Nutrition in Mountain Agro-ecosystems phase II: baseline-endline analysis

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This report presents the findings of the Nutrition in Mountain Agro-ecosystems phase II baseline and endline surveys. The project sough to replicate and up-scale nutrition sensitive agriculture (NSA) practices in mountain agroecosystems to enable people in mountain areas to consume more diverse diets . The project was implemented in Nepal, Pakistan, Kyrgyzstan, Ethiopia and Peru, India, Tajikistan and Ecuador. This report includes data on dietary diversity of women of reproductive age who participated in the project, as well as an snapshot of the affects of COVID-19 on the diets of people in rural mountainous areas in the eight target countries.

Keywords: Nutrition sensitive agriculture, mountainous areas, dietary diversity, COVID-19, Ecuador, Ethiopia,India, Kyrgyzstan, Nepal, Pakistan, Peru

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List of abbreviations and acronyms

CDP	Capacity Development Program
DDS	Dietary Diversity
FAO	Food and Agriculture Organization
GPFS	Global Programme Food Security of SDC
ICIMOD	International Centre for Integrated Mountain Development
IFOAM-OI	International Federation of Organic Agriculture – Organics International
MDD-W	Minimum Dietary Diversity Women
MI	Micro-interventions
NMA	Nutrition in Mountain Agro-ecosystems Project
NSA	Nutrition sensitive agriculture
RSP	Rural Service Provider
SDC	Swiss Agency for Development and Cooperation
SUNSAI	Scaling Up Nutrition Sensitive Agriculture Interventions
WCDI	Wageningen Centre for Development Innovation, Wageningen University & Research
WDDS	Women's Dietary Diversity Score
WUR	Wageningen University & Research

Executive Summary

Overview: Nutrition in Mountain Agro-ecosystems phase II is a SDC GPFS project implemented by IFOAM – OI in a consortium with Helvetas and Fibl to replicate and up-scale nutrition sensitive agriculture (NSA) practices in mountain agroecosystems. The overall goal of the phase II is to enable men, women and children in mountain areas to consume more diverse diets containing sufficient, safe and nutritious food. Phase II of the project focuses on ensuring the sustainability of the capacities built among Rural Service Providers in phase 1 (Nepal, Pakistan, Kyrgyzstan, Ethiopia and Peru) continue, and to expand the project to three new outreach countries: India, Tajikistan and Ecuador.

Methods: This report presents the quantitative and qualitative data for the SUNSAI and MI, which was collected in the 2019 (baseline) and again after the project was implemented in 2021.The SUNSAI are larger projects implemented by institutions whereas the MI were implemented by individuals rural service providers (RSPs). To analyse WDDS a 24-hour recall method was used using 10 food groups with suggested cut-off of 5 to correlate with a high probability of nutrient adequacy. Production data, related to the number of food groups produced (using the same list of 10) was also collected at baseline and endline. Additionally, qualitative data was collected through focus group discussions to provide additional information on themes such as consumption behavior, production system, gender roles in decision making and collaboration between institutions. Finally, a market survey was conducted (endline only) to estimate the additional income generated by selling the production surplus and to better understand if the sales can be sustained even after the project ends.

Findings: The table below compares average WDDS for each project country at baseline and endline for both SUNSAI and MI. A paired-t test was used to check if the observed differences are statistically significant. For all countries, the average WDDS under SUNSAI has increased as compared to the baseline. The difference between the average dietary diversity score at baseline compared to the endline is statistically significant in Ethiopia ($P<0.05$), India ($P<0.05$), Pakistan ($P<0.05$), and Peru ($P<0.05$). Whereas in Ecuador ($P>0.05$), Kyrgyzstan ($P>0.05$) and Nepal ($P>0.05$) the difference is statistically insignificant. Similarly, under MI, all the intervention countries have statistically significant findings: Ecuador ($P<0.05$), Ethiopia(($P<0.05$), India ($P<0.05$), Kyrgyzstan ($P<0.05$), Nepal ($P<0.05$), Peru ($P<0.05$) and Tajikistan ($P<0.05$).

During the endline survey, respondents consumed, on average, foods from at least 5 food groups a day across all countries. At the endline, the lowest dietary diversity for SUNSAIs was reported in India (6.2) and for Mis in Ethiopia (4.1).

Table 1 *WDDS SUNSAI baseline-endline comparison*

Country	SUNSAI baseline	SUNSAI endline
Ecuador	6.2	6.9
Ethiopia	4.3	6.7
India	4.2	6.2
Kyrgyzstan	7.9	9.3
Nepal	7.1	7.4
Pakistan	5.5	6.9
Peru	4.9	6.8

Table 2 *WDDS MI baseline-endline comparison*

Country	MI baseline	MI endline
Ecuador	5.5	6.2
Ethiopia	2.2	4.1
India	5.1	6.5
Kyrgyzstan	6.3	7.4
Nepal	5.7	9.1
Pakistan	3.5	6.3
Peru	5.1	6.4
Tajikistan	8.9	6.3

Likewise, the qualitative findings from the FGDs suggests that there has been improvement in the consumption and production patterns related to dietary diversity. Regarding, the gender balance in decision making, Peru and Ecuador seem to be performing well compared to other countries. Similarly, the collaboration between multiple institutions to improve nutrition seems to be performing better in all intervention countries but needs to be strengthen. In addition, the findings from the market survey suggest that there has been increases in the income of the participants linked to the sales of the crops produced during the interventions.

Conclusion: The NMA phase II findings suggest that the project may have contributed to improved diets in mountain areas. The results indicate improvement in the intake of a diverse diet among women as well as an increase in knowledge about NSA in all intervention countries, and suggests the project has been able to increase dietary diversity in all countries, except Tajikistan. The types and scales of interventions varied in each country. Likewise, the seasonality also contributed to influence the overall dietary diversity, which can be seen in the higher score in Kyrgyzstan, Nepal and Pakistan (SUNSAI) as well as Nepal, Kyrgyzstan and India (MI) where there is significant seasonal variation in terms of the average DDS. The findings also highlight the approaches promoted through the project has been effective to increase the intake of diverse food groups among women of reproductive age. The market survey suggested increased income from selling the surplus production and stimulating market demand of organic food, contribute to project sustainability. The project supported improved knowledge and awareness of traditional food and supported improved gender balance in decision making. Other identified themes, such as the impact of climate change and out migration are also critical issues which need to be addressed to achieve healthier, sustainable and equitable food systems in mountain regions.

Suggestions: The NMA phase II countries have different geography, economic, social and environmental situations, yet there are some general trends that were observed across the mountain regions. There is a growing opportunity to tap into the underutilized traditional crops, with support for disseminating information on the nutritional properties of traditional foods and promotion through marketing. Climate change impacts are visible in some intervention countries, causing depletion of water supply for production. To mitigate this, future interventions could focus on climate resilient agriculture methods with improved understanding of pesticides use. Mountainous areas are affected by a range of social (out-migration, increase intake of junk food) and environmental (human-wildlife conflict such as wild boar destroying crops, harsh winter conditions) that negatively impact dietary diversity.

To achieve a sustainable food system and nutrition security for present and future generations in mountain regions, it is essential for the economic, social, cultural, and environmental issues to be taken into account. It is crucial to focus on improved year-round food availability through improved food processing and storage units to support year-round availability of nutritious foods in mountain regions. Most importantly, unbalanced gender role in decision making requires more and active collaboration with all relevant stakeholders particularly, women affair office to influence behavioral changes regarding gender sensitive nutrition awareness to influence gender norms. Similarly, effective cross-sector collaboration regarding health, nutrition and agricultural production should be maintained. Longer term, to improve the nutrition and dietary diversity in mountain regions, food systems thinking may be an effective way to bring together the many actors who contribute to nutrition and food security in mountain areas and could be something to explore for future projects.

1 Overview of Nutrition in Mountain Agro-ecosystems Phase II

The Nutrition in Mountain Agro-ecosystems Phase II aims to replicate and up-scale nutrition sensitive agriculture (NSA) practices in mountain agroecosystems across Himalaya, Hindukush, Pamir-Tian Shan, East-African Highlands and the Andes. Nutrition in Mountain Agro-ecosystems phase 1 was a 3-year program, running from 2015-2018, which sought to address poverty, low production and low dietary diversity, in mountain agro-ecosystems by promoting nutrition sensitive agriculture (NSA) at the local level.

The overall goal of the phase II of the project is to enable men, women and children in mountain areas to consume more diverse diets containing sufficient, safe and nutritious food. The second phase of the project seeks to consolidate learning from the first phase to achieve systemic changes in improving knowledge about, and access to, nutritious foods. Rural Service Providers (RSPs) are the main agents through which the project is implemented. RSPs are the empowered local experts who provide extensions and training services to the local community on issues related to nutritious diets such as agriculture, health, water etc. to promote improved nutrition and resilience.

For both SUNSAI and MI, the RSPs, were primarily responsible for data collection for WDDS, FGDs and market surveys. In the case of the SUNSAI, the implementing partners were local organizations that hired RSPs for the direct implementation. The selection process for the SUNSAI was through a competitive call and had 2 selection rounds. The RSPs were selected and mobilized with the support of national coordinator in each country. The RSPs were selected by publishing a call-in local newspaper. All the RSPs had to apply for the CDP. The RSPs implement SUNSAI, and MI based on the proposals which are approved by the national coordinator. Those who are selected for the process were trained for the implementation and were focal points during the project implementation. In terms of outreach, the MI aimed to reach 50 families, whereas the SUNSAI aimed to reach at least 500 farmers and 5000 consumers. The project also seeks to achieve national and global objectives of supporting nutrition sensitive agriculture and improving access to nutritious food for people living in mountainous areas.

Phase I provided a better understanding regarding the quality of diets of women of reproductive age as well as an improved understanding of what people eat, and why. In the second phase, the project focuses on ensuring the sustainability of the capacities built among RSPs in Nepal, Pakistan, Kyrgyzstan, Ethiopia and Peru continuing from Phase I, and India, Tajikistan and Ecuador as new outreach countries. The project is designed to facilitate cross-country learning and ensure that NSA interventions are replicated and scaled to increase the consumption of nutritious food at the local level, and that these findings contribute to national and global level policy work. The project set up the Mountain Agriculture Action Network (MAAN), a virtual social and knowledge network of RSP that meet both virtually and face to face to share experiences around improving nutrition in the NMA target areas for the benefit of all NMA partners and other relevant nutrition stakeholders. The evaluation of the MAAN will be covered by an external team and is not considered in this evaluation.

The NMA phase I leveraged the capacities and opportunities to support the SUN movement (Scaling up Nutrition), a global movement initiated by UN to expand nutrition specific and nutrition sensitive approaches. Like Phase I, the current phase focused on primarily contributing to improved diets in mountain areas through SUNSAI and MI and to support the SUN movement in those countries (Figure 1).

The project supported two types of interventions:

1) Scaling-up nutrition sensitive agriculture interventions (SUNSAI) are larger projects which are awarded though a competitive grant process and implemented by RSP institutions to scale up proven nutrition sensitive agriculture interventions in collaboration with a range of actors including municipalities, farmer organizations, educational institutions, and health care providers. These

projects work over a larger geographic area and seek to promote systematic change to improve the consumption of more diverse diets that contain sufficient, safe and nutritious food. Examples of funded SUNSAI include projects which support school nutrition garden/education, high value inclusive business, developing businesswomen project, school nutrition etc. Learning, outcomes and stories from the SUNSAI are collected and documented and used for national and global advocacy work.

2 Micro-Interventions: Micro-interventions are small initiatives that are implemented by RSPs at the local level. Its design was part of the Capacity Development Program (CDP). They are smaller interventions compared to SUNSAI to increase the accessibility and availability of nutritious foods in mountain areas, through the introduction of nutrition-sensitive agriculture practices, technologies and awareness raising, where RSPs are the catalyst for change. Examples of MI supported by the project include household level home garden promotion, diversified food item promotion, livestock management, prevention of post harvest losses thorough processing or improved storage etc.

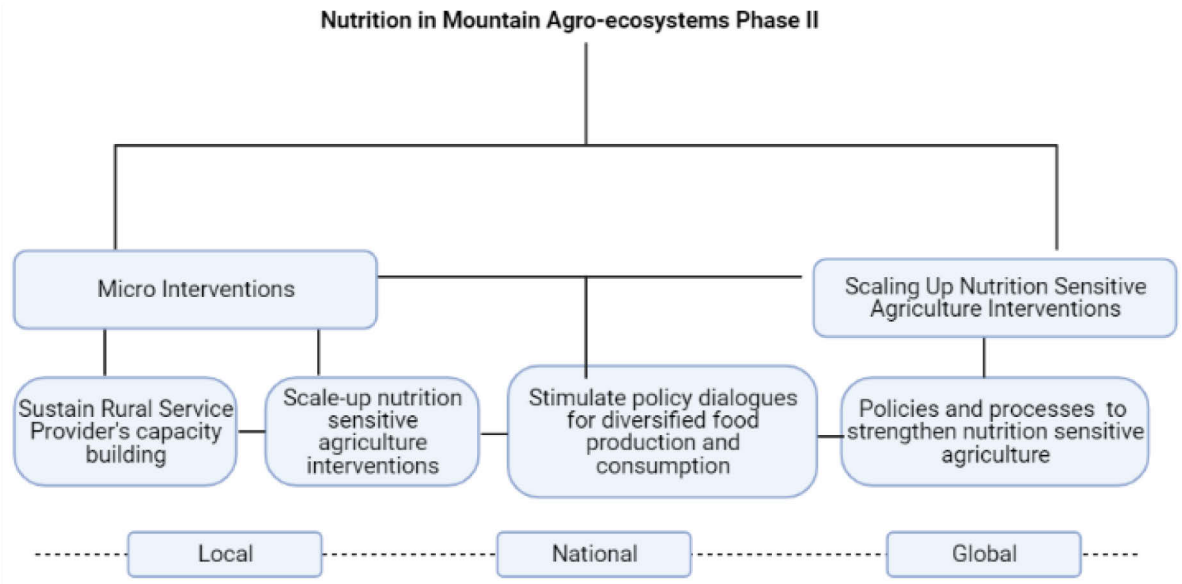

Figure 1 *Nutrition in Mountain Agro-ecosystems Phase II*

1.1 NMA phase II baseline-endline Analysis

This report presents the results and analysis from the baseline and endline data collected in all eight countries to understand in what ways, where, and how the interventions have supported increased access to diverse diets for those living in mountainous areas. In addition, the report will also explore the other consequences of healthier diets in diverse areas such as improved income or increased knowledge about healthier diets in the community. The lessons learnt and successful approaches from the report will contribute to the design an improved and holistic approach for a potential phase III or for others considering effective nutrition sensitive programming in mountainous areas.

1.2 Overview of SUNSAIs

The SUNSAI interventions were grouped into four broad categories that captured the focus of the projects sought to target. The elaboration on the interventions are provided in Appendix 1.

The following Table 3 presents an overview of the SUNSAI interventions supported by NMA phase II in the focused countries.

Table 3 *Overview of the SUNSAI interventions in NMA phase II countries*

SUNSAI	Number of interventions per country							
	Ecuador	Ethiopia	India	Kyrgyzstan	Nepal	Pakistan	Peru	Total
1. Seek to improve the whole value chain for a number of nutrient dense crops, with the assumption of nutritional improvements coming from increased production diversity and incomes	1			1	2	1	2	7
2. Whole value chain projects which focus on specific crops, nutritional improvements are assumed through increased incomes, as only one crop is being targeted		1		1	2	2	1	7
3. Nutrition behaviour change communication focused on increased consumption- these seem to be mainly in schools and if there is a production element, it is around education					2	1	2	5
4. Mixed value chain and nutrition education approaches: direct improved production of nutritious foods leading to improved consumption. While in theory all projects focus on both production and consumption, many of these are much stronger one side than the other.		6	2		2	2	1	13
Total	**1**	**7**	**2**	**2**	**8**	**6**	**6**	**32**

1.3 Overview of MI

In the following section, the overview of the micro-interventions being supported by the NMA phase II is presented. More details about the MI are provided in Appendix 2.

Table 4 *Micro-interventions being supported by the NMA phase II*

MI	Number of interventions per country								
	Ecuador	Ethiopia	India	Kyrgyzstan	Nepal	Pakistan	Peru	Tajikistan	Total
1. Awareness raising activities focused on dietary diversity promoted thorough agro-ecological production and consumption practices		3	3	1	1	1	2		11
2. Value-addition activities with local products by promoting indigenous products in market		7	1	2	1	1	5		17
3. Fruit trees production to promote consumption and production					1	4	1		6
4. School and kitchen gardens introduced to promote dietary diversity in home and schools	5		1	1	1	10	4		22
5. Small fish farms established to enhance production and access to protein-rich food				1					1
6. Conservation techniques promoted to foster production and increase intake throughout year			1		1	2	1	3	8
7. Guinea pig production promoted to improve access to protein production, consumption and sale of surplus in the market to generate additional income							1		1
8. Poultry farming introduced in small scale farms to increase protein consumption and production at household level to generate income especially for women		1	2	1	1	2	2	1	10
9. Goat milk promoted to improve access to protein and calcium								1	1
10. Low cost greenhouses to enhance plant growth, protect crops for crop diversification and income generation			2	1			1		4
11. Beekeeping promoted among women group to earn income through honey production and learn importance of dietary diversity				1	1			1	3
Total	**5**	**11**	**10**	**8**	**7**	**20**	**17**	**6**	**84**

1.4 NMA Target groups and Beneficiaries

The project aims to reach beneficiaries at the local, national and global level.

1.4.1 Local level

At local level, the project capacitated teams of trainers (ToTs), who then were responsible for the implementation of CDPs. The RSPs were trained and supported so that they can facilitate improvement and diversification of production systems and diets of rural households as well to advocate more support from the local governments and to achieve a better integration between health, nutrition and the agricultural sector. The focus was to make local markets respond to increase dietary diversity and resilience to scale – up nutrition sensitive agriculture interventions in collaboration with local institutions, mainly to increase production of nutritious foods and increase value of the benefits of dietary diversity.

1.4.2 National level

Policy makers and civil society organisations are focal points at national level to influence policies and programs towards the main streaming of nutrition sensitive agriculture, processing and consumption. The engagement of policy makers and the support from civil society organisations to increase awareness enabled the project to work on supporting diversification of production, support market access and stimulate diverse consumption. At the national level, the impact on local levels beyond the project's geographical scope can be increased by supporting policy dialogues and strategy discussion in regard to agriculture and nutrition based on successful cases, which contribute to development goals.

