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Empowering rural service providers to improve nutrition in mountain regions

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Improved agroecological practices tend to lead to production diversity but often fall short of achieving optimal dietary diversity in rural contexts. Thus, multi-prong interventions involving knowledge and skill development for production and consumption are needed. This study assesses nutrition and production-related interventions implemented in the East African Highlands, Pamir-Tian Shan, Hindukush and the Andes. Overall, 601 rural service providers were trained and supported to implement various nutrition-sensitive agroecological interventions. Study results show that these interventions significantly increased the intake of flesh food, eggs, vitamin A-rich leafy greens, and vitamin-A-rich vegetables and fruits. The increase in production diversity was correlated with the increase in dietary diversity. Thus this study highlights the crucial role of rural service providers in catalyzing nutrition-related changes in mountain contexts.

KEYWORDS

nutrition-sensitive agriculture, rural service providers, food security, dietary diversity, mountain-agro-eco-systems, nutrition

Introduction

Around one billion people live in mountain areas in developing countries, out of which 65% live in rural areas (FAO, 2020). The vulnerability to food insecurity was reported to have affected 38 million more people since 2012 reaching 346 million people or 53% of the rural mountain dwellers (FAO, 2020). With the COVID-19 global pandemic, the situation has likely worsened. Besides lower productivity levels and a lower number of crops that can be grown in mountain contexts, food insecurity among mountain communities is challenged by other relevant factors, including extreme climatic changes linked to high exposure to natural disasters, agricultural land and soil degradation, and commonly underdeveloped infrastructure hampering access to markets and acquisition of resources (Mishra et al., 2016; Poole et al., 2019; FAO, 2020; Hussain et al., 2021). All these factors strongly influence eating habits and dietary intake. Food aid and imported food that is sometimes cheaper than locally produced alternatives do not lead to sustainable improved nutrition situation among mountain communities (Naomi, 2014).

While in urban contexts, nutrition-specific interventions, like using food supplements, are common to fight malnutrition, in rural contexts, these are seen as less promising than nutrition-sensitive interventions (Barrett and Maxwell, 2005; Hossain et al., 2017). Nutrition-sensitive inventions target primary underlying causes of malnutrition as a means to derive actions leading to behavioral change on both the production and consumption side. Overall, nutrition-sensitive agricultural interventions with the potential to produce durable positive effects on dietary intake are more effective when combined with behavior change communication, flexibility and contextual knowledge (Ruel, 2019; Di Prima et al., 2022). Knowledge of nutrition was highlighted to be a key driver of positive impact on

nutrition in the context of low and lower-middle-income countries (El-Ahmady and El-Wakeel, 2017; Sharma et al., 2021). One way to achieve this is to relate "nutrition knowledge" to personal, social, and environmental perceptions and interests, explicitly considering food likes/dislikes, social norms around food acquisition, preparation, and consumption (i.e., food as social status), and availability and access to healthier foods (Kandel et al., 2021). With low levels of literacy being prevalent in rural mountain areas in developing countries (Gentle and Maraseni, 2012; Qamar, 2017), this challenge becomes even more compounded as education is integral to capability and motivation (Laranjo, 2016), both of which, with the addition of opportunity, drive particular behavior (Rothschild, 1999). Equally critical are perceptions about adopting agricultural innovations and dietary changes for improved nutrition that drive behavior changes (Glanz et al., 2008). In both cases, adoption is likely hampered by the fact that the benefits may not be immediately experienced (Gebremariam and Tesfaye, 2018; Harper et al., 2018; Ogundari and Bolarinwa, 2018; Adnan et al., 2019). Furthermore, quite often, nutrition promotion is carried out by health workers with no connection to food production. Such a connection is especially vital in remote mountain areas where consumers are often also producers of food, and market access to obtain external food is limited, i.e., a sustainable healthy diet must strongly rely on locally produced food options (Muehlhoff et al., 2017).

With the aim of better linking production and consumption-related factors to improve nutrition outcomes in mountain contexts, the Nutrition in Mountain Agroecosystems (NMA) project was launched in 2015 by IFOAM - Organics International together with the Research Institute of Organic Agriculture (FiBL), Helvetas Swiss Intercooperation, and Wageningen University. Focusing on rural mountain communities in East African Highlands, Pamir-Tian Shan, Hindukush and the Andes, the objective of project interventions was to improve dietary diversity among mountain dwellers to alleviate malnutrition rates by diversifying food production and by promoting the consumption of diverse foods produced locally. To achieve this, the project hypothesizes that rural service providers would be critical catalyzers to motivate behavioral change, especially at the local level, which would ultimately lead to improved nutrition outcomes among the rural mountain communities. Additionally, by supporting learning, networking and policy dialogue activities at the national and international level, the project was expected also to influence nutrition-related policy-making for mountain regions (see Figure 1).

