when their diets provide all the macro- and micronutrients they need. Narrowing the nutrition gap requires "nutrition-sensitive" food and agriculture systems that explicitly incorporate nutrition objectives (Thomas et al. 2012).

Webb and Kennedy (2014) stressed the importance of linking nutrition education properly to enable producer households acquire significant nutrition benefits in the form of food production and consumption. According to Maestre et al. (2017), even if many nutrition interventions minimize the impacts

of malnutrition, dietary diversification strategies applied separately from other strategies have not shown remarkable outcomes. They further outlined food should be safe to eat provided that it is nutrient-dense at the point of consumption (Maestre et al. 2017). As a result, diet diversification strategies of the kinds considered were classified as an “optional” intervention to be used in appropriate settings (when trying to improve nutrition), but without modeling the potential effects to be gained or specifying what settings are more “appropriate” than others.

Nutrition-specific interventions alone, even if implemented at scale, will not meet global targets for improving nutrition. Other sectors need to contribute as well, and agriculture has strong potential due to the many ways in which it can influence the underlying determinants of nutrition outcomes, including improving global food availability and access and through enhancing household food security, dietary quality, income, and women's empowerment. Making agriculture more nutrition-sensitive however, requires a new way of thinking, planning, implementing, and partnering, as well as the active engagement of a variety of stakeholders from multiple sectors. It also requires identifying critical entry points where nutrition goals can be incorporated into agro-food systems (McDermott et al. 2015). This author looks at different directions, choosing to narrow the focus to the role of animal-source protein in improving nutrition as generated by interventions promoting animal production.

This literature review generated 14 studies across a range of nutrition education interventions; home gardens; consumption behavior and behavior change communication activities. Most of the studies reported positive impacts on production associated with an intervention, but only four evaluated nutrition outcomes directly. Those four reported improvements in various nutritional indicators (night blindness, serum retinol and ferritin levels, hemoglobin levels, and linear growth). Still, they did not document statistical significance attributable to the intervention or concerning counterfactuals (Webb and Kennedy 2014).

Research, development, and policy to improve dietary diversity of women and children in rural areas:

Interventions aimed at improving diets and raising levels of nutrition should combine public health, nutrition education, and dietary strategies. Agriculturalists need to work with nutritionists to identify deficits in local diets and micronutrient intakes. Food-based interventions will be more effective when accompanied by community health programs. Interventions should include a vigorous

program of nutrition education and behavior change, targeted principally towards women, to ensure that increases in food supply and income lead to improved household nutrition (Bello and Pillay 2019).

According to Bruins (2015), policy and program responses include food-based strategies such as dietary diversification and food fortification, as well as nutrition education, public health and food safety measures, and finally supplementation. These approaches should be regarded as complementary, with their relative importance depending on local conditions and the specific mix of local needs (Bruins et al. 2015). According to a baseline cross-sectional survey conducted in Ghana, the effect of increased agricultural biodiversity on dietary diversity was significantly higher in households of lower socioeconomic status. Therefore, improvement of agricultural biodiversity could be one of the best approaches for ensuring diverse diets, especially for households of lower socioeconomic status of the rural areas (Saaka et al. 2017). A cluster-randomized community-based prospective study in the rural area of Tanzania witnessed, integrated agriculture and nutrition intervention among rural farming households is a simple and innovative solution that may contribute to the reduction of undernutrition and disease burden among women and children in developing countries (Mosha et al. 2018). The 2013 Lancet Series on maternal and child nutrition highlighted a multi-sectoral nutrition strategy that improves nutrition to save lives, build resilience, increase economic productivity, and advance development. To define and measure the approach for meeting this goal, the strategic objective is to scale up effective, sensitive interventions, and integrated nutrition-specific, programs, and systems across humanitarian and development contexts (USAID 2014).

An observational study from 9 sub-Saharan African countries revealed that, in agriculture, interventions to enhance food security and increase crop yields include the promotion of subsidized fertilizers and improved seeds for the major staple crops. Efforts to improve nutrition include support for nutritious crops alongside home gardens, fish farming, livestock, and small animal rearing. Agricultural interventions are combined with field training by extension staff on best agronomic practices. Income-generating activities include the introduction of high-value crops, agro-processing initiatives, and microfinance programs to stimulate small-business development (Remans et al. 2011). The nutrition literature has demonstrated that diversity of foods and food groups is the foundation of a healthy diet that provides adequate calories, fats, proteins and micronutrients (Tapsell et al. 2016).

Conclusion and recommendations

This review assessed the impact of nutrition-sensitive intervention on dietary diversity and nutritional status of women and children on five outcome indicators: participation in the program; household income; diet composition; nutritional status of women; and nutritional status of children. Of all the studies we reviewed, 14 met our criteria for establishing a credible counterfactual. These 14 studies broke down into the following intervention types: nutrition education interventions; home gardens; crop production; market access; consumer behavior; poultry intervention; and animal source food promotion. No study reported participation rates in the program. Only one study tested for impact on household income and found a positive effect. Twelve studies attempted to assess the impact of the interventions on diet diversity. Two of these studies undertook no statistical test on diet change, four found no statistically significant impact, and six found a significant and positive impact on the consumption of food targeted by the intervention. The major gap observed in nutrition-sensitive agricultural interventions is found to be lack of multi-sector collaboration for tackling malnutrition. None of the studies assessed whether nutrition-specific interventions should be jointly or separately applied for tackling malnutrition.

We recommend researchers, development partners and policymakers to improve dietary diversity of women and children in rural areas after systematically analyzing different articles in two areas; agriculturalists need to work with nutritionists to identify deficits in local diets and micronutrient intakes, and food-based interventions which accompanied by community health programs to be effective. For nutrition security in general and dietary diversity in particular, we recommend, multi-sectorial approach for tackling malnutrition. Applying nutrition-sensitive intervention together with nutrition-specific intervention is the other way of minimizing macro and micronutrient deficiencies.

Competing interest: The authors declare that they do not have competing interest.

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