1.4.3 Global level

The international nutrition and food security debate are influenced by advocacy messages that are based on local and national success stories. At global level, the project contributes knowledge and practical evidence on the impact of different NMA phase II activities to shape discussions and policy documents that influences policy making as well as program funding priorities in mountain countries.

2 Nutrition, Agro-biodiversity and Dietary Diversity Links

While intuitively logical, the links between agriculture and nutrition are complex and there are many overlapping and interacting pathways linking agriculture and nutrition outcomes. In a recent research, Gillespie and van den Bold (2017) present a framework for how agricultural nutrition linkages are thought to act. The framework was also applied in the NMA phase I endline-baseline comparison to try to better understand how nutrition outcomes maybe influenced by agriculture.

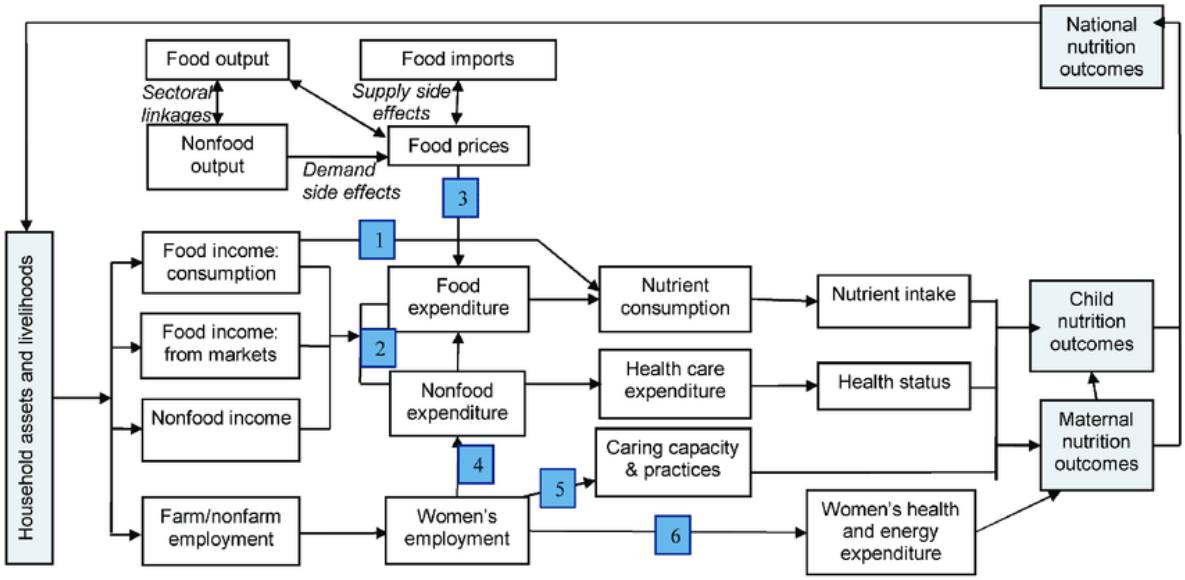

Figure 2 *Pathways and links between agricultural livelihoods and nutrition*

As seen in the Figure 2, the direct pathway of growing food for consumption is only one pathway by which agriculture is thought to influence nutrition outcomes. Additional pathways include through increased incomes (selling food and non-food crops) which can increase expenditure for both food and other areas important to nutritional outcomes such as health care, education and increases in women's employment, which can lead to positive impacts around increased incomes for both food and non-food expenditures. However, the women's employment pathway can also have negative implication. If an increase in the demand for female agricultural labor is not also supported by enhanced decision-making power and control of household resources such as time, both women and children's nutritional status can suffer. Therefore, both positive as well as potentially negative effects should be considered.

The NMA II project aims to increase the global evidence base around how to stimulate the consumption of more diverse diets containing sufficient, safe and nutritious food for improved nutritional outcomes in mountain areas. It will be important to keep in mind the various pathways by which the second phase of the project may influence nutritional outcomes. Many of the SUNSAI and micro-interventions are focused on pathway 2 in the figure, increasing incomes which will hopefully lead to increased expenditure on both food and non-food items. Additionally, because food intake is only one elements of nutritional status; health and the ability of the body to absorb key nutrients are also essential, although access to health care was not something which was supported in the project and may be a challenge for some groups living in remote mountainous areas.

3 Methodology

The project combines quantitative and qualitative data for both baseline and endline data collection and analysis. Quantitative data was collected for the analysis of WDDS and MDD-W for consumption and production. The qualitative data was collected through focus group discussions to sought to explore behavioral, social, institutional and situational aspects related to production, consumption and decision making at the household and community level. Likewise, market survey was also collected for a sample SUNSAI for market/commercialization component.

3.1 Women's Dietary Diversity Score

Women's Dietary Diversity Score (WDDS) was analysed for both SUNSAI and MI during baseline and endline. Dietary Diversity Score (DDS) is a methodology developed by FAO which counts the number of different food groups consumed by an individual in a 24-hour time period. The WDDS is a proxy indicator for dietary intake. It is calculated by summing the number of food groups consumed by the individual respondents of households over the 24-hour recall period (FAO, 2011). The foods recalled by the respondent are categorized into 10 food groups by trained enumerators. Women of reproductive age are selected as the respondents due to their increased vulnerability to micronutrient deficiencies, because of the high nutritional demands of pregnancy and lactation. Other women who are not pregnant or lactating also have higher needs for nutrients than men and tend to eat less food overall due to traditional or cultural factors.

A t-test (paired two samples for means) was used to assess the statistical significance of the difference in average WDDS and food groups between baseline and endline for SUNSAI and MI.

3.2 Production Survey

In addition to the WDDS, data on production diversity was also collected and analyzed. The production survey asked questions about the 10 food groups included in the dietary diversity score that were grown/produced by the households of the female respondents. The production survey reflects the number of different crops produced by those who produce at least one crop. For each country, the total consumption and production of 10 food items in both SUNSAI and MI are compared for both baseline and endline data.

3.3 Minimum Dietary Diversity – Women

The MDD-W presents findings as a simple dichotomous variable (adequate/ inadequate). While there is no specific cut-off for dietary adequacy, a cut-off of 5 food groups consumed in a 24-hour period has been suggested to correlated with an increased likelihood that a woman is consuming a diet that meets her macro and micronutrient needs. However, while interpreting, it is crucial to acknowledge that it does not indicate any quantity of food consumption. Likewise, there can be variation in diet across seasons, urban/rural and urban and peri-urban areas. The other limitation to the 24-hour recall method is that it can be prone to recall bias as people's memory can be distorted regarding their food consumption, especially common for snacks and foods consumed outside the homes. Also, people may deliver answers which the interviewer wants to hear or are socially desirable.

3.4 Survey Timing

This survey was carried out different teams in different countries, and each country carried out its training of enumerators individually. It is possible that food classification may vary in different countries. Likewise, the surveys were carried out in different season in each country, therefore, cross-country comparisons should be treated with caution. The table below informs about the surveys conducted for SUNSAI and MI in both endline and baseline:

SUNSAI	Ecuador	Ethiopia	India	Kyrgyzstan	Nepal	Pakistan	Peru
Baseline		Nov- 2019	Sep-2019	Sep-2019	Aug-2019	June-2019	May-2019
Endline	April-2021		July-2021	June-July 2021	April-June 2021	April-June 2021	April-May 2021

MI	Ecuador	Ethiopia	India	Kyrgyzstan	Nepal	Pakistan	Peru	Tajikistan
Baseline		Oct-2020	Oct-2019	Oct-2019	Aug-2019	Oct-2019	Aug-2019	Aug 2020
Endline	May-July 2021	Oct-Nov 2021	July-2021	Aug-2021	April-June 2021	April-June 2021	March-April 2021	July-Aug 2021

3.5 Market Survey

The report also contains data collected using a market survey. The survey was conducted during the final monitoring for a sample of SUNSAI that have a market/commercialization component, whether that is through direct commercialization, through middle-men or private companies. The survey contributed an estimation of the additional income generated by selling the production surplus and to better understand the types of approaches used in introducing new products in the local market; as well as potential benefits and constrains of these approaches. The survey also assessed the role of the farmers when introducing new crops. The surveys was conducted with three different respondent types: farmers, middle-man and market vendors using the "4P" perspective product, price, place and promotion. Data was collected by visiting the market where the products promoted in the SUNSAI were sold, and interviews with a minimum 2 farmers selling directly to consumers, 2 local shops and 2-3 traders.

3.6 Focus group Discussion

The FGDs provide qualitative data to supplement the findings from the WDDS and production survey. The qualitative data collection was carried out in all SUNSAI intervention countries-Ecuador, India, Pakistan, Kyrgyzstan, Nepal, Ethiopia and Peru. For MI, the FGDs were carried out in Ecuador, Pakistan and Kyrgyzstan. The process of FGDs during baseline and endline was similar across all countries, however, the number of participants varied. Under SUNSAI, the respondents belonged to diverse social background such as smallholder farmers, local communities, traditional tribal groups and peasants. Whereas for MI, each RSPs themselves selected 5-25 households to implement the projects amongst farming communities, smallholder farmers and traditional tribes.

How the focus groups were carried out varied significantly by country. In Peru focus groups were organized at both community and family level. Focus group discussion questions were co-created in a workshop composed of leaders of the communities. In Ethiopia two or more groups for discussions were organized where 6-8 key participants from local religious leaders, pregnant women, farmers, local leaders and traditional health workers participated. In Kyrgyzstan, FGDs were conducted by coaches of the training teams themselves. In total 354 people in baseline and 160 participants in endline participated in the focus group discussions, including - the head of the village, the Village Health Committees, women activists, social workers, the head of the village administration and

activists. Meanwhile in Nepal, FGDs were conducted in 30 different groups with 324 participants including 240 women during baseline and 456 members (405 women) of 23 different groups during endline. Participants were included from each SUNSAI implementing areas and sought to include a representative mix from the community in terms of caste, age group and gender.

The FDGs sought to understand various aspects related to behavior associated with food consumption and production in both SUNSAI and MI. The general focus was to understand food consumption behavior, and factors influencing decision making associated with food intake. The FDGs also provided insights to understand the gender dynamics within the household and how this influenced decisions about what to produce, purchase and consume. Furthermore, the FDGs also elaborated on the perceived effectiveness and weakness associated with the collaboration between different organization and/ or service providers locally to improve consumption of nutritious diets. The FGDs also provided insights on how the pandemic affected the participants behavior related to food intake and production especially for remote mountain communities.

3.7 Study Limitations

The NMA phase II project included multiple countries and interventions. There are some limitations that are important to mention.

First, the sample size was inconsistent. Throughout SUNSAI and MI, the sample sizes of respondents were not uniform. This may have influenced the WDDS and MDD-W scores. Second, the timing of data collection for baseline and endline were different in each country for both SUNSAI and MI. The seasonality factor largely influences the consumption and production pattern, as seen in the findings. Therefore, seasonality inhibit access to nutritious and diverse diets year-round. Third, there was a lack of training/ oversite of the enumerators due to the large coverage of the intervention. Fourth, there could have been confirmation bias during data collection. The enumerators were too closely connected to the overall work of the project, and this could have influenced the responses from the participants to to answer in a socially expected manner, excluding objectivity.

4 Overall Findings

7.1 Phase I and phase II scores comparison

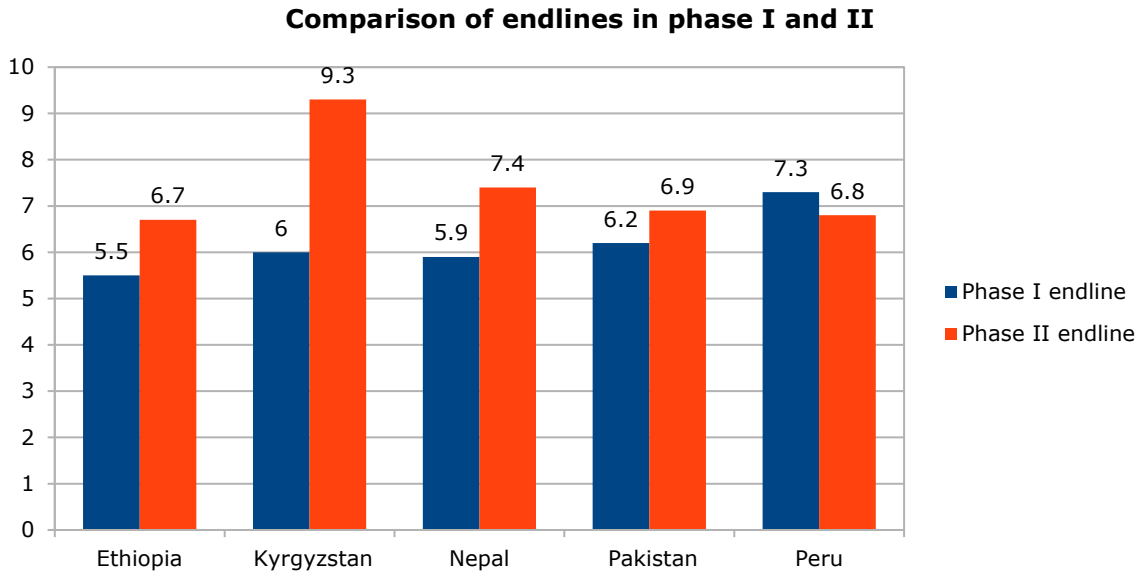

Figure 3 *Endlines comparison between NMA phase I and phase II*

Figure 3 compares the endlines of phase I and II. Since Ecuador, India and Tajikistan were new outreach countries, the comparison is limited to the countries only from phase I. Also, the focus of phase I was only limited to SUNSAI, so the comparison for MI in not available. As seen in the Figure 3, the WDDS increased across intervention countries, with the highest increase in Kyrgyzstan followed by Nepal. The findings suggest that the replication and scaling up sustainable agriculture practices were influential to promote improved nutrition and resilience driven by RSPs at the local level.

However, in Peru compared to the endline in phase I, WDDS seem to have decreased. Although, in phase II the score improved between baseline and endline. The findings suggests that Peru still struggles with low birth weight and exclusive breastfeeding, non- communicable diseases and obesity. Between endlines of phase I and phase II the situation seems to have not improved. Furthermore, the insights form the qualitative data suggests the needs to incorporate nutrition into food processing for making nutritionally rich foods available year-round. Also, there is lack of focus on improving nutritional diet and prioritizing traditional food that required information dissemination on the nutritional properties of each food to increase the consumption of traditional food. These issues might have influenced the scores.

4.1 NMA phase II baseline-endline findings

This section below presents comparative country data from the baseline and endline in NMA phase II followed by a country specific analysis.

4.2 WDDS baseline-endline comparison SUNSAI

This section presents comparative country data from the SUNSAI baseline and endline data followed by a country specific analysis.

Women's Average Dietary Diversity Score SUNSAI baseline-endline comparison

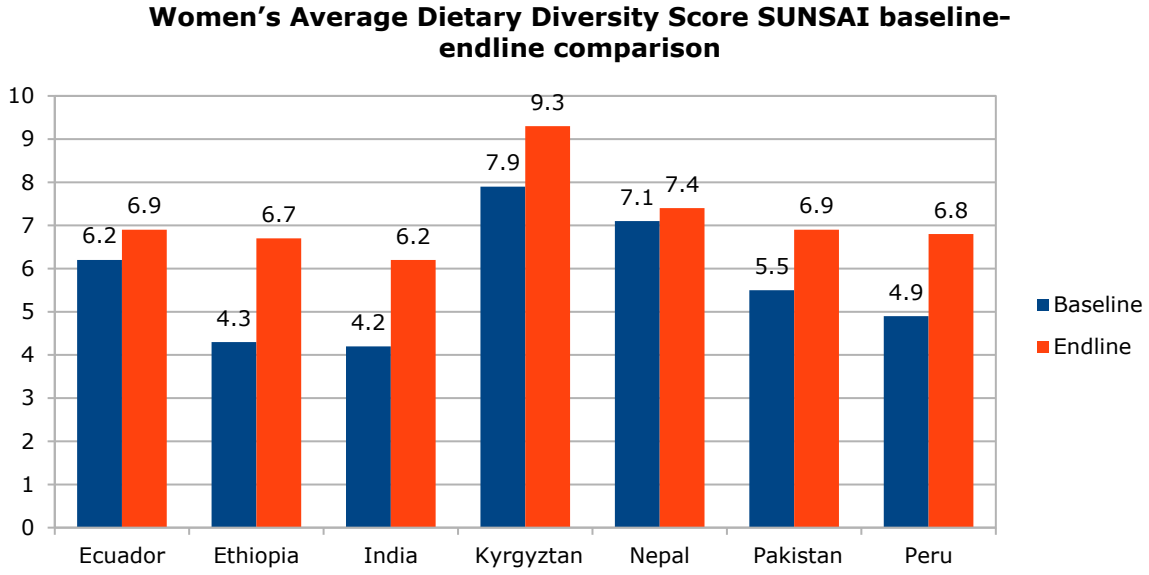

Figure 4 *Overall, Women's average dietary diversity score SUNSAI baseline-endline comparison*
** Ethiopia, India, Pakistan and Peru (P<0.05)*

Figure 4 compares the overall WDDS baseline and endline across SUNSAI intervention countries. As seen in the Figure 4, the score has increased in all the countries between baseline and endline. The contributing factors for the changes in the score is different in each country. The context specific findings are elaborately discussed in the sections below based on both the quantitative and qualitative data. Under SUNSAI, Kyrgyzstan achieved the highest WDDS in the endline, whereas India has the lowest WDDS in the endline. The highest increase between baseline and endline is for Ethiopia as the score increase by +2.4.

A paired T-test was used to understand the statistical significance of the average dietary diversity scores at baseline and endline. In Ethiopia ($P<0.05$), India ($P<0.05$), Pakistan ($P<0.05$), and Peru ($P<0.05$) the difference between the average dietary diversity score at baseline compared to the endline is statistically significant. Whereas in Ecuador ($P>0.05$), Kyrgyzstan ($P>0.05$) and Nepal ($P>0.05$) the difference between the WDDS score at baseline compared to the endline is statistically insignificant (meaning any increase seen could be due to chance alone, as a result of random variation).