Methods

NMA's rural service provider approach

The NMA project's interventions aimed to sustainably improve the nutritional situation in different intervention sites driven by enhanced individual and group capacities of rural service providers in designing and implementing comprehensive and complementary nutrition-sensitive agricultural and food-related interventions (see Figure 1). The rationale for such a strong focus on rural service providers as critical 'change makers' is outlined in Box 1.

Intervention and study sites and implementing actors

In its first phase (2015–2018), the project involved five countries: Ethiopia, Kyrgiztan, Nepal, Pakistan and Peru (see Figure 2). The intervention sites included locations in the mountain regions of the above-mentioned countries where the project co-financed so called 'micro-interventions' (MIs). The project technically and financially supported these MIs as part of a small grant scheme for Rural Service Providers (RSPs). The RSPs were local-level stakeholders in the area of sustainable agriculture and nutrition women. Most of them were employed by non-governmental organizations working in different fields, including agricultural extension, school teaching, nutrition/nursing, and radio operations. Selected service providers were mainly young, between 20 and 40 years of age. The micro-interventions they implemented (Figure 2) reflected a great extent the professional background of the involved rural service providers. This was made possible by encouraging these RSPs to bring their own ideas to turn into micro-interventions whose implementation would be led by themselves.

The MIs essentially served as a practice opportunity for the RSPs to learn from while creating tangible nutrition impact for their communities. Different training workshops were conducted at the national and international level to build capacities among RSPs relating to nutrition-sensitive agriculture. Overall, a total of 782 rural service providers received training during the two project phases, as depicted in Figure 1. Project Phase 2 built on the achievements and capacities developed during Phase 1. Those micro-interventions with the best potential to benefit larger population groups were scaled-up. These bigger projects were called Scaled-Up Nutrition-Sensitive Interventions (SUNSAIs) and were only partly financed by the project. With a train-the-trainer (ToT) concept, key service providers of Phase 1 trained other service providers to conceptualize and set in place sound interventions in their communities. For Project Phase 2, the geographical scope was expanded to Ecuador, India, and Tajikistan (see Figure 2).

All partner organizations and RSPs were also linked to a web portal called Mountain Agro-ecosystem Action Network (MAAN) where information about nutrition-sensitive agriculture (NSA) was actively shared together with project-related information. In MAAN, each country had its own "country page" to place country-specific information in the local language. Furthermore, project-supported national and international seminars created opportunities for exchange and learning for both projects implementing staff and rural service providers.

Both MIs and SUNSAIs involved different context-specific interventions responding to concrete nutrition-sensitive needs and opportunities along different food value chains. The decision on the type of intervention was based on proposals for interventions composed by the RSPs. The RSPs presented information about the intervention they proposed to implement, pertinent background

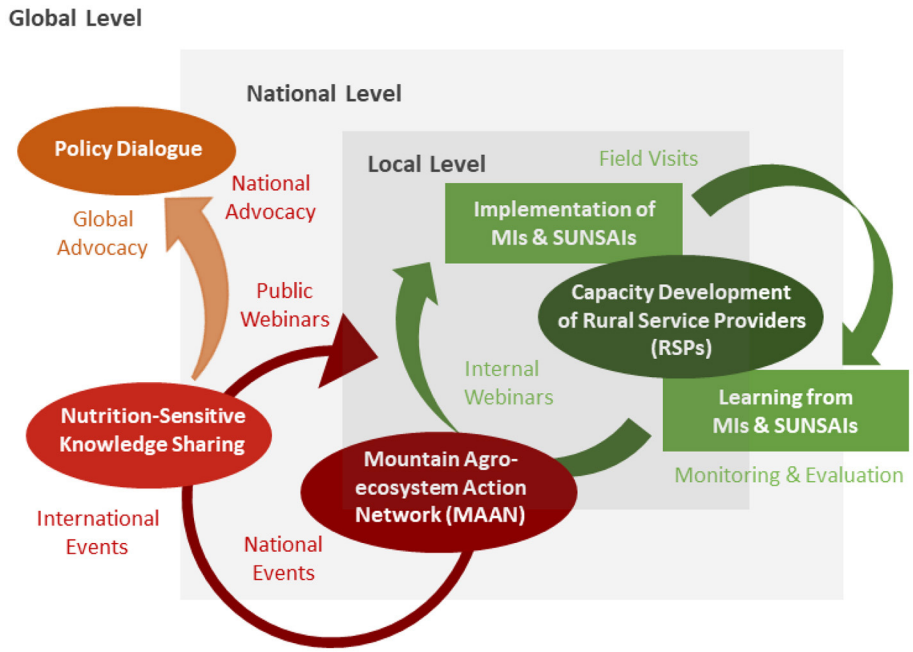

FIGURE 1
Overall NMA project approach building on differentiated interventions at the local, national, and global levels, showing the central role of capacity development of rural service providers (RSPs) to catalyze outcomes and impact; adapted from Bernet et al. (2018).