Average food groups produced by households SUNSAI baseline-endline comparison

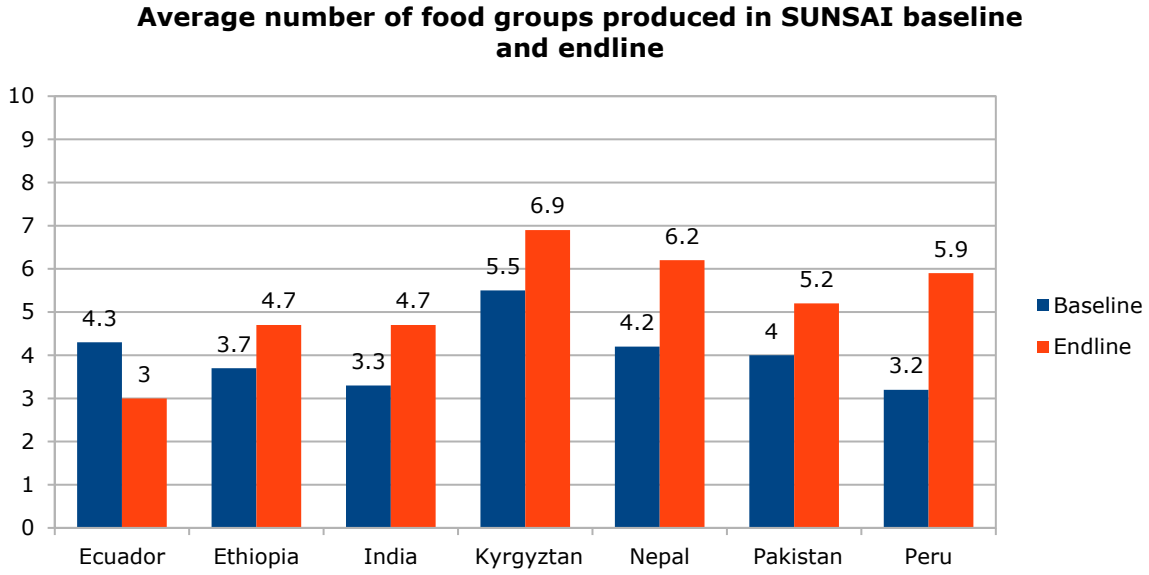

Figure 5 *Average number of food groups produced in SUNSAI baseline and endline*
** Ecuador, Ethiopia, India, Kyrgyzstan, Pakistan and Peru (P<0.05)*

At the end of the project, the food groups produced by the households was measured again. The Figure 5 represents the average number of food groups produced by SUNSAI participants in the baseline and endline across each intervention country. Like what is seen in the consumption data, Kyrgyzstan has the highest food production score followed by Nepal and Peru. Ethiopia and India share the lowest score. The highest increase between baseline and endline (+2.7) can be seen under Peru (explanation provided below under comparisons by each country). Unlike other countries, the score of Ecuador has decreased attributed to lower number of respondents in the endline. According to the paired t-test the findings for Ecuador (P<0.05), Ethiopia (P<0.05), India (P<0.05), Kyrgyzstan (P≤ 0.05) Pakistan (P<0.05), Peru (P<0.05) are statistically significant, except Nepal (P>0.05).

4.3 WDDS baseline-endline comparison MI

Figure 6 below represents a summary of the average WDDS for each project country during MI baseline and endline.

Women's Average Dietary Diversity Score MI baseline-endline comparison

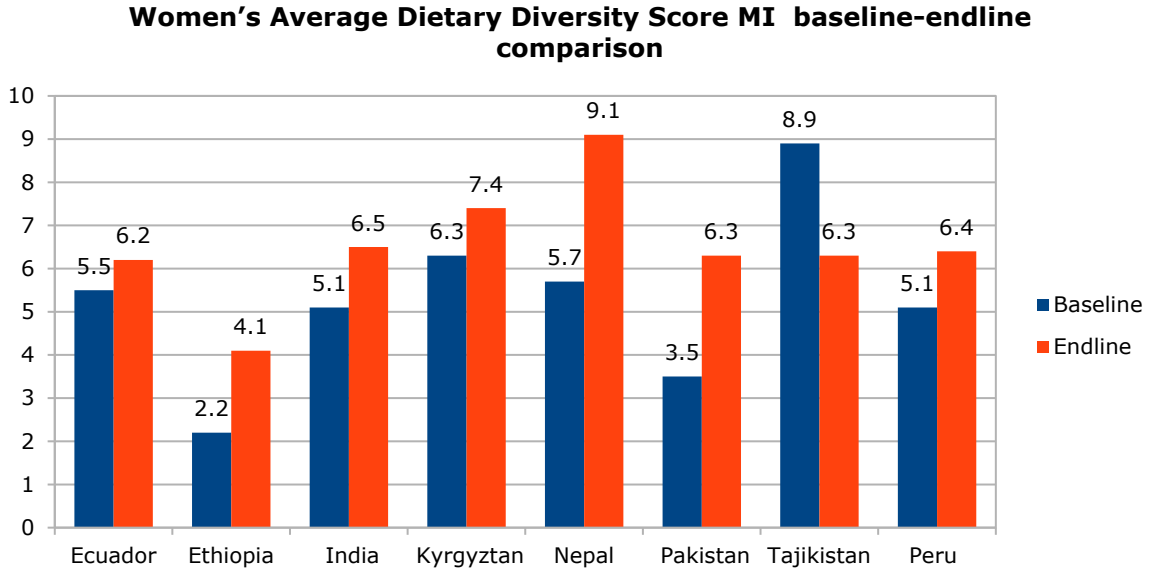

Figure 6 *Women's average dietary diversity score MI baseline-endline comparison*
** Ecuador, Ethiopia, India, Kyrgyzstan, Nepal, Pakistan,_Tajikistan and Peru (P<0.05)*

As seen in the Figure 6, Nepal has the highest WDDS under MI followed by Kyrgyzstan and India. Nepal also has the highest difference between baseline and endline (+3.4). Tajikistan is the only country where the baseline is higher compared to endline. The reason could have been the low number of participants during the endline, due to which the findings need to be interpreted cautiously. According to the paired t-test the findings for all the MI intervention countries are statistically significant: Ecuador (P<0.05), Ethiopia((P<0.05), India (P<0.05), Kyrgyzstan (P<0.05), Nepal (P<0.05), Peru (P<0.05) and Tajikistan (P<0.05). During the endline study, respondents consumed, on average, foods from at least 5 food groups a day across all countries under MI.

Average food groups produced by households MI baseline-endline comparison

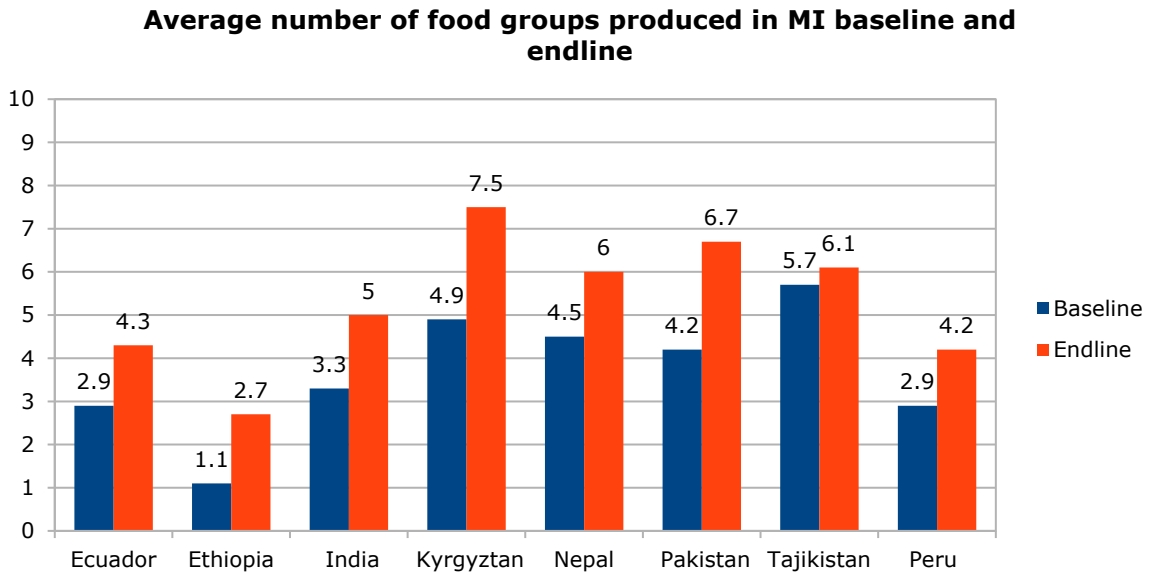

Figure 7 *Average number of food groups produced in MI baseline and endline across countries*
** Ecuador, India, Kyrgyzstan, Nepal and Peru (P<0.05)*

The Figure 7 presents a summary of the average number of food groups produced by households in each project country during baseline and endline. For all countries, the overall score has increased as compared to the baseline. Kyrgyzstan has the highest increase followed by Tajikistan and Nepal. The lowest score is for Ethiopia. The paired t-test was also used to understand and compare the statistical significance for baseline and endline. According to the findings the scores in Ecuador, India, Kyrgyzstan, Nepal and Peru are statistically significant. Whereas for Ethiopia (P>0.05) and Tajikistan (P>0.05) the scores are statistically insignificant.

4.4 MDDS-W comparison

SUNSAI

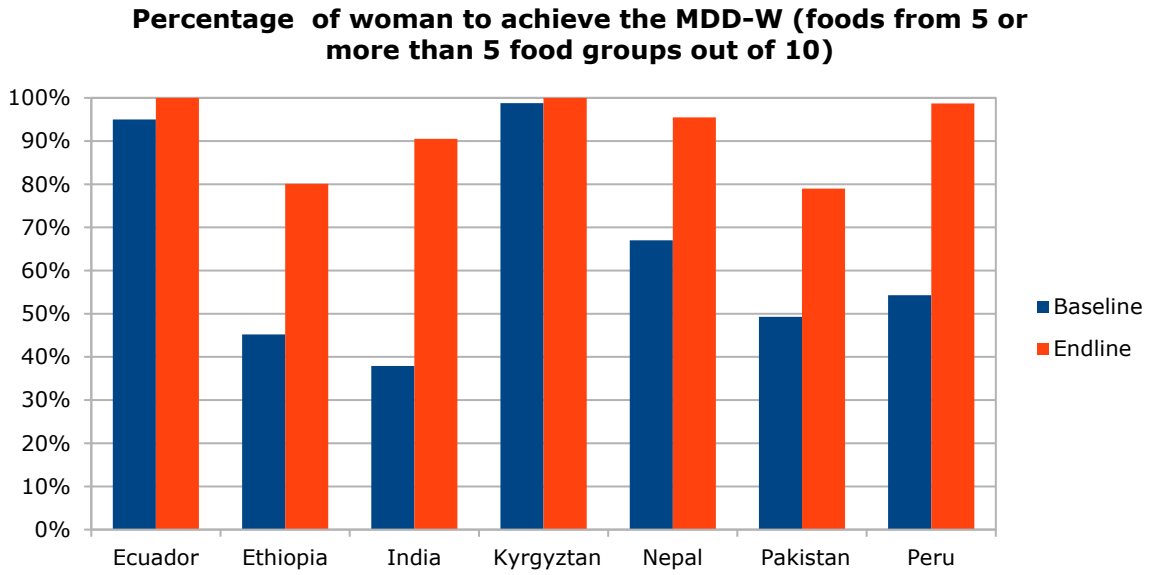

Figure 8 *Percentage of women consuming an adequate diet (food from 5 or more food groups) between baseline and endline in SUNSAI interventions by country*

The baseline and endline data were analyzed for SUNSAI using the dichotomous variable, MDD-W. In Ecuador and Kyrgyzstan, during endline data all participants (100 percent) of women were consuming an adequate diet. However, in Pakistan endline data found only 79% of the women are consuming an adequate diet, the lowest of the NMA countries. India had the lowest MDD-W score in the baseline (37.9%) of women consuming food from five or more than five food group, but in the endline the percentage increased up to 90.5%, which means that it is highly likely that these women are consuming a diet which met their micronutrient needs.

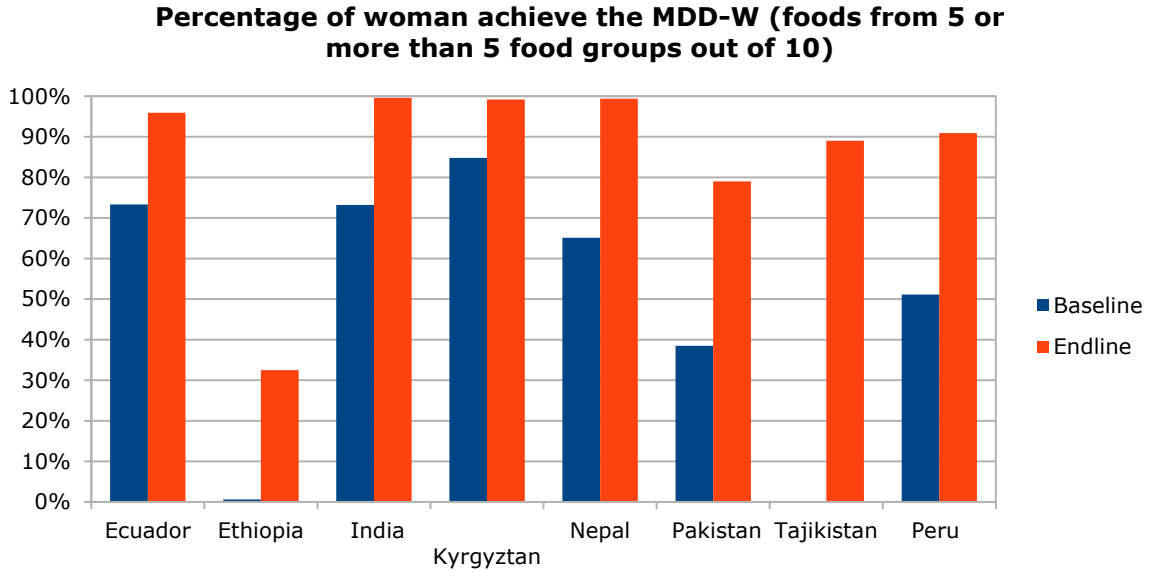

Figure 9 *Percentage of women consuming an adequate diet (food from 5 or more food groups) between baseline and endline in MI by country*

Ethiopia, the NMA country has the lowest MDD-W score in the baseline with only 1% of the women consuming adequate diet. In the endline, this increased to 33%. In India, the country with the highest MDD-W, all the participants were consuming an adequate diet in the endline, which increased by 27% compared to baseline. The MDD-W baseline for Tajikistan is not available due to the absence of data in measurable format. Nevertheless, in the endline 89% of women of reproductive age seemed to have consumed adequate micro-nutrient diet.

5 Baseline-endline comparison by country SUNSAI

5.1 Ecuador

Overview of Nutrition situation

According to the 2020 Global Nutrition Report, Ecuador is 'on course' to meet one global nutrition target for maternal, infant and young child nutrition. The country has made some progress to achieve the target of reducing anemia among women of reproductive age with 18.8% of women now affected. Ecuador is 'on course' to be the 2025 the target for wasting and stunting for children under 5 years of age. Meanwhile, there has been no progress to achieve the targets around low birth weight and overweight in children under 5 years of age. Ecuador has shown limited progress on achieving targets related to diet-related non-communicable disease targets, where 24.7% of adult women are obese and 8.5% of adult women suffer from diabetes.

Regarding the dietary diversity score, in Andes highlands the nutrition transition is marked by increasing rates of comorbidities and obesity with concurrent micronutrient deficiencies. According to study by Melby et al. (2020), in the Imbabura Province of the Andes Highlands, the dietary diversity of women was 5.7 and was characterized as double burden of malnutrition where micronutrient deficiencies exist parallel to obesity as many traditional home-grown foods are replaced by more commercially prepared convenience foods.

Consumption

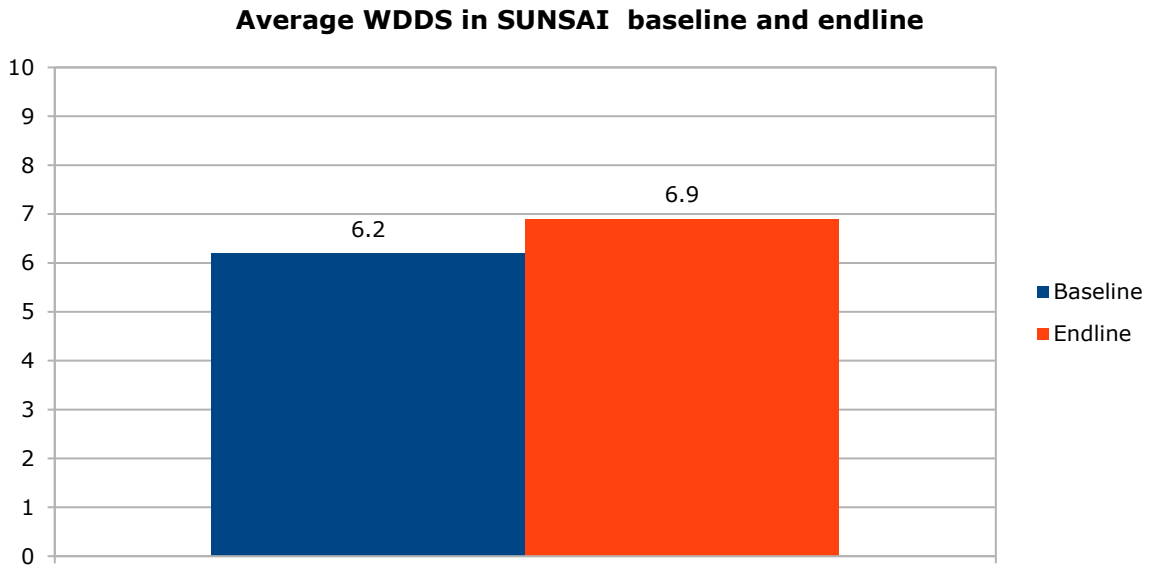

Figure 10 *Comparison of average WDDS in Ecuador SUNSAI baseline and endline*

Overall, in Ecuador, the average WDDS increased from 6.2 in baseline to 6.9 in endline. However, based on the paired t-test, the increment was insignificant as the P>0.05. The dietary diversity did not increase as dramatically compared to other country's SUNSAI even though Ecuador had only 2 SUNSAI of which only one was focused on production and consumption, while the other was focused on awareness raising.