BOX 1 Rural service providers act as catalyzers for dietary behavior change by:

- Designing context-specific feasible interventions based on personal experience and knowledge of community needs as well as local government's plans and strategies for possible support;
- Reinforcing nutrition messages received from other sources, as service providers are health care workers. This led to the community's increased exposure to nutrition promotion;
- Showcasing and teaching how the recommended foods can be grown and prepared for increased acceptability among household members;
- Having an intrinsic motivation to work for the benefit of their own community members;
- Presenting information, educating and counseling in a culturally sensitive way as respected peers rather than by outsiders;
- Galvanizing already established relationships and networks in getting funds and advocating for nutrition-sensitive agricultural interventions.

information including the reasons for their choice, their capacity in carrying out the proposed intervention, the potential impact and the required resources. In the project's Phase 1, most interventions emphasized local crop production, organic agriculture, processing, conservation and post-harvest, marketing, and awareness creation activities (Bernet et al., 2018). In the project's Phase 2, MIs continued (see Figure 3) while nutrition promotion was integral to all SUNSAIs. Box 2 provides the overview of the activities and sample sizes for bassline and endline surveyes for nutrition-sensitive interventions in mountain agro-ecosystems in each country. The scope of awareness-raising campaigns and advocacy activities varied, involving, for instance, radio programs in Nepal, and promotion work for improving the dietary intake of children in rural schools in Pakistan.

Each country had a local partner organization supporting the project's training activities and overlooking the operation of the project. The local project partners, 35 in total, were responsible for coordinating and implementing the MIs and SUNSAIs. In Phase II, project partners contributed on average 60% of their own funding to get their SUNSAIs implemented. The NMA study reached more than 160,000 consumers and almost 20'000 farmers as direct beneficiaries. Numbers varied per country, depending much on the total number and scope of MIs and SUNSAIs that were implemented during the project's duration period.

Dietary diversity scores measurements

As part of a baseline (2018) and endline (2021) study, changes in dietary diversity scores for participating women were analyzed using Welch's *t*-test (Delacre et al., 2017) grouped per country. Using 24-hour food intake recalls as per the Minimum Dietary Diversity for Women (MDD-W) tool (FAO and FHI 360, 2016) was used to measure dietary diversity. To obtain a sample for surveys, women who voluntarily attended focus group discussions for the SUNSAI activities were invited to participate in the MDD-W survey including sharing information on food produced. Food production diversity was measured by classifying the types of