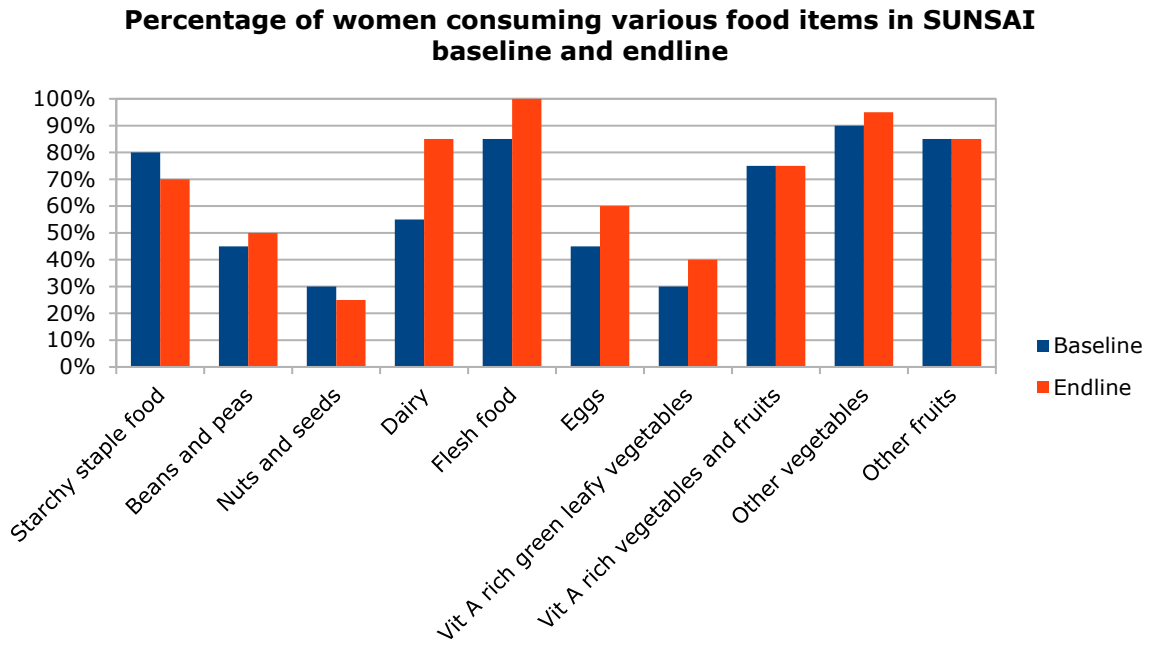

Figure 11 *Percentage of women consuming various food groups in Ecuador SUNSAI baseline and endline*

In Ecuador, the largest increase in food group consumption was for dairy and egg, by 30% and 15% respectively. According to the analysis, every woman consumed flesh food. The increase in the consumption of animal products also correlated with insights from FGDs under SUNSAI interventions that animals are commonly consumed. Under dairy, there has been increase in both consumption as well as production. Under flesh food, the consumption is more than the production, suggesting that they are brought from the market. The results are depicted in Figure 11.

Production

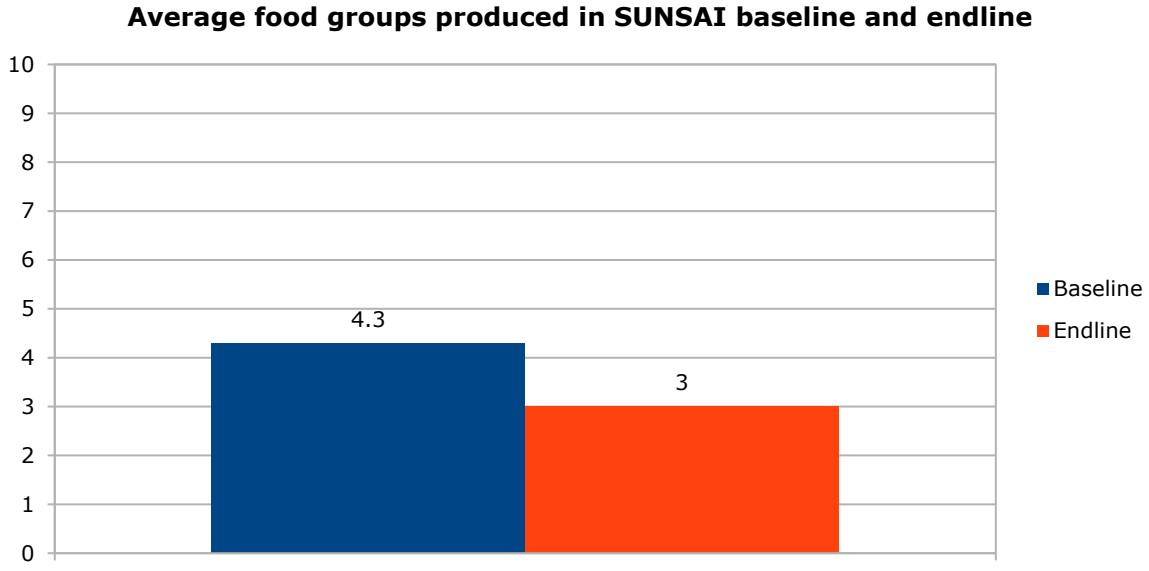

Figure 12 *Comparison of average food groups produced in Ecuador SUNSAI baseline and endline*

Contrary to other NMA countries, the overall average number of food groups produced by the household decreased from 4.3 to 3 in the endline. The decrease was significant (P=0.02). The decrement of the produced food group can be attributed to the low number of observations (20 during baseline and 3 during endline) during the data collection, therefore the results must be interpreted with caution.

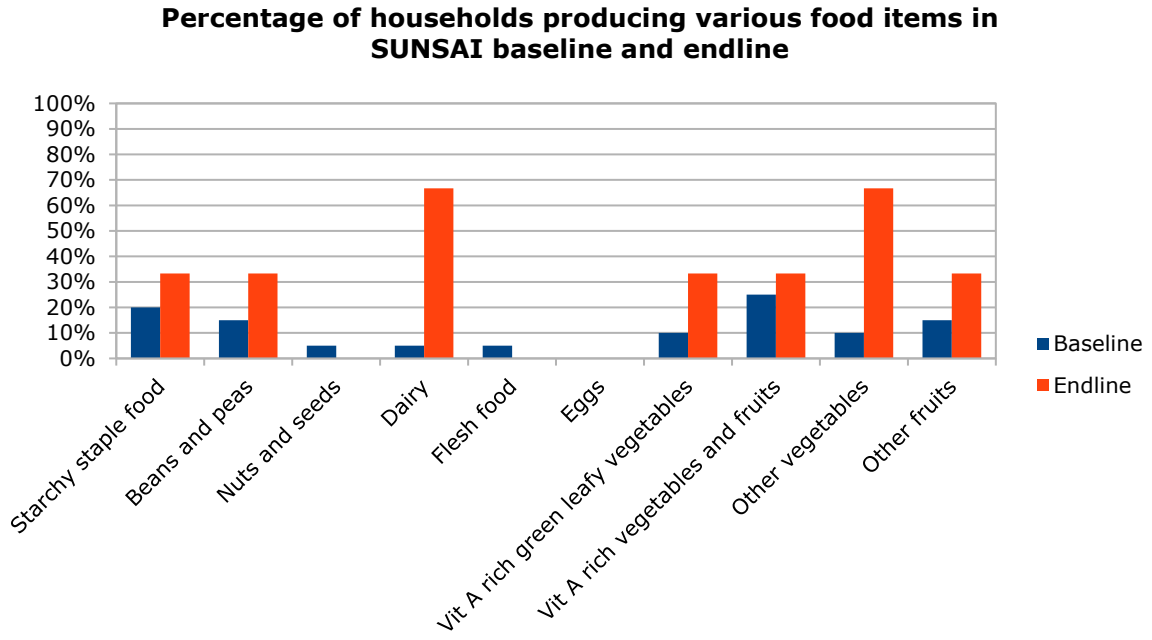

Figure 13 *Percentage households producing each food group in Ecuador SUNSAI interventions during baseline and endline*

The Figure 13 shows the average number of food groups produced by households suggesting that the average number of food groups produced during baseline and endline across the intervention areas in Ecuador varies substantially. The highest increment is under dairy and other vegetables. In other studies, conducted in the highlands in northern Ecuador suggest that the possible reason for relatively low number of food groups produced could be due to many farmers growing multiple crops from the same food group, high altitude, limited the crop diversity and increased availability of convenience stores and small food markets (Melby et al., 2020). The other causes for low production reflected in the FGDs under SUNSAI were water irrigation issues.

Market survey

The following information was gathered from the markets survey in Ecuador.

Farmers	
Choice of crop promoted in the SUNSAI	• Vegetables, fruits, new product such as Romanesco • Crops produced on farm are sold in fixed market
Approaches used to introduce new products	No promotion done
Challenges	• Small land, sometimes there is not enough product for what the market needs • -Lack of better market to improve the economy • -Lack of increased production to achieve better sales to improve the economy • Weather and climate variability
Market sell	• Everything produced goes to the market as there is always enough to sell and consume • Crops are directly sold to customers at the fair or delivered as the products are valued by them • Customers are mainly friends and neighbours
Additional income generated	Between 50-120 USD monthly by each farmer
Availability of the product after project ends	• The products are liked by customers because it's organic, good quality, fresh and chemical free so the demand can be maintained
Vendors	
Reason for selling crops promoted in the SUNSAI	• They are healthy, fresh, agro-ecological, availability of crops based on seasonality and produced in an environmentally friendly manner • Sold in sacks with word of mouth, flyers and social networking sites
Response from the costumers	• People are getting to know the producers and are making demands according to their taste. • Incorporation of new products into the family diet, including ancestral agrobiodiversity • Customers prefer the demonstration and use and recipes in the stalls

Key insights from Focus Group Discussions in Ecuador

Consumption behavior: The insights from the participants of the FGDs reflected that a good diet includes diversified food from their own production and should include cereals, vegetables, meat from animal raised on their farm and legumes which are all considered healthy foods. Farmers identify healthy foods as those which are of a high quality, and organic, which they feel are of higher nutritional values and thus reduce the incidence of disease. Towards the endline, vegetables including broccoli, romanesco, swiss chard, watercress, carrots, potatoes, and guinea pigs, were considered healthy foods. Apart from the home-grown food products, salt, sugar, some legumes, potatoes, beef, and chicken are bought from the market. While hygiene was not considered a critical issue for people, participants mentioned several challenges to achieving a diversified diets including self-awareness, time allocation, need to be organized to have the products all the time and lack of knowledge.

Production system: The insights from the participants during FGDs suggested they produce vegetables, grains, carrot, beet, cauliflower, chard, romanesco, broccoli, celery, parsley, lettuce, zucchini, potatoes, beans, corn, peas etc. In the endline participants also mentioned new varieties of chives, potatoes, corn, peas, animals such as guinea pig, cow, chicken, trout were also produced by the participating households. It is estimated that 10% of farm production is destined for self-consumption, including turnips, cilantro and beans. Blackberries were mentioned as a commonly produced product, with those who produced selling about 20 boxes per week. In both baseline and endline irrigation issue were frequently mentioned by the participants who indicated weekly irrigation is needed to increase production in order to obtain higher revenues and maintain product variability.

Gender roles in decision making: The participants expressed that the whole family oversees making decisions in the household, determining what to produce, when and how the products will be

used. Some participants also suggested that the mothers oversee decision making associated with food consumption. Each member of the family has designated agricultural activities and farm functions. In the household, the highest priority activity is crop production and animal husbandry. Regarding food, there seems to be no bias in food distribution within households, but children eat a little less. Overall, in both baseline and endline, there seems to be a balanced decision-making hierarchy between genders.

Public and private institution collaboration: The institutions that contribute in some way to the nutrition sector are state institutions that work with academics, who support training, especially for children. Other institutions are involved in the promotion of fair trade and consumption of local products with some support from provincial councils. However, the participants were of the view that there was not much collaboration done for promoting good nutrition. The participants suggested that to improve the dietary diversity and nutritional status more training and workshops should be conducted regarding good nutrition, what it includes and how it should be maintained in the home. Likewise, suggestions such as training for minors. promotion of new forms of food preparation and additional information for families should be provided.

Impact of Covid-19 pandemic: During pandemic, the participants expressed that they have included aromatic waters, such as linden, ginger, and other types of ingredients, because they are good for protection against the coronavirus to be healthy.

5.2 Ethiopia

Overview of Nutrition situation

Ethiopia is 'off course' to meet the global nutrition targets for maternal, infant and young child nutrition according to the 2020 Global Nutrition Report. There has been minimal progress on targets related to reduce anemia among women of reproductive age 15 to 49, with 23.4% of women affected. There was some progress towards achieving targets related to exclusive breastfeeding target, stunting and wasting.

Similarly, in Ethiopia, undernutrition is one of the leading factors for morbidity and mortality causing major public health issues. Studies in Ethiopia indicates, 52% of women in Angecha District (Boke et al., 2018), and 56.4% lactating mothers in Aksum town, Nothern Ethiopia, had low dietary diversity (Weldehaweria et al., 2016). Similarly, Wachamo and Tegene (2020) suggests that the average dietary diversity score of mothers in *Shalla Bura District* was 4.27. The studies highlight low dietary diversity among mothers and the need for increased focus on increasing dietary diversity. The following section presents WDDS under NMA II in Ethiopia.

Consumption

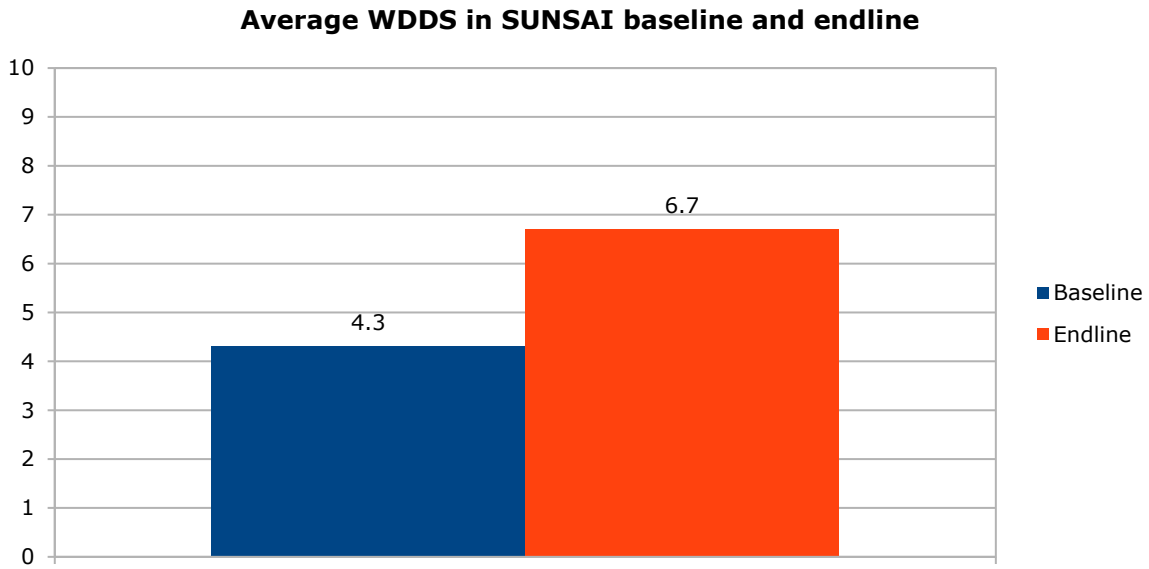

Figure 14 *Comparison of average WDDS in Ethiopia SUNSAI baseline and endline*

Overall, the average WDDS increased from the baseline to the endline by 2.4 food groups in SUNAI participants in Ethiopia (P<0.05). The findings indicate that participants in the SUNAIs have diversified their consumption over the course of the intervention.

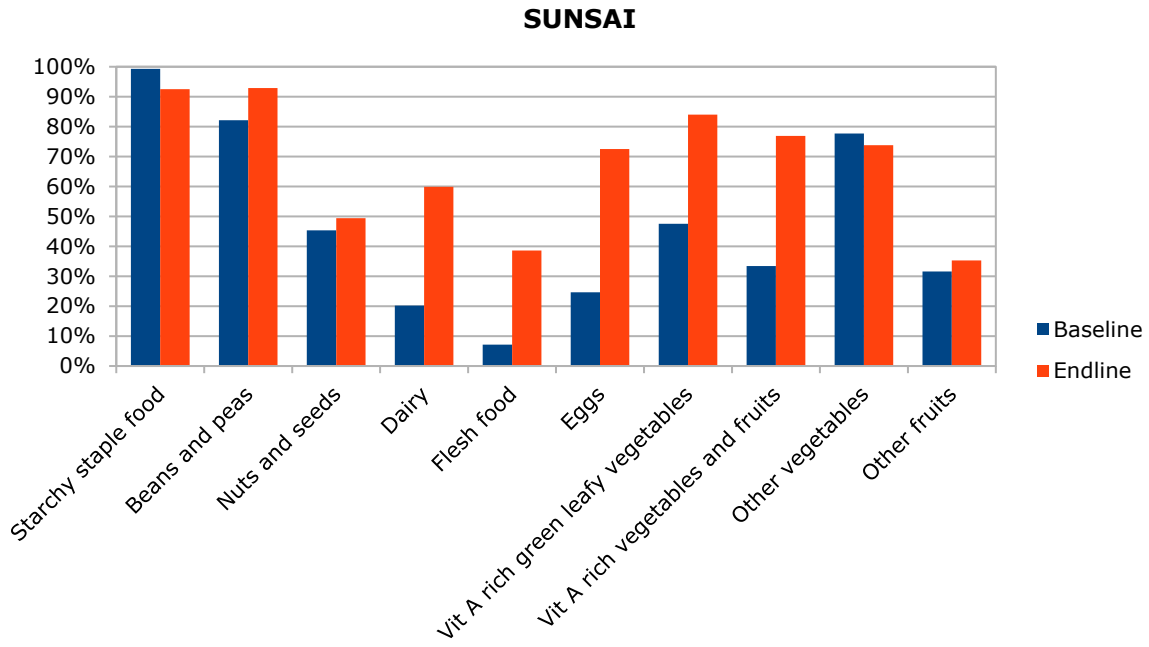

Figure 15 *Percentage of women consuming various food groups in Ethiopia SUNSAI baseline and endline*

As seen in the Figure 15, the consumption of all food groups increased between the endline compared to the baseline, except for the food group starchy stable food and other vegetables. Based on the insights from FGDs, before the intervention, the consumption of cereals and legumes were prominent but now emphasis is given to Vit A rich vegetables, fruits, porridge containing cereals, legumes, nuts and seeds. The main food crops consumed includes teff, wheat, chickpea, millet, and beans, barley,

green leafy vegetables, egg, milk and millet and porridge. After the interventions the consumption increased from diverse food groups like legumes, fruits, vegetable, diary produce, eggs and other animal source foods. There was seasonal variation in consumption pattern, the baseline data was collected during Nov-2019 around the time of harvest, where the food availability was more. The other reasons explaining variation in consumption gained from the qualitative data includes health problems, perception of foods as medicinal value, fasting times during which people consume no animal source foods, dislike of taste, few producers of fruits and vegetables and low levels of nutrition awareness.