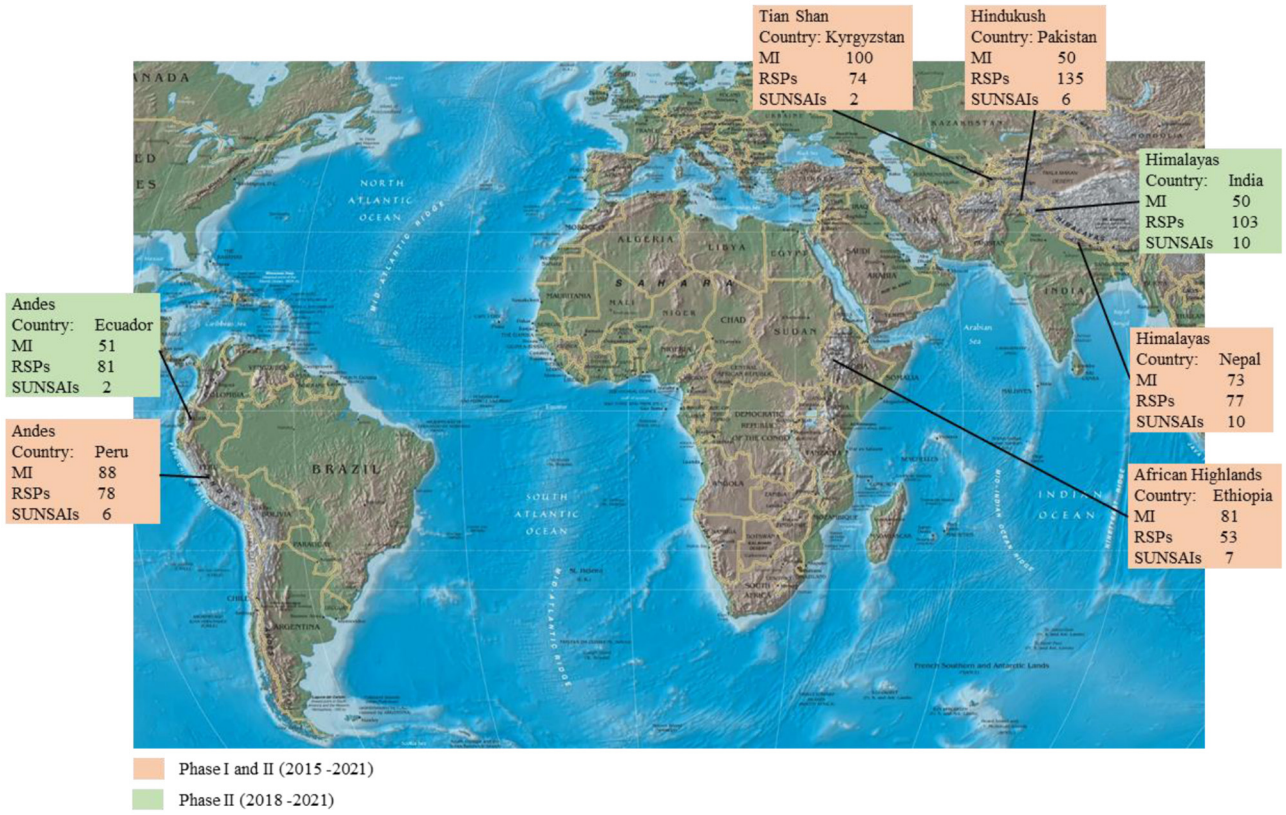

FIGURE 2
Geographical coverage of the NMA project and number of micro-interventions (MIs) supported by the project, trained rural service providers (RSPs) and scaled-up nutrition-sensitive interventions (SUNSAIs) per country.

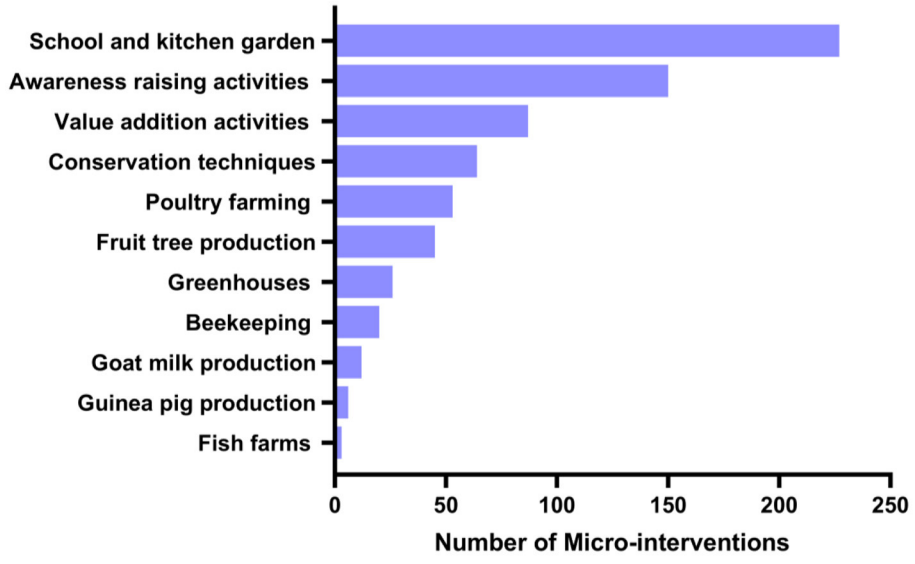

FIGURE 3
Main focus of micro-interventions implemented by service providers in both the project phases (2015–2021).

food produced in the ten food groups of the MDD-W survey. This provided parallel food groups what enabled measuring correlations between production and consumption. Thus, the 10 food groups from MDD-W was used to categorize and obtain a diversity score for the foods consumed and produced. Focus group discussions were guided by a set of questions relevant to

BOX 2 Overview of the activities and sample sizes for nutrition-sensitive interventions in mountain agro-ecosystems.

Phase 1 (2015–2017): Testing different Micro interventions

- Rural Service Providers (RSP) responded to a public call for small-scale nutrition-sensitive agricultural interventions in Ethiopia, Kyrgyzstan, Nepal, Pakistan and Peru.
- Rural service providers selected (selection criteria listed in Bernet et al., 2018) received 2 rounds of training in nutrition and nutrition-sensitive agricultural interventions' design and implementation. RSP trained in Ethiopia ($n = 25$), Kyrgyzstan ($n = 26$), Nepal ($n = 30$), Pakistan ($n = 25$) and Peru ($n = 25$).
- Micro-interventions were implemented for 1-year.
- In addition, online education, peer support and advocacy *via* Mountain Agro-ecosystems Action Network (MAAN) website.

Phase 2: (2018–2021): Scaled-up Nutrition-Sensitive Agricultural Interventions and Micro interventions