Production

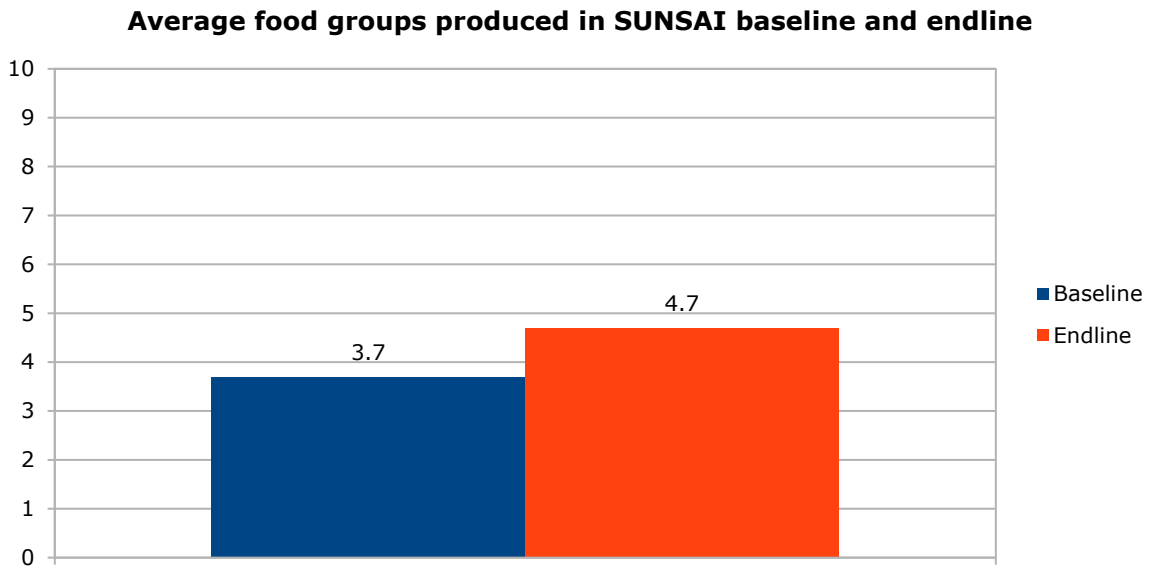

Figure 16 *Comparison of average produced food groups in Ethiopia SUNSAI baseline and endline*

Overall, in Ethiopia, the average number of food groups produced by the households of the respondents increased significantly (P=0.05). There was an increment of + 1 in the average food groups produced in the intervention areas.

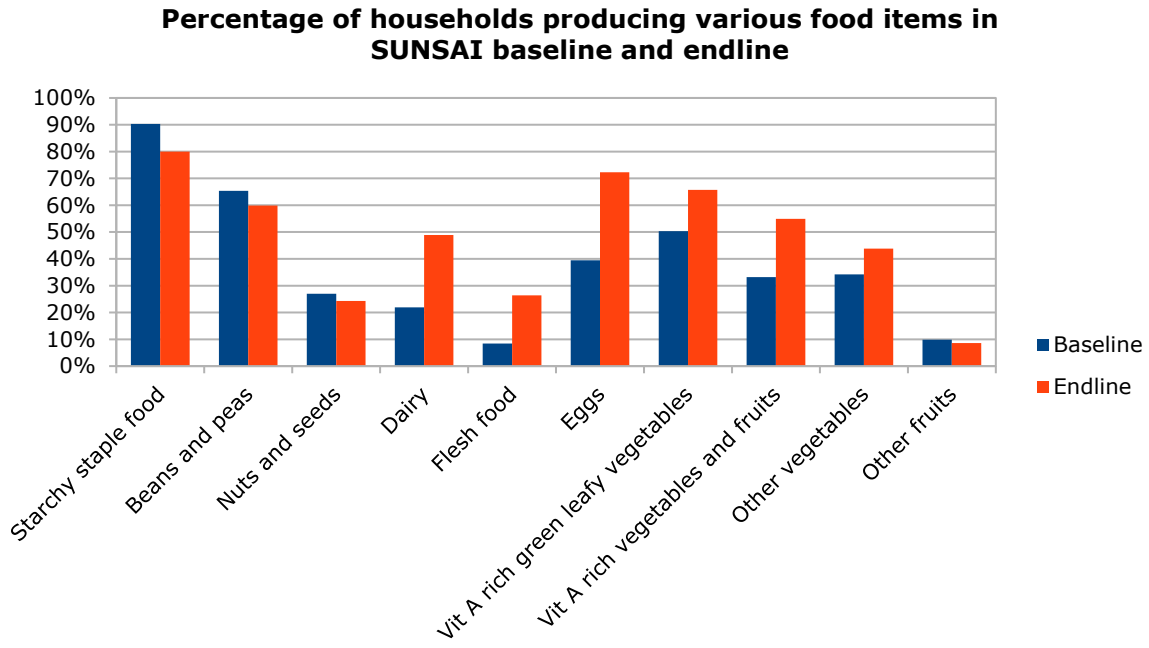

Figure 17 *Percentage households producing each food group in Ethiopia SUNSAI interventions during baseline and endline*

The production of diverse food groups has increased slightly. However, there was a decrease in the production of starchy food, beans, peas, nuts, seeds and other fruits. Fruits are rarely cultivated, rather people obtain fruit through at the market or trade for other crops. Changes in the production of food groups can be attributed to many factors. In focus group discussions the community indicated that they produce more vegetables for their own consumption. Likewise, the improvement in market access and organic vegetables resulted in increased consumption. However, compared to consumption, the production of diverse food groups seems lower in Ethiopia. This may be attributed to the limited mobility to sell the products in the market due to the pandemic.

Market survey

The table below contains the information from the markets survey in Ethiopia on July 2021.

Farmers	
Choice of crop promoted in the SUNSAI	Carrot, cabbage, beetroots, swiss chard and vegetables after learning about the importance of diversified nutrition
Approaches used to introduce new products	A prominent spot in the market was chosen but no other specific marketing was carried out
Challenges	Shortage of water for irrigation, crop pest and diseases
Market sell	• Carrot, cabbage, swiss chard, and beetroots are produced for market as well as used for family consumption. • Products are sold when they are surplus to earn income for the family by selling to customers directly at relatively lower prices.
Additional income generated	2000-3000 birr (44-66 USD) per farmer
Availability of the product after project ends	• Products are fresh, clean, organic and people's understanding of benefits of organic fertilizers could lead to ongoing demand
Vendors	
Reason for selling crops promoted in the SUNSAI	Demand in the local market
Feedback to farmers/suppliers	Comments on quality and price of product
Response from the costumers	Increasing demand since organic products have health benefits.

Key insights from Focus Group Discussions in Ethiopia

Consumption behavior: One of the significant transformations in the consumption behavior was the shift in perception of food only as means of survival. During baseline, the participants expressed that there was less consumption of diverse food items and emphasis on showing wealth leading to consumption of more meat and teff instead of eating nutritious vegetables. However, during the endline participants acknowledged the importance of consuming a diverse diet. Diverse eating was acceptable by family members including children. Participants mentioned that as a result of more diversified consumption the children have become healthier, and their nutritional status improved. Focus group participants also mentioned the value of education and training for pregnant women to consume more diverse diets. Women mentioned foods such as mangoes, avocado and banana are included in their diets regularly. However, participants mentioned some challenges related to diverse food consumption including income constraints, knowledge gap on the benefits of diverse organic vegetables, fruits and more focus on fulfilling children's, rather than women's health needs.

Production system: During the baseline the participants raised concern regarding low production of vegetables, prioritizing cash crop for commercial reasons and affordability issues related to production During the FGDs in the endline, the participants explained that increased production of fruit and vegetable, instead of cereal is prioritized by the community and even if they were not producing in backyard, they try to buy diverse foods from the market. The increase in household production of vegetables & fruits throughout the year could be possible through small irrigation that may make foods more accessible to households. For vegetable production, both organic and chemical fertilizer are used, with an increasing priority is placed on chemical fertilizer. Increasing the diversity of crops produced also has spillover effect to other members in community by increasing access to more diverse foods. Focus group participants mentioned that the contributing factors for the change in production diversity include education, training, support, nutrition awareness, professional advice

delivered at community members homes, and monthly growth monitoring. However, several factors also limit consumption of a diverse diet including low incomes, trade-offs on how income is spent including meeting other household needs including agricultural inputs, crop diseases, lack of water, land degradation, limited land size, nutrition awareness and skill gap.

Gender roles in decision making: In Ethiopia, the gender roles are constraint by traditions. During baseline, the participants mentioned a gendered division of household decision making where males are responsible for decisions around agricultural production and women make decisions about consumption and preparation of food. Participants reported some changes in traditional roles in the endline. In some intervention areas, both women and men equally decided in the food production and preparation. Women took more than half of responsibility in buying foods, determining the type of food to be bought and participated in decisions around food production. Apart from the interventions, the legal protection of women's rights and education led to improvement in equal right and decision making for day-to-day activities. However, the traditional practices still exist such as women being mainly involved in feeding and taking care of the children, and men being involved in feeding and taking care of the children only if the women are busy or away. During the FGDs, the participants also reflected that woman eat left over foods indicating strong practice of tradition and gender bias preventing the gender roles to be flexible and equal.

Public and private institution collaboration: The participants expressed lack of communication and collaboration between health, agriculture, women affairs and health extensions officers on issues related to eating habits and nutrition driven awareness during baseline FGDs. However, during the endline participants mentioned there was now some integrated work, mainly between health workers, agriculture extension workers, education, women's affair and community leaders about nutrition, especially dietary diversity, and organic production. As explained by the discussants, the project had an impact on production and consumption behavior and market access for diverse food groups, especially fruits and vegetables, which was attributed to the support and contribution of a number of community organizations. These stakeholders generated and shared ideas on how to deal with the community to deliver the project's activities, therefore, community mobilization was possible. However, there was less emphasis on the women's affair office compared to other organizations.

5.3 India

Overview of nutrition situational

According to the 2020 Global Nutrition Report, India is 'on course' to meet two global nutrition targets for maternal, infant and young child nutrition. There was some progress to achieve the exclusive breastfeeding target for infants aged 0 to 5 months, with 58% exclusively breastfed. The country is 'on course' to meet the target for stunting and to prevent an increase in the number of overweight children under 5 years of age. Still, there is no progress to achieve the target of reducing anemia among women of 15 to 49 reproductive age, with 51.4% affected. There is also no progress towards achieving the target for wasting with 17.3% of children under 5 years of age are still affected. The country has shown limited progress towards achieving the diet-related non-communicable disease (NCD) targets.

Regarding the dietary diversity among women in India, cultural factors impact women's dietary diversity. According to Gupta et al. (2020) there is evidence that women eat less diverse diets compared to their households. The total mean WDDS recorded was 4.3 and evidence suggests that women's diets are particularly deficient in non-staple food groups such as Vitamin A rich fruits and vegetables, dairy, eggs, and green leafy vegetables.

Consumption

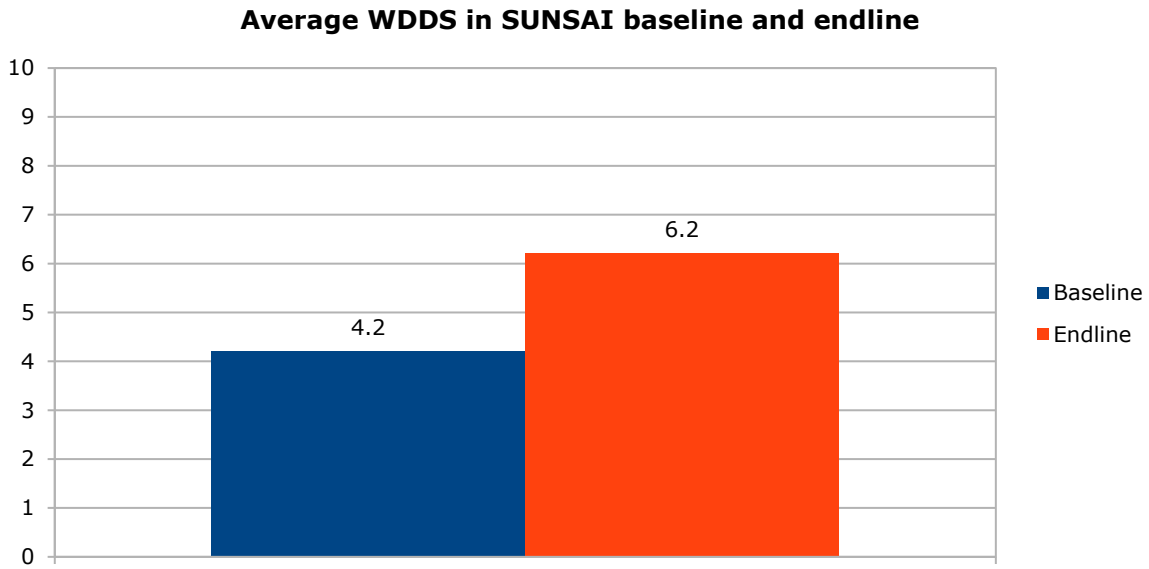

Figure 18 *Comparison of average WDDS in India SUNSAI baseline and endline*

The WDDS in India suggest that the score has increased by from 4.2 to 6.2. Between the baseline conducted in September 2019 and endline in July 2021, the score by +2. The increase is statistically significant as P<0.05.

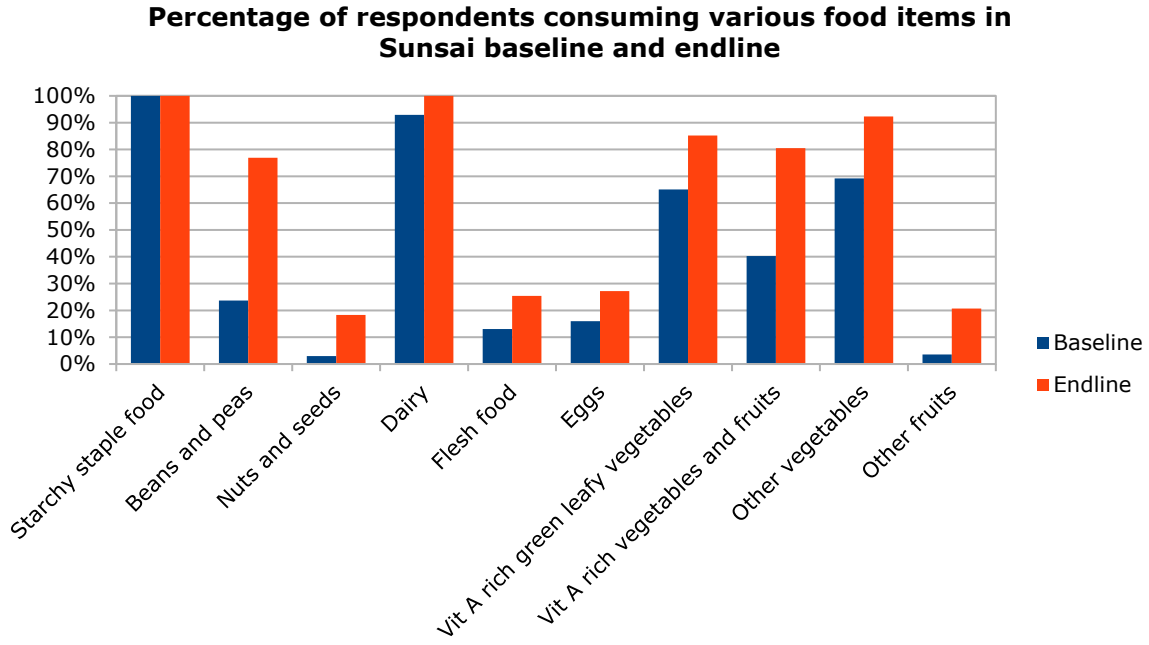

Figure 19 *Percentage of women consuming various food groups in India SUNSAI interventions during baseline and endline*

As seen in the Figure 19, the increase in consumption of food groups is varied. The highest increase in consumption is under beans and peas (53%), followed by Vit A rich vegetables and fruits (40%). Although, the FGDs suggested that there has been increase in the consumption of eggs in everyday meal, but the baseline-endline comparison suggest only small increase (12%). The FGDs also suggested that overall, they have become more aware and understood the importance of dietary

diversity and now consume fruits and vegetables regularly. However, the increase in consumption is not as large compared to other countries in the endline. This could be ascribed to the variation in seasonality as the endline was collected during in July 2021, which is normally the sowing period resulting in less food availability compared to harvesting period.