1. Trained service providers received extra training on how to train other service providers. RSP trained in Ecuador (81), Ethiopia ($n = 53$), Kyrgyzstan ($n = 74$), Nepal ($n = 77$), Pakistan ($n = 135$), Peru ($n = 78$), and Tajikisten ($n = 50$).
2. Baseline data on Dietary Diversity Score for Women and Production Diversity Score was collected by RSP in Ecuador ($n = 20$), Ethiopia ($n = 25$), India ($n = 169$), Kirgizstan ($n = 160$), Nepal ($n = 400$), Pakistan ($n = 101$) and Peru ($n = 576$).
3. Rural service providers designed and implemented Scaled-up Nutrition-Sensitive Agricultural Interventions (SUNSAIs) for 1-year.
4. Some key SUNSAIs implemented were egg production and the use of poultry manure for home gardening (Ethiopia); construction of vegetable and fruit dryers for food preservation and expansion of fisheries (Kyrgyzstan); production of low-cost post-harvest units for agricultural products' sale in the market (Nepal); and mushroom production and commercialization (Pakistan).
5. Focus group discussions with participants, semi-structured interviews with rural service providers.
6. Endline data on Dietary Diversity Score for Women and Production Diversity Score was collected by RSP in Ecuador ($n = 20$), Ethiopia ($n = 549$), India ($n = 169$), Kirgizstan ($n = 160$), Nepal ($n = 400$), Pakistan ($n = 311$) and Peru ($n = 532$).
7. MAAN used for education and support from experts to service providers and advocacy; social media was utilized by service providers for peer-networking and support.

evaluating the project such as perceived benefits and shortcomings of the project and any relevant events that influenced food production and/or consumption in the participants' communities. Furthermore, semi-structured interviews with service providers from Nepal and India were conducted by an external panel of experts on separate field missions. Findings from the qualitative data from the field mission in Nepal included in this article relates to semi-structured interviews conducted with 19 rural service providers. Other qualitative data collected by the service providers who conducted focus groups with the local producers and consumers in their communities are presented in the discussion section.

Results

Changes in daily dietary intake and dietary diversity

Significant changes in specific food groups' consumption were observed in all project focus countries for several food categories. In Ecuador, dairy-based products' consumption increased by 29% (Figure 4A). In Ethiopia, increased intake of beans and peas, dairy products, flesh food, eggs, Vitamin A rich green leafy vegetables, Vitamin A rich vegetables and fruits was increased by 18, 42, 35, 48, 32, and 35%, respectively (Figure 4B), going hand in hand with a notable decrease of 6 and 7% in the consumption of starchy staple food and other vegetables. Interestingly, no change for the consumption of starchy staple food was observed while consumption for all other food groups increased except for dairy products, where already a high proportion of the sample (93%) was using dairy products in 2018 (Figure 4C). In Kyrgyzstan, a significant proportion of the sample started consuming beans and peas, nuts and seeds, and starchy staple food where a signification proportion of sample population did not include vitamin A rich vegetables and fruits and other fruits and vegetable in the daily diets in 2021 compared to 2018 (Figure 4D). Similarly to Ethiopia, a significant proportion of sample population in Nepal did not include starchy food and other vegetables in their daily diets during 2021 compared to 2018 (Figure 4E) however, these reductions may have enhanced the inclusion of nuts and seeds, dairy products, flesh food, eggs, Vitamin A rich green leafy vegetables, Vitamin A rich vegetables and fruits and other fruits; which was increased by 20, 23, 37, 40, 31, 49 and 9%, respectively. In Pakistan, changes for daily dietary intake food groups were only observed for an increase in flesh food and eggs by 31 and 28%, whereas a small but significant decrease of 2% was observed for dairy products (Figure 4F). Contrary to all other countries, a significant increase in the population consuming all food groups was observed in Peru (Range 1–36%; Figure 4G).

Significant changes in the percentage of sample population consuming diverse food groups in daily diets also increased the MDD-W dietary diversity score in all countries (see Figure 5), except Ecuador. The highest increase was observed in Ethiopia where the MDD-W scores increased by 2.07 followed by 1.94 in India, 1.90 in Nepal, 1.89 in Peru, 1.44 in Kyrgyzstan and 0.73 in Pakistan.

The SUNSAI interventions also appeared to influence the production diversity positively in all project locations except for Ecuador. The highest increase in production diversity was noted in Pakistan by 3.6 followed by Peru by 2.9, Nepal by 1.8, Ethiopia by 1.4, India by 0.8, and Kyrgyzstan by 0.7 food groups on average. The changes in the dietary diversity score of women from surveyed households per country showed a significant correlation with production diversity of the respective region both before and after the interventions baselines (Figure 5), indicating that in mountain areas, the implementation of nutrition-sensitive interventions by local service providers was effective in increasing both production diversity and dietary diversity.

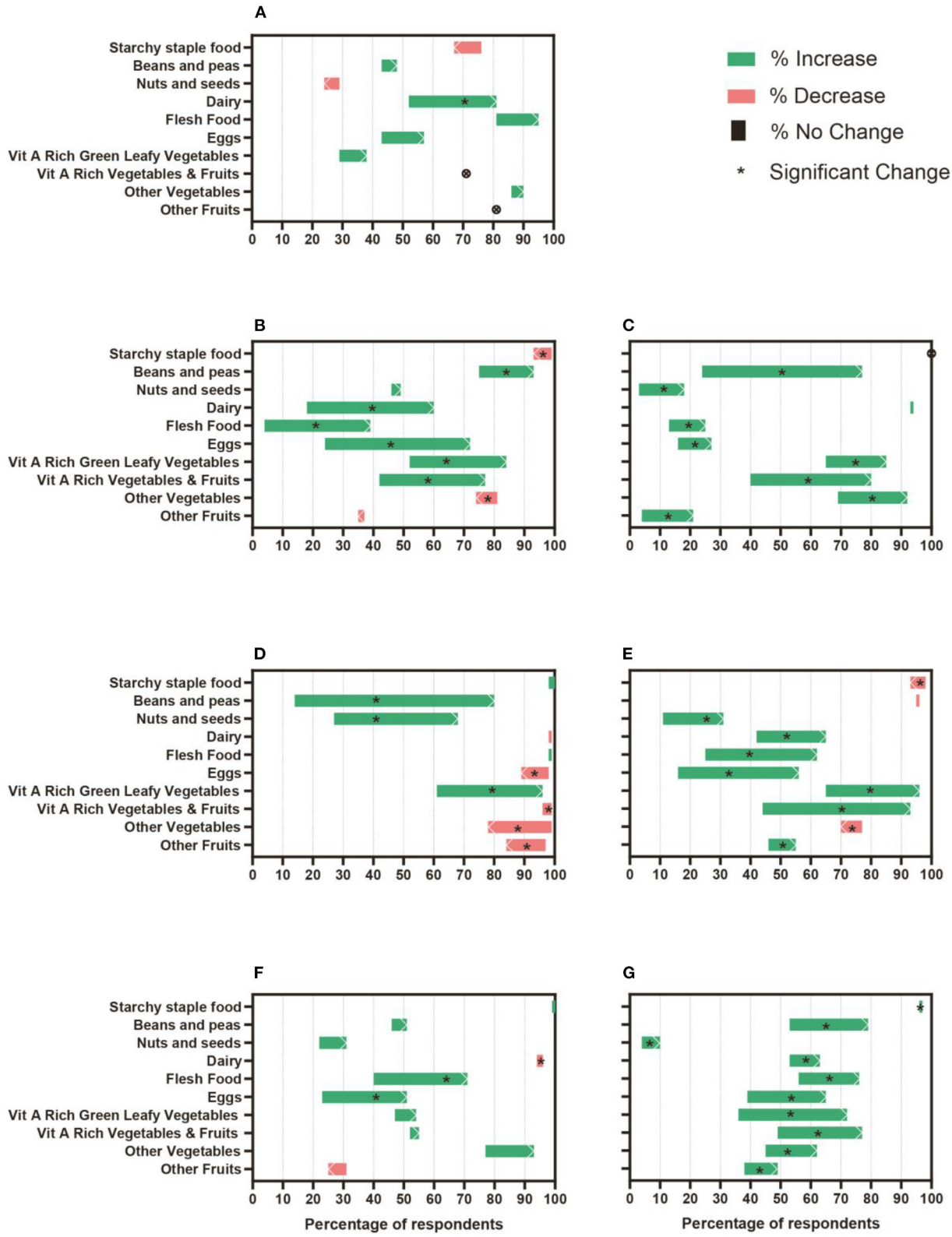

FIGURE 4
Dietary changes in percentage among target populations before and after the implementation of SUNSAIs in different project countries: **(A)** Ecuador, **(B)** Ethiopia, **(C)** India, **(D)** Kyrgyzstan, **(E)** Nepal, **(F)** Pakistan, and **(G)** Peru.

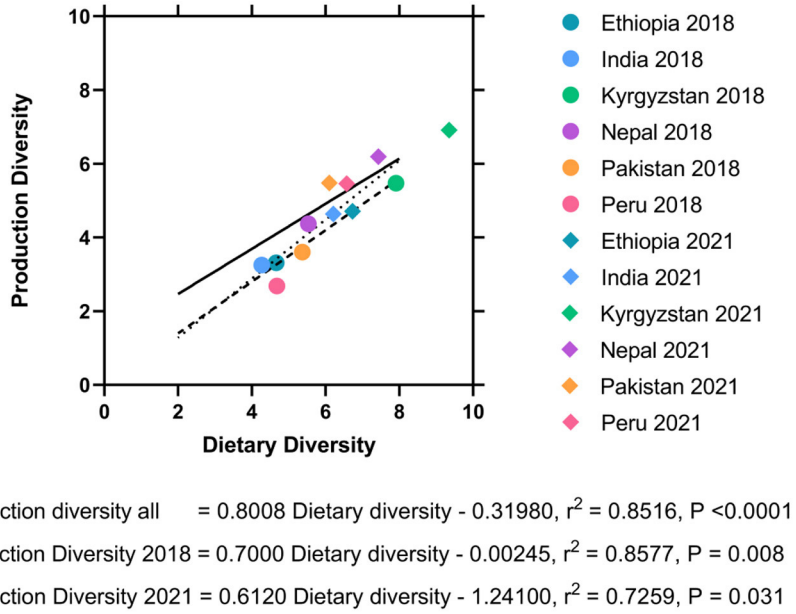

FIGURE 5
Relationship between the average number of produced and consumed food groups (from 10 food groups as per minimum dietary diversity for women survey) before (2018) and after (2021) implementing the SUNSAIs in different project countries.