Production

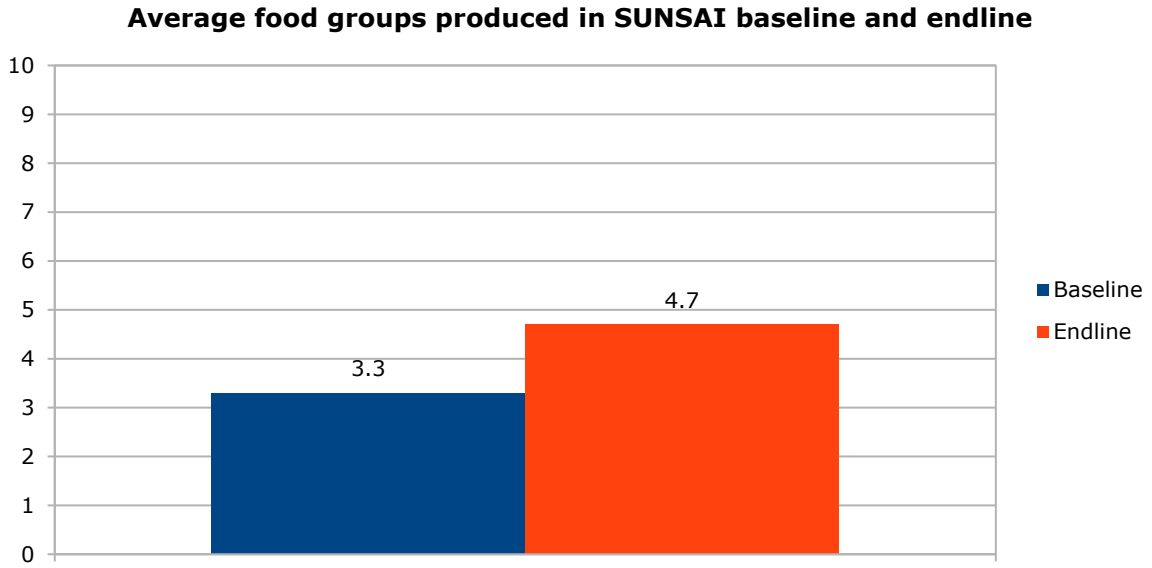

Figure 20 *Comparison of average produced food groups in India SUNSAI baseline and endline*

The average number of food groups produced by households was also analyzed for the endline data. The Figure 20 shows that the increase in the average number of food groups produced during baseline and endline across the SUNSAI intervention areas in India. There has been a total increase of +1.4. Overall, the average number of food groups produced in India increased significantly ($P<0.05$).

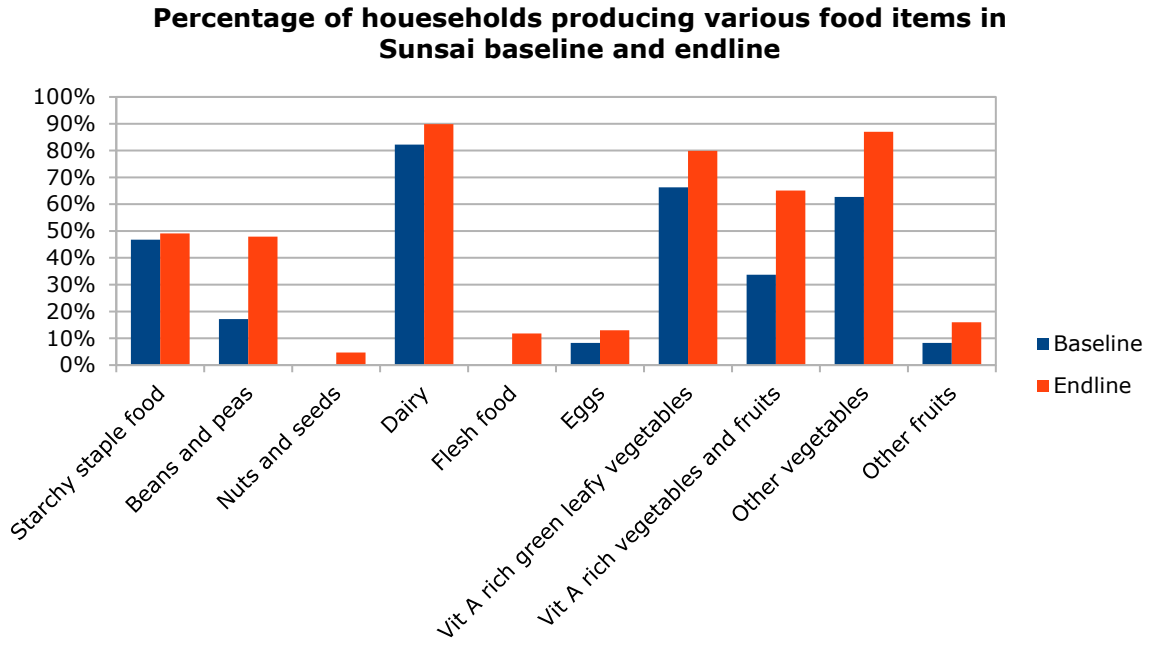

Figure 21 *Percentage households producing each food group in India SUNSAI interventions during baseline and endline*

Like the consumption pattern, there is variation in the production by the households. Overall, there has been increase in production in every food group. The largest share of production in dairy suggests that the large share is sold in the market, as reflected in the FGDs. Similarly, the increase in other vegetables (25%) indicates that the growing interest to sell cash crops and introduction of new crops for income, also reflected in the FGDs. Similarly, other reasons for low productivity as suggested in FGDs could be frost & pests damaging crops, changing weather patterns, drying streams, destruction of crops by animals, seasonality and increasing out-migration.

Market survey

The table below contains the information from the markets survey in India after SUNSAI intervention was completed.

Farmers	
Crops promoted in the SUNSAI	Cucumber, beans, pumpkin, okra, peas, maize. due to availability of seeds, being indigenous, easy to grow, marketable and nutritious value
Approaches used to introduce new products	Through the retail vendors at specific corner for vegetables in the local market where only locally sourced vegetables are sold
Challenges	• Lack of timely procurement of seeds • Unavailability of organic/locally preserved seeds. • Lower price during the mass harvest time at the market • Lack of knowledge and awareness among the farmers and consumers to understand significance of organic farming • Higher cost of organic production and lack of compensation as it requires and extra inputs to grow
Market sell	• Sold when there is enough harvest in the farm and in need of additional income • Major chunks of harvest are sold through local buyers and around 25% sold directly to the consumers without middlemen
Additional income generated	• Unable to calculate due to Covid-19 lock down and wildlife intrusion in the farm
Availability of the product after project ends	• Seems promising due to demand for indigenous crops and fermented foods for example millet, buck wheat, fermented soya, fermented green leaves, mostly radish and mustard
Vendors	
Reason for selling crops promoted in the SUNSAI	• Has good local market/consumers attributed to the products of quality and benefits. • Promotion possible by word of mouth
Feedback to farmers/suppliers	• No such type of interactions exists between the seller and the consumers.
Response from the costumers	• Sourced from the local farmers and grown organically • Locally grown good quality produce.

Key insights from FGDs

Consumption behavior: The qualitative data suggests that during baseline participants felt the contribution of agriculture to income has fallen. The issues of migration, barren lands, lack of availability of agricultural labor, animal invasion in farm and modification in consumption of traditional recipes were prevalent. To confront this, self-help groups and crop protection committees were initiated. Regarding food and nutrition, the government's Public Distribution System (PDS) were implemented but people were not sure of its nutritional value or safety, as it is mostly grown using chemicals and may be stored and transported without following health protocols. During the endline, participants mentioned that were consuming meals more often, 3-4 times a day. Earlier, they used to eat only twice a day. They are also consuming a more diversified diet with 2-3 food items included in their meals. Now eggs have become regular part of their diet. The quality of fruits and vegetables was also considered better now. They consume more fruits and vegetables such as red amaranthus, orange, avocado, lemon and incorporated new variety such as papaya, carrot, coriander. The

discussants said they dry and keep radish, radish leaves, potato, cauliflower, bamboo shoot, and cabbage for consumption. A few discussants believed it will be better if diversified food were supplied in the public distribution system (PDS) as they all now understand importance of diet diversity. Earlier the participants purchased snacks like puffed rice for their kids but now they can afford to buy fruits. The participants suggested that both income and expenditure has increased. Overall, expenditure on fresh fruits and vegetables fell but they buy more sugar, oil, milk powder. They also mentioned the continuation of growing and eating nutritious crops even after the program is over.

Production system: During the FGDs, the major challenges reported were frost & pests, changing weather patterns, drying streams, destruction of crops by animals and increasing out-migration affecting self-sufficiency. They suggested most crops are produced for home consumption, but a large share of the meat and milk raised is destined for the market. In some villages, farmers mentioned responding to changing conditions by selling more of what they grow, particularly cash crops. Some women reported cultivation of finger millet, which is very rich in calcium, is less labour intensive than rice and wheat, and requires less water. Other crops included, *Alsi* (flax seed) and spinach as it does not get eaten by birds. Economic pressures have made people reintroduce some crops that had disappeared but currently have huge market demand, like chilli and flax seeds. Farmers still self-save 80–90% of their seeds, although farmers no longer pre-select plants to harvest separately for seed. The participants mentioned that they keep production for own consumption and sell the surplus or keep it for next year. Crop residue is used as feed for livestock and for fencing or thatching.

Dietary pattern based on Gender: The FGDs provided insights on the changing dietary pattern of women. After the SUNSAI interventions new fruits and vegetables were included in the diet. Earlier they had to buy it from the market and women used to eat less if there was less availability. Now, since it is home grown they can eat as much as they like. The women also mentioned their health is getting better, they feel less tired and there is lower occurrence of disease in the villages. Therefore health of pregnant women is also better owing to more time for rest. They also go for regular checkups. The participants seemed to be aware that good nutrition and good health is linked to good food.

Spillover effects of the intervention: In the endline, the participants expressed that now they have more knowledge, more training on growing and eating nutritious food and awareness about food. This led to informing other people and relatives in other villages about the programme. They have also shared their improved seeds with them. They seemed to be sharing with other people about the training and knowledge that they have received from the programme. They also mentioned they will continue growing and eating nutritious crops in the future. They mentioned they were wearing clean clothes, taking care of cleanliness for children, wearing slippers etc. A few participants also told about the diet chart which showed them what food to be given to children of different ages. They knew yellow/orange fruit or vegetable like carrot, papaya are good for eye and bones become strong by eating fruits and vegetables. Consuming non vegetarian food like meat and egg helps in reduction of joint pain and gives more strength.

5.4 Kyrgyzstan

Overview of nutrition situation

Kyrgyzstan is 'on course' to meet two global nutrition targets for maternal, infant and young child nutrition according to the 2020 Global Nutrition Report. There has been some progress towards achieving the low-birth-weight target and the country is 'on course' to meet the target for stunting. Kyrgyzstan is also 'on course' for the wasting target, with 2.0% of children under 5 years of age affected. Like other project countries, Kyrgyzstan has made to achieve the target of reducing anemia among women of reproductive age between 15 to 49, with 36.2% of women affected. There is no progress on the exclusive breastfeeding target, or reduction of overweight children under 5 years of age. Similarly, progress towards achieving the diet-related non-communicable disease targets is limited, an estimated 18.6% of adult women suffer from obesity and 10.8% of adult women have diabetes.

Regarding DDS in Kyrgyzstan, the scaling up high-impact nutrition practices, policies and improvement in maternal and child nutrition outcomes seems to be improving. Findings from The Strengthening Partnerships, Results, and Innovations in Nutrition Globally (SPRING) project- a USAID-funded Cooperative Agreement suggests that the WDDS increased in both intervention and compression areas. In the intervention area, on average the score increased from 5.4 in the endline from 4.1 during baseline (SPRING/Kyrgyz Republic, 2017). The causes of the improvements could be associated with factors such as greater availability of food in the oblast or efforts by the Kyrgyz Republic government and related partners to disseminate dietary diversity information across the country.

Consumption

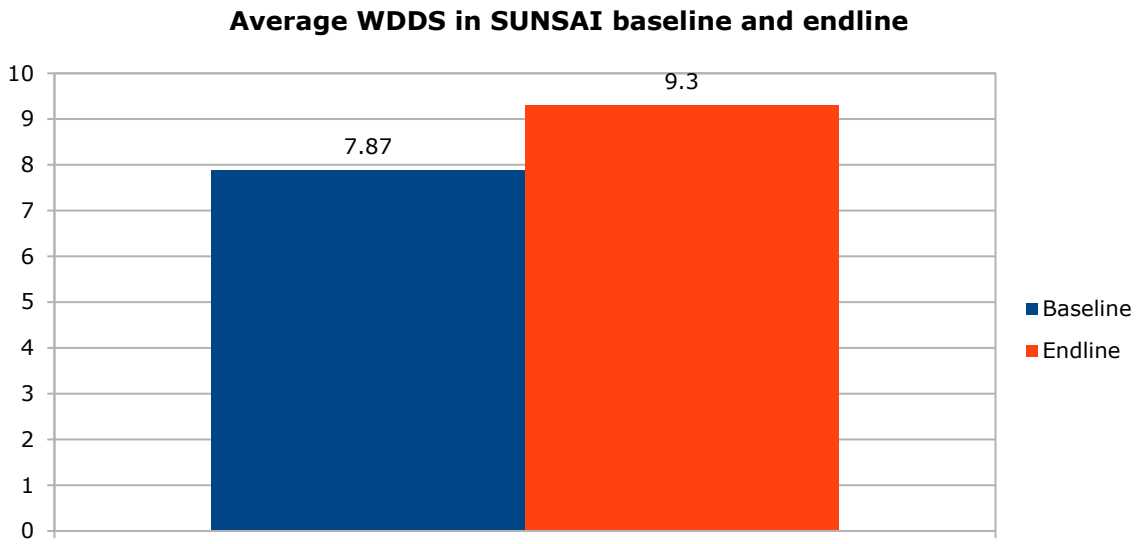

Figure 22 *Comparison of average WDDS in Kyrgyzstan SUNSAI baseline and endline*

Kyrgyzstan has the highest overall SUNSAI WDDS baseline score of all NMA phase II countries. The country also had the highest overall average SUNSAI WDDS during endline (9.3). An increase in average SUNSAI WDDS was observed in all intervention areas, with the increment of +1.4. However, the overall average increment in SUNAI WDDS was insignificant as P>0.05, as there is still a slight probability that the increment in WDDS could have occurred by chance influenced by other broader factors such as socio-economic and political changes influencing food and nutrition practices.

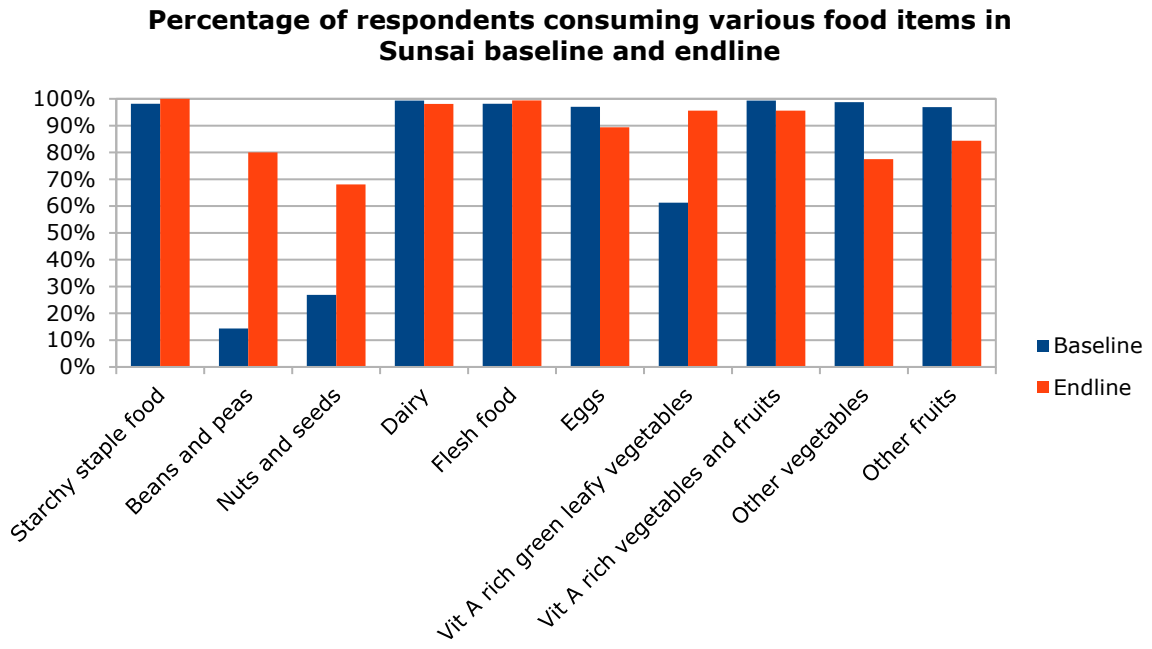

Figure 23 *Percentage of women consuming various food groups in Kyrgyzstan SUNSAI baseline and endline*

As seen in Figure 23, diets in Kyrgyzstan are quite diverse and there is no specific food groups with is completely lacking from the diet, most prevalent in the endline. On a daily basis, most people are consuming foods containing a starchy staple, diary, flesh foods, eggs, fruits and vegetables, suggesting that they are unlikely to be deficient in any key micronutrients. The consumption increment under SUNSAI is under beans and peas (66%), nuts and seeds (42%) and green leafy vegetables (34%). There was an impressive increment in the consumption and production in food groups such as beans, peas, nuts and seeds. As reflected in FGDs under, this could be attributed to expansion of production from home gardening to horticulture. The other SUNSAI intervention was the expansion and promotion of fisheries to improve and diversify by promoting NSA, which conveys the increment in flesh food, compared to fruits and vegetable, also reflected in FGDs.