The key to the effect seen in this study related to the capacity-building of rural service providers. Their effort in presenting the issues pertinent to their communities, the solutions they saw that would best fit their communities and the resources they needed and could utilize were seen by examples of secured funding that many RSPs achieved. In a round of monitoring reports by September 2020, the level of co-investment secured across all sites for SUNSAIs was 67%. This was despite the COVID-19 pandemic that thwarted public investment by local governments in agricultural and nutrition activities among others.

The MAAN platform that was created to support learning and communication among RSPs turned out to be not preferred by RSPs for communication as they tended to create their own communication groups *via* WhatsApp application. The language-specific sites for the RSPs were used by RSPs to upload information about their interventions. This demonstrated their improved access to not only gain information as receivers of knowledge but also to showcase their activities and be producers of knowledge. Interviews with RSPs in Nepal revealed that RSPs gained confidence in project management, gained technical knowledge such as innovation, local and neglected plants, and nutritious food, and utilized the support and knowledge they gained from other RSPs both nationally and internationally. Furthermore, service providers shared information on their increased capacity to engage collaboratively with their local communities, partners and local government. RSPs highlighted their improved their efficiency and effectiveness in managing their projects as well as their taking a health-based approach to agricultural development by putting emphasis on nutritious plants needed for their own communities. Thus, there was a shift in the RSPs perspectives when they planned agricultural activities.

Discussion

Importance of selecting and empowering well-motivated RSPs

The capacity development of RSPs coupled with their active and functional involvement in implementing NSA activities laid at the core of the NMA project. Calling on them to propose micro-interventions without full monetary coverage attracted dedicated RSPs, who valued the aim and approach of the project, and were eager to invest time, energy and other resources to participate in the project. By applying such a selection strategy, the project's learning platforms provided better results in empowering the involved RSPs, i.e., boosting their capacities, performance, and outcomes.

In this regard, the deliberate decision to also engage the RSPs in data collection activities (e.g., 24 food recall surveys and focus groups research) may have potentially created a bias in findings, but this decision critically helped RSPs to gain essential insights from their beneficiaries to upgrade their micro-interventions to boost impact. In fact, the improved "food diversity promoting skills" of the RSPs were key for the project's successful nutrition-related outcomes. Gained skills related especially to food preparation know-how, which supported the shift toward more nutritious food choices, including the use of nutrient-rich local produce (e.g., pumpkin, leafy vegetables). Mostly, these skills were successfully complemented with production-related innovations (e.g., vegetable gardening, chicken and guinea pig raising, vermicomposting, introducing solar driers) to improve respectively the supply and thus the availability of nutritious local food. In most SUNSAIs, relevant "awareness creation skills" were also developed and used, helping to raise interest in healthier food

choices, especially among consumers (e.g., through street theaters and radio programs).

Importance of coupling direct interventions with awareness creation activities

The observed significant consumption increase in most countries of the four food groups (1) flesh food, (2) eggs, (3) vitamin A-rich leafy greens and (4) vitamin A-rich vegetables and fruits relate mainly to the combination of direct interventions with improved nutrition awareness. In fact, both direct consumption and income from crop production (Rasul et al., 2019) are effective in improving dietary diversity when combined with nutrition education (Singh et al., 2020; Margolies et al., 2022). MDD-W as a proxy indicator for micronutrient adequacy indicated improvements in almost all intervention countries with achieved micronutrient adequacy, assessed at a value of (≥5 food groups) (Martin-Prevel et al., 2018; DIop et al., 2021), in Nepal, Pakistan and Peru moving from below five food groups average consumption at baseline to over five food groups at endline. The unfavorable outcomes in Ecuador may be due to a small sample size.

The findings from focus group discussions revealed that meat-based food was perceived as prestigious, which favors consumption (Bogueva et al., 2017). At endline, this perception was overshadowed with participants expressing their conviction about the positive health effects of vegetables and fruits, which was not noted at baseline focus group discussions.

Importance to link the promotion of production diversity and dietary diversity

Diversification of agricultural production, as an agroecological approach to food production, was promoted in all SUNSAIs. While the general impact of production diversity on dietary diversity alone has been reported to be minimal according to a meta-analysis of available studies (Sibhatu and Qaim, 2018), NMA's interventions appear to have had good impact on dietary diversity, as shown in Figure 4, at both the country and global level. Most likely, the positive impact on dietary diversity was triggered by the nutrition-related behavior change communication activities that were implemented in parallel (Jones et al., 2014; Ecker, 2018; Ruel, 2019; Bellows et al., 2020; Di Prima et al., 2022). This confirms the critical role of nutrition promotion to catalyze behavioral change in regard to dietary diversity, which has been highlighted in different studies (Ruel et al., 2018; Ambikapathi et al., 2021).

Another factor that may have contributed to improved dietary diversity is the fact that the rural communities involved in NMA rely more strongly on what is locally produced. Yet, also here, the critical role of RSPs must be underlined to introduce new crops in ways to change both consumption and production behavior as the basis for successfully combining production- and nutrition-related interventions. The importance of such interventions has been recently highlighted in low- and middle-income countries (Di Prima et al., 2022). It should be noted that MDD-W is a qualitative indicator of micronutrient adequacy making it unsuitable for measuring adequacy of micronutrients when larger amounts of staple food, for instance, can provide an adequate amount of particular micronutrients (Kano et al., 2017). Furthermore, diversity in consumption and production within a particular food group is not captured by MDD-W, thereby possibly underestimating the increase in the diversity of production and consumption post-intervention compared to their diversity pre-intervention. This was reported for a number of implementation sites.

Varying impact of COVID-19 on dietary diversity outcomes

The COVID-19 pandemic hampered the project's Phase 2 capacity development activities in all intervention countries. In 2020, the training format had to be changed to online sessions, and because of delays, the project was extended for 1 year. Furthermore, the co-funding from local governments was troubled as it was reoriented in some countries to respond to COVID-19 mitigation measures. The COVID-19 pandemic disrupted food chains at the global level and caused migration movements due to job losses. In Peru, for example, the "reverse migration" phenomenon was noted in rural mountain communities, as the young population who had out-migrated for work and education purposes to urban areas returned to their rural communities due to school and business closures in urban centers. While a large number of returnees increased the demand for food, the integration of this workforce in food production reinvigorated the diversity and supply of food. Also, the restriction of movement limiting bringing food from other localities encouraged the diversification of production to cater to the market demand with low or no competition from imported food. Moreover, escalated processed food prices (Cañari-Casaño et al., 2021) may have discouraged processed food consumption in Ecuador, for instance. Endline focus groups in Kyrgyzstan and Peru even revealed the belief that flesh food and eggs make the human body strong against COVID-19 infection emerged, which likely contributed to the increased consumption of these food groups.

In Pakistan, the effect of COVID-19 restrictions on food transportation and food prices strongly influenced both consumption and production decisions. In the Chitral region, nuts and seeds consumption decreased significantly during the pandemic, while the opposite was observed in the Gilgit Baltistan region. Chitral is a big producer of pine nuts, which hiked in price drastically. Producers took advantage of the price hike and sold their nuts to outside communities, consuming less themselves. In contrast, as transportation was hardly affected due to COVID-19 lockdown in the region of Gilgit Baltistan, nuts consumption increased in this context. These findings reveal the great importance of market access and sales prices as a driver for food production choices in rural areas. Nevertheless, it seems that awareness about the importance of good nutrition was heightened

during COVID-19, motivating consumers to shift toward foods perceived to be protective of their health.

Conclusions and recommendations

Service provider-centered approaches effectively build and link health, nutrition, and agriculture-related capacities at the local and national level

The presented findings strongly endorse participatory approaches for integral capacity development of rural service providers (RSPs), who are in fact, effective catalyzers for improved nutrition outcomes in rural contexts (see Box 1). Thereby, capacity development efforts must involve and link nutrition-sensitive agriculture, nutrition promotion and production-related intervention to be effective. Thus, to optimize the performance and outcomes of wider nutrition projects, a sound selection of well-embedded service providers and mechanisms to promote effective collaboration is decisive. For peer learning and promoting collaboration, multi-stakeholder platforms at both the local and national levels are promising. Thanks to COVID-19, digital platform activities have become more relevant for exchanging experiences and enhancing tangible practice-related learnings.

Policy-making must aim at institutionalizing nutrition-sensitive agriculture among agriculture and health-related organizations

The presented findings reveal important impact potential when health, nutrition, and agriculture related capacity building efforts and interventions are combined. In practice, this is challenging, given the institutional setup in most countries where different ministries tend to be in charge of coordinating and implementing interventions with an other approach logic. A Ministry of Agriculture is commonly responsible for production-oriented interventions, with a strong focus on best agricultural practices to obtain good yields and income. In parallel, the Ministry of Health is responsible for healthcare interventions, and where nutrition deficiencies are mainly targeted with supplements. Especially in and for rural areas, where the benefit of interlinking agricultural interventions and nutrition education is greatest, policy must help ensure that improved nutrition outcomes are obtained through improved dietary diversity. In practice, this means that policy at the national and local level must promote functional collaboration among agriculture and health-related public entities and their staff closer and empower them for joint action. At the same time, policy measures should explore opportunities for collaboration with non-governmental institutions (NGOs) and private companies aiming to promote nutrition-sensitive agriculture in local contexts.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

GS prepared the first draft. TB coordinated data collection. GS and AR analyzed the data. AR visualized the data. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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