Production

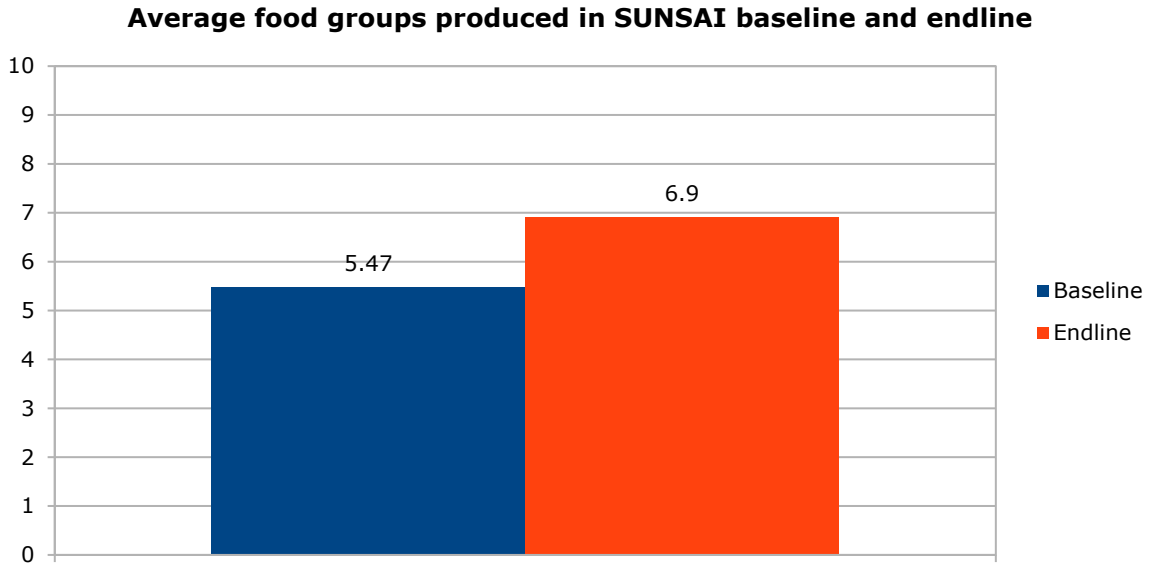

Figure 24 *Comparison of average produced food groups in Kyrgyzstan SUNSAI baseline and endline*

The average number of food groups produced by households was also analyzed for the endline data. The Figure 24 shows that the average number of food groups produced during baseline and endline across the SUNSAI intervention areas in Kyrgyzstan increased from 5.4 in baseline to 6.9 in the endline. Overall, the average number of food groups produced in Kyrgyzstan increased significantly (P≤ 0.05).

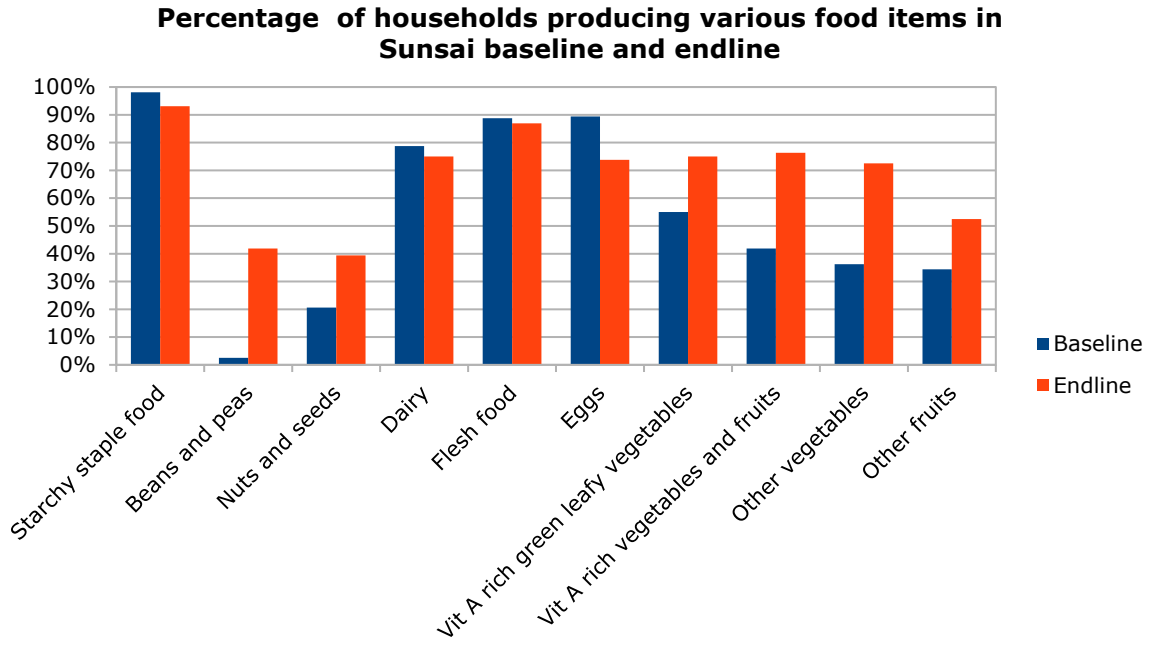

Figure 25 *Percentage of households producing each food group in Kyrgyzstan SUNSAI interventions during baseline and endline*

There is a difference in the food groups consumed by the women and those produced by the households, as presented in Figure 25. Overall, the percentage of women consuming the food groups was higher than the percentage of women whose household produce the food group. This could be attributed to the seasonality factor as the baseline was collected during Sep-2019, usually harvesting period and endline was collected during June-July 2021, usually growing season causing lower food availability. This could imply that the food items from these food groups are obtained through purchase from market (e.g., for Vit A rich green leafy vegetables, Vit A rich vegetables and fruits, other vegetables and fruits) especially during off season based on the insights from FGDs. The other enabler for improvement in consumption compared to production maybe be because of political and economic changes in the Kyrgyz Republic contributing to poverty reduction, including introduction of land and health reforms, and improvements in the health and nutrition sectors (Wigle et al., 2020). Challenges to production, which may account for the overall lower levels of production diversity include a lack of cattle breeding, poultry farming, vegetable growing and lack of incentives for the development of agriculture.

Market survey

The following information was gathered from the markets survey in Kyrgyzstan after the SUNSAI were finalized.

Farmers	
Choice of crops promoted in the SUNSAI	Fish because of lack of availability in the region and higher prices Dried apples, apricots and pears after the project encouraged producing extra fruits to improve families nutrition and get some income.
Approaches used to introduce new products	Promote products within organized classes and trainings under the theme of proper nutrition and organic agriculture
Challenges	• Weather conditions causing late spring, cold weather and rainy days resulting in delayed fishing • Lack of knowledge about organic products • COVID- 19 pandemic decreased the demand for dried fruits causing difficulty in selling
Market sell	Families prepare the stock of the food for the family use and the extra products goes to the market where about 80% of products were sold directly.
Additional income generated	Between 20000-87500 som (236-1.032 USD) per family
Availability of the product after project ends	High demand and possibility of continuation if affordable prices and the quality of the products are maintained
Vendors	
Reason for selling crops promoted in the SUNSAI	• Demand from consumers • Products are of high quality targeted to tourists
Feedback to farmers/suppliers	Provide some master's classes
Response from the costumers	All consumers are satisfied because of high quality of organic products
Private companies	
Promotion of new crops/products from the farmers	Offer products for the hotels, camps and other tourism places by promoting new methods and technologies of cultivating the products

Key insights from FGDs

Consumption behavior: The qualitative data suggests that the participants mainly consumed food such as bread, flour, potato, berries, meat, fresh vegetables/fruits in a peak of season and canned food during out of season. In the endline participants mentioned producing fish. Eggs and meats were also imported but the quality is poorly controlled, and stores lack adequate storage facilities. The participants expressed that there is great variety of products available on the market, but due to seasonality they are cheap during season and expensive out of season. In endline, the participants expressed that their diet should be balanced with protein and vitamin rich fruits and vegetables, as well dairy, greenery and beans. The participants noted the importance of consumption of nutritious food for health, normal physical and mental development, education, labor engagement, well-being and its final impact to the country development. Towards the endline the participants suggested there was transformation in perception regarding healthy cooking practices by participating in training sessions on healthy nutrition. They also seemed to gain knowledge about importance of balanced diet for women, especially women of childbearing age and for girls, how to improve vitamin consumption year-round, the importance of consuming seeds and legumes, and information to reduce anemia among children. However, low income, consumption of fruits only in harvest season, lack of information in media especially regarding junk food such as soda is affecting parents and teens. To make the situation better the participants suggested the need for knowledge on nutrition from an early age by organizing trainings on "Healthy and Balanced Nutrition" for parents and schoolchildren.

Production system: The insights from the participants during FGDs suggested difference in production pattern during baseline and endline. In the baseline, the participants stated that they produce mainly alfalfa, corn, potatoes, apricot and small-scale gardening. Whereas in the endline all participants grew potatoes, engaged in horticulture for fruit and berry crops, apricots, pears and apples. Other produced crops were dairy products, honey and livestock. The surplus of all produced

goods are sold to fulfill their own needs such as: clothes, soap products, personal care products, etc. According to all participants, products are bought at the market, except for those that are grown based on the limitations due to financial capabilities. The participants suggested that many locally produced products are of better quality, compared to processed food due to a lack of food safety standards. But at the household level, with knowledge and skills, the participants were confident in their ability to produce quality food products. To improve production of diverse crops the majority of participants voiced the desire to expand food production, cattle breeding, poultry farming, and vegetable growing. They also seemed interested in state assistance in the form of low-interest loans and incentives for the development of agriculture. Additionally, the production, harvesting, storage and processing would improve if the sanitation and hygiene standards are met.

Gender roles in decision making: Between the baseline and endline, there was not much difference in the insights from participants in regards to household level decision making. The participants suggested men are responsible for farming and women are responsible for preparing food for the family, and raising children. The women expressed they were responsible for cooking, except on days when guests and ceremonies were planned, when husbands and relatives are consulted. In some wealthier families, men and women participate together in decision making. The participants agreed that men have more power for taking decision to sell certain food but educated and employed women better understand the link between nutrition and health as well as the importance of sanitation and hygiene issues. Therefore, the nutrition issues in such families are organized better.

Public and private institution collaboration: The insights between baseline and endline suggested improvement in collaboration between stakeholders in relation to changing people's behavior toward nutrition and agricultural production. For example, during baseline the village health committee provided information to the villages on the prevention of anemia and the use of vitamin foods. Whereas, towards the endline, in addition District Sanitary Station were active to ensure sanitation standards. The school meals were monitored by the district education department and projects aimed at improving the nutrition of the population were being implemented. The rural health committees were also active in discussing topics related to nutrition. During the implementation of some SUNSAI, the participants were regularly participated in demonstrations and round tables with representatives of the local administration, members of health committees, teachers, and local deputies, where together they discussed health and nutrition problems and measures to improve them. The local governments played a key role in working with the population on issues of food security, development of agriculture and animal husbandry, and to raise public awareness of the importance of a balanced diet for the full development of the body especially for pregnant women and children. Decisions were made on the formation of mechanisms to provide targeted assistance to groups of people whose income level does not allow them to provide adequate food. However, in both baseline and endline the particpants mentioned the lack of monitoring and systematic comprehensive approach to implement activities and disseminate information on nutrition and food safety. There seemed no strategic plans to improve food and nutrition security and there was inadeque staff with insufficient knowledge about nutrition.

Covid-19 pandemic: In the endline, the participants raised the issue of the COVID 19 pandemic and its effect on the increased food prices that created difficulties in selling the products produced. The quarantine phase created difficulty to work, and the rising cost of food affected the affordability of the food in the market. After the pandemic many products such as oil, cereals, sugar and other priority foods became very expensive. According to participants selling produced products did not pay off due to the high production costs.

5.5 Nepal

Overview of nutrition situation

Nepal is 'on course' to meet one global nutrition targets for maternal, infant and young child nutrition according to the 2020 Global Nutrition Report. There has been some progress to achieve the target of low birth rate, stunting and wasting for infants aged 0 to 5 months. There is reduction in anemia among women of reproductive age. The country is 'on course' to prevent overweight children under 5 years of age. In terms of achieving the diet-related non-communicable disease targets, Nepal has

shown limited progress to achieve obesity and diabetes target, with an estimated 5.4% of women living with obesity 9.5% of adult women with diabetes.

In a study conducted by Shrestha et al. (2021), the mean dietary diversity score during pregnancy in the western hill region was 4.76. The study revealed that pregnant women have low diet diversity associated with low birth weight, infant mortality and preterm birth. The factors influencing adequate dietary diversity during pregnancy are socio-economic status, food taboos, nutritional knowledge, education, income status and women empowerment.

Consumption

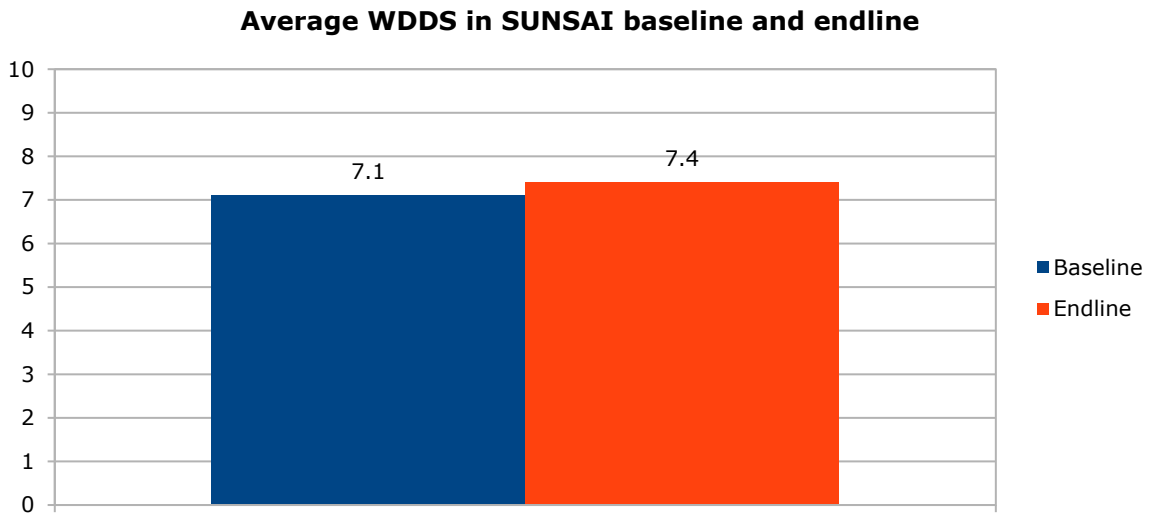

Figure 26 *Comparison of average WDDS in Nepal SUNSAI baseline and endline*

In Nepal, between the baseline and endline there was an increase of WDDS with + 0.3. The difference is not statistically significant (P>0.05), meaning any increase seen could be due to chance alone, as a result of random variation. Another reason for the insignificant increment in WDDS could be that the baseline score for dietary diversity was already high, indicating limited space for improvement.

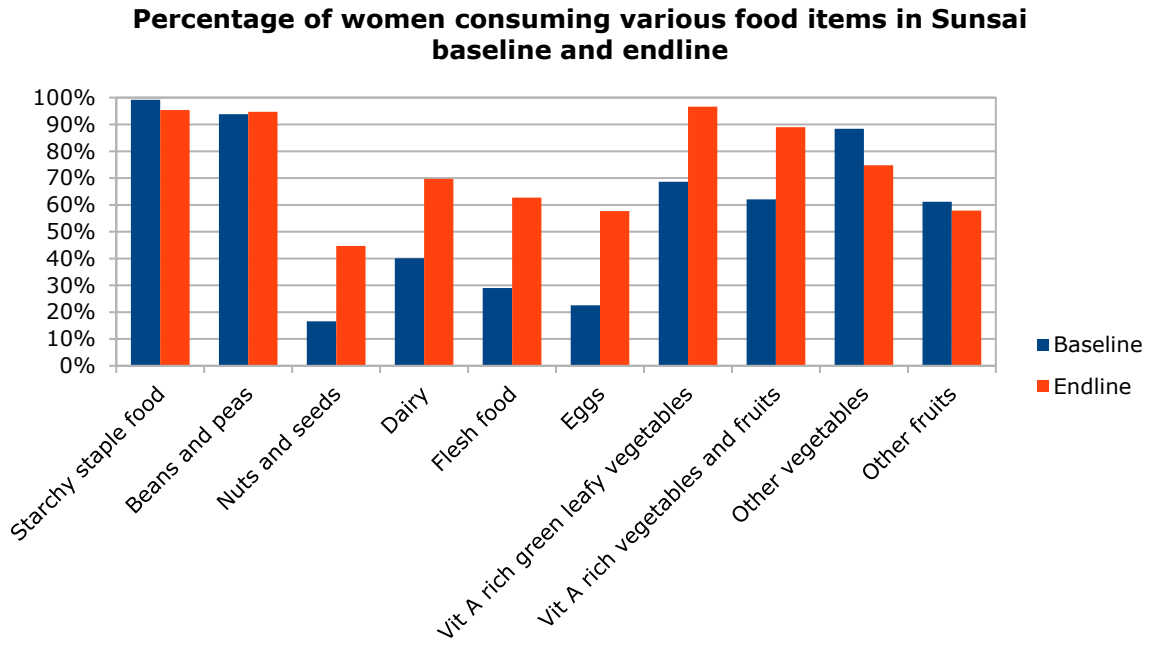

Figure 27 *Percentage of women consuming various food groups in Nepal SUNSAI baseline and endline*

Figure 27 show consumption of ten food groups in Nepal. The greatest increase is seen in food groups such as eggs (35%), flesh food (33%), dairy (29%), nuts, beans (28%), and green leafy vegetables (28%). The increase in consumption of these food suggests improvement in knowledge regarding nutritious food and its influence to boost immune system and improved health amongst women. Other factors from FGDs highlighting the increased intake of these food groups includes mobility restrictions due to geographic barrier focusing only on few specific food groups, allocation of food within the household based on priority, production of specific crops, and collaboration between organizations to promote nutrition awareness. The increment in food groups such and nuts and beans could be linked with the intervention such as nutrition mill and high value agriculture inclusive business for improved technical knowledge and skills.

Production

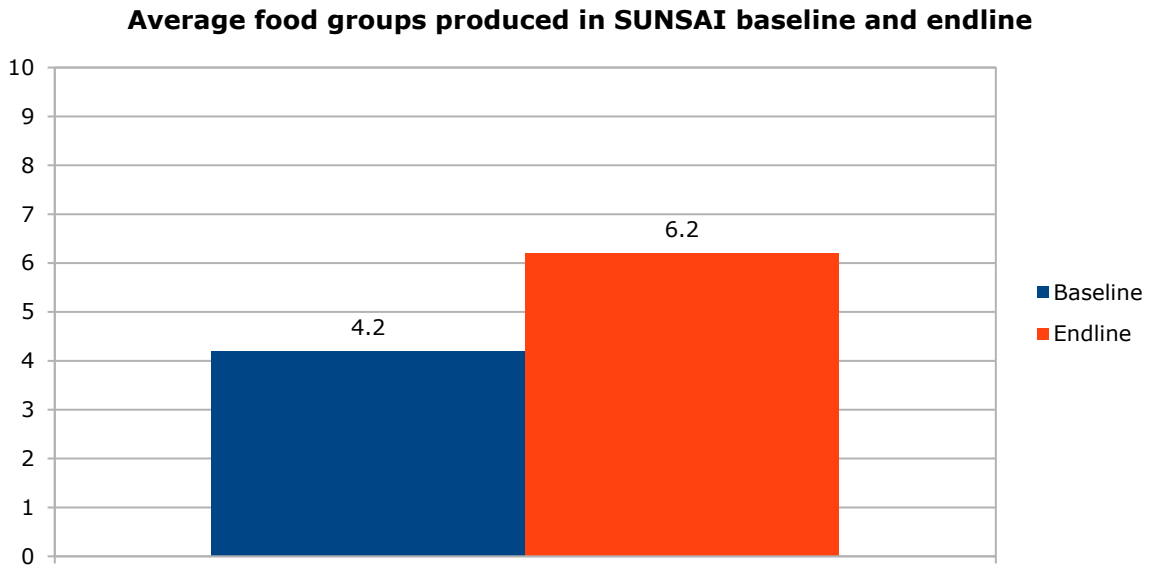

Figure 28 *Comparison of average produced food groups in Nepal SUNSAI baseline and endline*

Compared to baseline, the average food groups produce in Nepal increase by +2. Overall, there has been an increase on the production of food groups by household, but the increase is not significant (P>0.05).

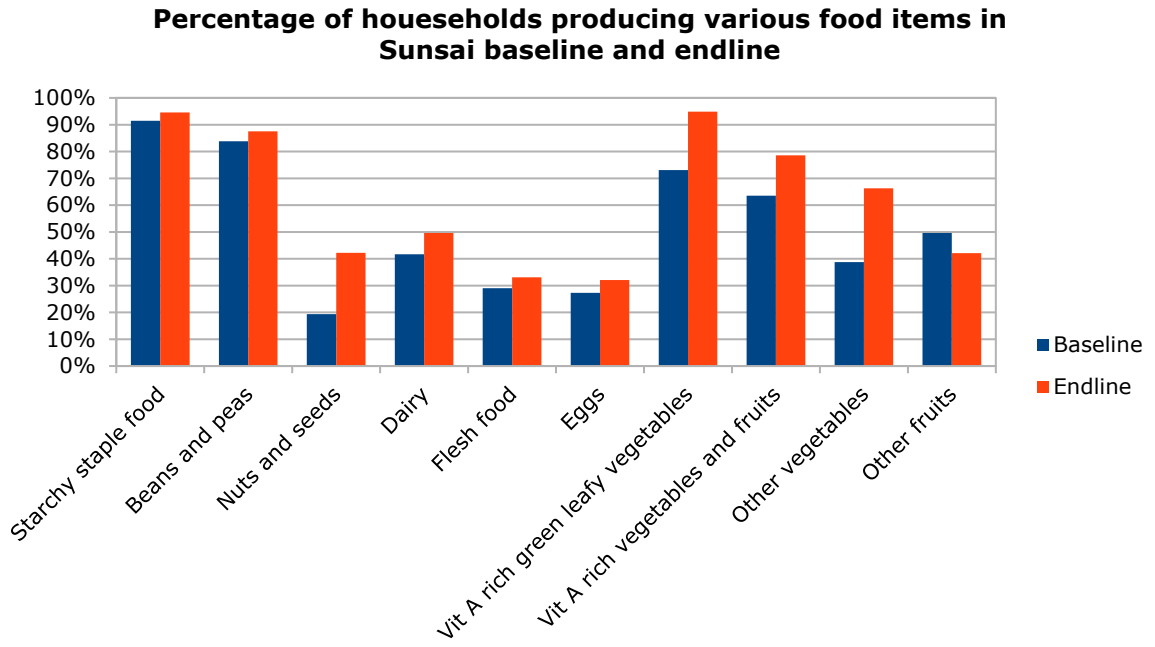

Figure 29 *Percentage households producing each food group in Nepal SUNSAI interventions during baseline and endline*

Figure 29 shows that the average number of food groups produced in the endline increased in most food groups, except other fruits. The highest improvement in production was observed in other vegetables (28%) followed by green leafy vegetables (21%) and Vit A rich vegetables and fruits (15%). In contrast to the data we see around consumption, the focus of production is on vegetables and fruits in Nepal. The findings from FGDs suggests that there is a trade-off between selling nutritious food and buying rice from market, as rice can't be grown. Therefore, people sell their vegetables to increase their purchasing power and buy rice, which is considered as a source of food security. Likewise, SUNSAI intervention such as the construction of a post-harvest unit, school nutrition garden and promoting of organic home gardening might have contributed to an increase in production of vegetables and fruits.

Market survey

The table below contains the information from the markets survey in Nepal on July 2021.

Farmers	
Choice of crop promoted in the SUNSAI	• Local and indigenous crops with high nutritional value and market demand such as buckwheat, maize, barley, millets, beans, apples, potatoes, fresh and dry vegetables under 'Local crop production, consumption and marketing' and 'High value agriculture inclusive business' interventions
Approaches used to introduce new products	• Sell the products in local market, by applying word of mouth • Sell products to vendors/traders/cooperative who then use different strategies such as labelling, branding for regional markets as well as participate in different trade fairs, seminars, workshops, etc.
Challenges	• Unavailability of organic inputs (pest and disease control) in the market. • Poor processing facilities, technological gaps, insufficient storage in village and poor transportation to supply products • Products without proper sorting and grading. • Lack of awareness about nutritional value of local and indigenous crops among consumers.
Market sell	• Farmers generally sells high demanded crops and surplus crops to the trader/cooperative such as bean which had created a certain type of unofficial brand • Fresh vegetables are produced for self-consumption and the surplus is sold directly in the local market
Additional income generated	Between NRs. 275,000- 470,000 (2,370-4,052 USD) per family
Availability of the product after project ends	• Local consumers prefer crops from SUNSAI production area because the production area is known to them, they trust farmers, get fresh, organic, and nutritious food • Increasing demand of the products due to awareness on the importance of nutritious food and new production technology shows promising market demand in near future
Vendors	
Reason for selling crops promoted in the SUNSAI	• High quality, fresh, organic, produced by familiar farmers, traditional and nutritious crops, etc. • High market demand in local as well as regional and national markets because of the positive association consumers have with the place of production as well as through the creation of new product brands
Feedback to farmers/suppliers	• Through facilitating and participating in different events like workshops, meetings, fairs, and providing samples and displaying the products.
Response from the costumers	• Local consumers are happy with the products for reasons such as good quality and nutritious values • Customers also provide feedback for the improvement of the products, grading, packaging, and maintaining the quality

Key insights from Focus Group Discussions in Nepal

Consumption behavior: The consumption pattern varies according to the location, timing and income. Most of the people eat rice, pulses, vegetables, and pickles for lunch and a dinner, however, in the high hills people mostly eat bread, vegetables, and pulses as a dinner. In some cases, people can afford more food items like meat, eggs, fish, etc. Due to cultural influences, many families have restricted food habits and don't provide meats, eggs, onion, garlic, etc because they believe the consumption will lower their status in the society. In the endline, compared to baseline, there seemed to be more awareness reflected on the knowledge regarding association between nutritious food and its influence on the boost immune system, mental health, enabling more work and reduced visit to

doctors. The qualitative data also suggests improvement in awareness of the nutritional value of local/traditional food such as millet, buckwheat, oat, proto-millet, finger-millet, etc. Similarly, due to advancement in information technology the knowledge about the importance of nutritious foods is growing. However, the consumption of junk food, particularly among children, is increasing, mainly attributed to their availability in the market as well as advertising use of flavour enhancers. The other challenges include human migration, lack of information about the nutritional value of local foods, lack of knowledge about consumption/preparation process for optimal intake of nutritional properties of food and insufficient access to market.

Production system: The production pattern of nutritious food is changing mainly due to changing livelihoods and migration. Most of the household produce cereals crops but they don't produce variety of fruits and vegetable in their land. People tend to sell their nutritious products to buy rice from the market as preferences were given to rice-based food which have been promoted by some development agencies. There was very little production of the organic foods and those who produced using conventional methods don't follow all the health protocols like waiting period after pesticides use, etc. The other challenges for production includes lack of production technology, lack of agricultural processing unit and market center, geographic condition and more reliance on snow and rainwater supply.

Gender roles in decision making: Generally, women take care of the kitchen, and decide what to eat at home mainly influenced by the requirement of different age groups, status of their health, cultural and religious events, food production etc. Household members who are involved in more physical work, pregnant women and children eat more foods. Men and women are both responsible for buying food at home, however, most of the men work outside the home so they have greater opportunities to buy food. Other members of household support the decisions made by women. The reflection on gender discrimination in food distribution was profound in both baseline and endline FGDs. Most of the households believed that boys are the assets of the family, so they are provided by more nutritious food while girls are thought to be the liabilities who leave the house after marriage, so they are prioritized less for providing dietary diversity.

Public and private institution collaboration: According to the endline FGDs, there is active colboration between coordination and cooperation between various agencies, institutions and service providers working at the local level. There is joint planning, implementation and monitoring taking place in the local level among various organizations like agriculture offices, provincial offices, education offices, schools, cooperatives, local traders, service providers, I/NGOs, government projects, etc. Projects such as Multi-stakeholder Nutrition Plan (MSNP) under National Planning Commission (NPC), SUAHARA project under USAID project, along with other related organizations such as NMA-Helvetas Nepal, UNICEF, Agriculture Sector Development Program are working to fulfill the gap of nutrition insufficiency with local government and provincial Government. However, challenges includes lack of coordination and collaboration related to planning, local level project orientation, joint investment, reducing duplication etc. For this, the participants suggested that the government sector must take a lead role with the supports from private sectors, community organizations, schools, etc.

5.6 Pakistan

Overview of nutrition situation

According to the 2020 Global Nutrition Report, Pakistan is 'on course' to meet two global nutrition targets for maternal, infant and young child nutrition. The country is also 'on course' for the exclusive breastfeeding target for infants aged 0 to 5 months. The country has made some progress towards achieving the target for wasting and stunting, for children under 5 years of age. There are policies in place to prevent an increase in overweight in children under 5 years of age. There is no progress to achieve the target of reducing anemia among women of reproductive age. In terms of diet-related non-communicable disease Pakistan has shown no progress to achieve obesity target with 11.3% of adult women living with obesity. Similarly, 12.1% of adult women are estimated to be affected with diabetes.

In mountainous region of Pakistan, malnutrition is a significant challenge. According to Brazier et al. (2020) in low-resource community such as North-west Pakistan, the mean food group diversity score was 4 ± 1. The study reveals that typical diet among women of reproductive age has a low diet diversity resulting in micronutrient deficiencies.

Consumption

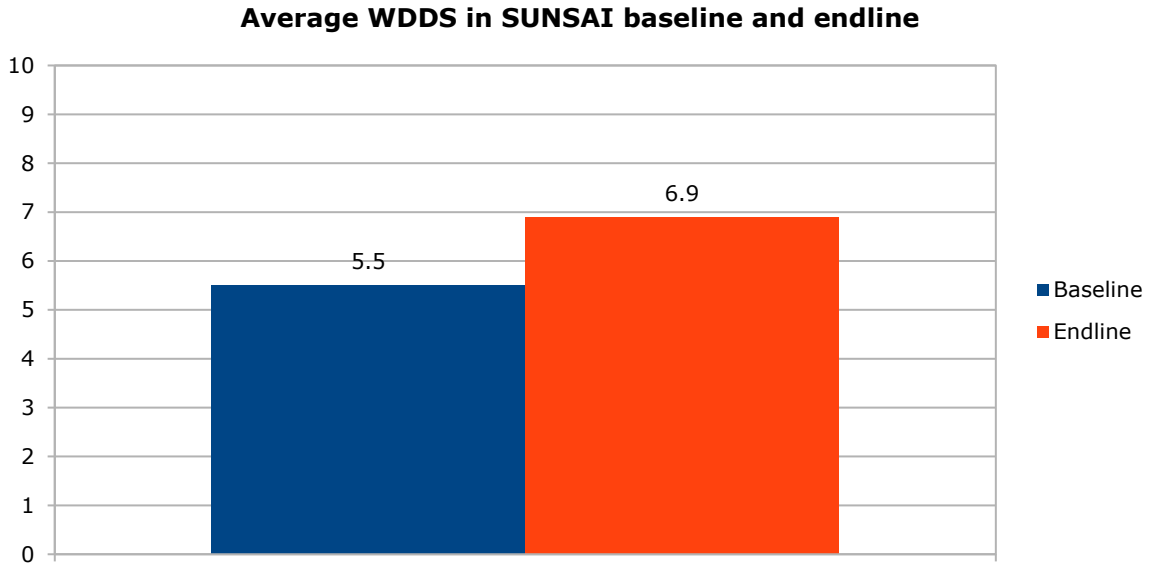

Figure 30 *Comparison of average WDDS in Pakistan SUNSAI baseline and endline*

Pakistan experienced an increase in the WDDS of +1.4 under SUNSAI intervention. The overall the average WDDS was increased significantly (P<0.05) between the baseline and endline.

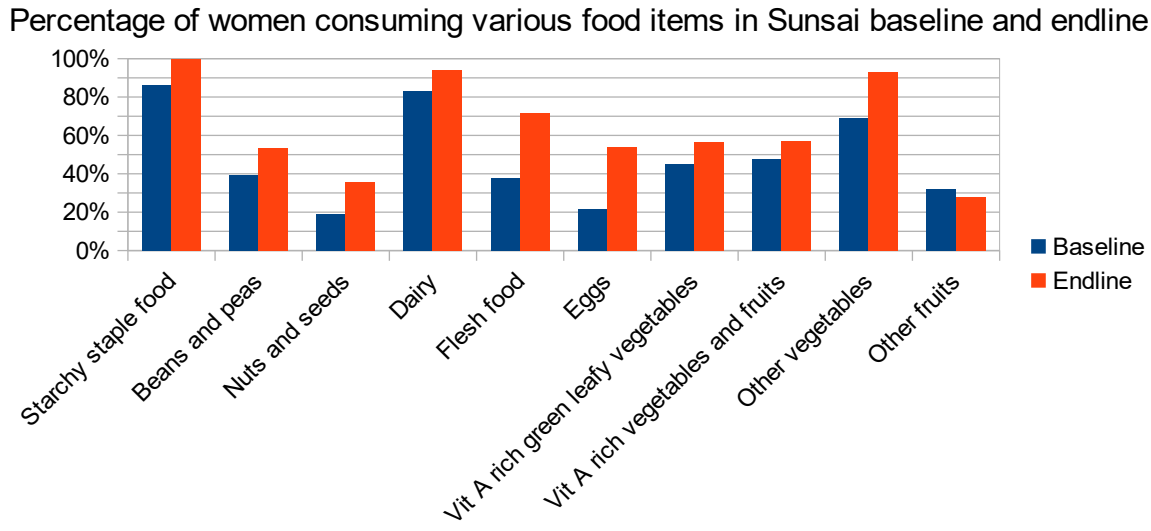

Figure 31 *Percentage of women consuming various food groups in Pakistan SUNSAI baseline and endline*

The Figure 31 shows that the average food consumption has increased in the SUNSAI intervention areas, for all food groups except for other fruits. The highest increase was in the food group eggs, that changes from 21% to 54% from baseline to endline, followed by flesh food from 37% to 71%. Consumption of all other food groups has also increased. There seems to be less variation in

consumption of food groups attributed to the seasonality factor as the baseline and endline were collected during the growing harvesting period (June 2019 and April-June 2021).

According to Haider and Zaidi (2017), people in the highest income quintile in mountainous regions spends the largest share of their food expenditure on meat in Balochistan. In Khyber Pakhtunkhwa meat has the second biggest food share. The intake in the food shares of meats and dairy products based on income in the mountainous region of Pakistan could explain the increment in the same categories of food groups under SUNSAI intervention as well. Likewise, the advocacy for changing dietary habits and increased awareness on nutritious food could have also influenced the food consumption of flesh foods and eggs.

Production

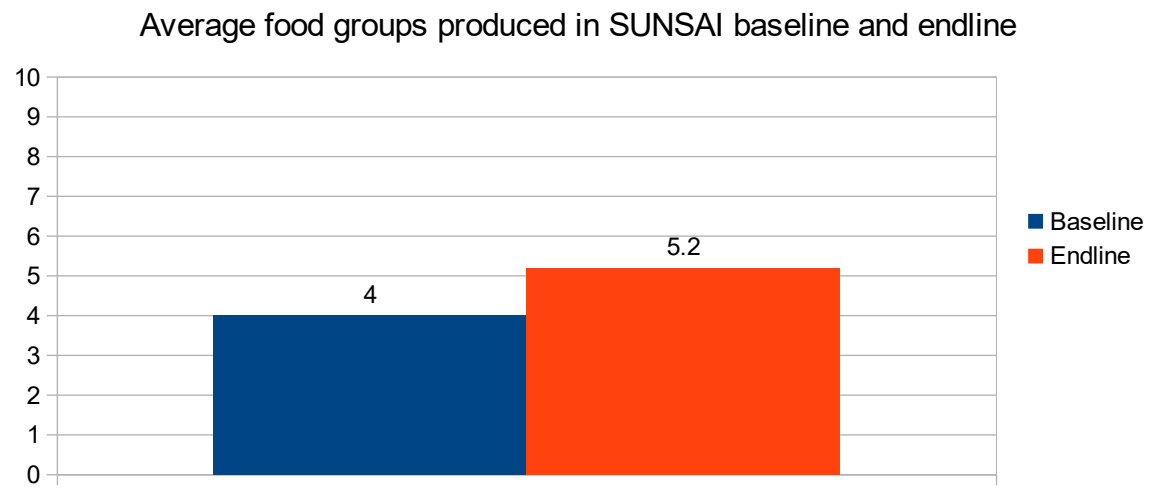

Figure 32 *Comparison of average produced food groups in Pakistan SUNSAI baseline and endline*

The average number of food groups produced by the household of the respondents increased from 4 to 5.2 at the endline. The increment in food production was significant for Pakistan ($P<0.05$).

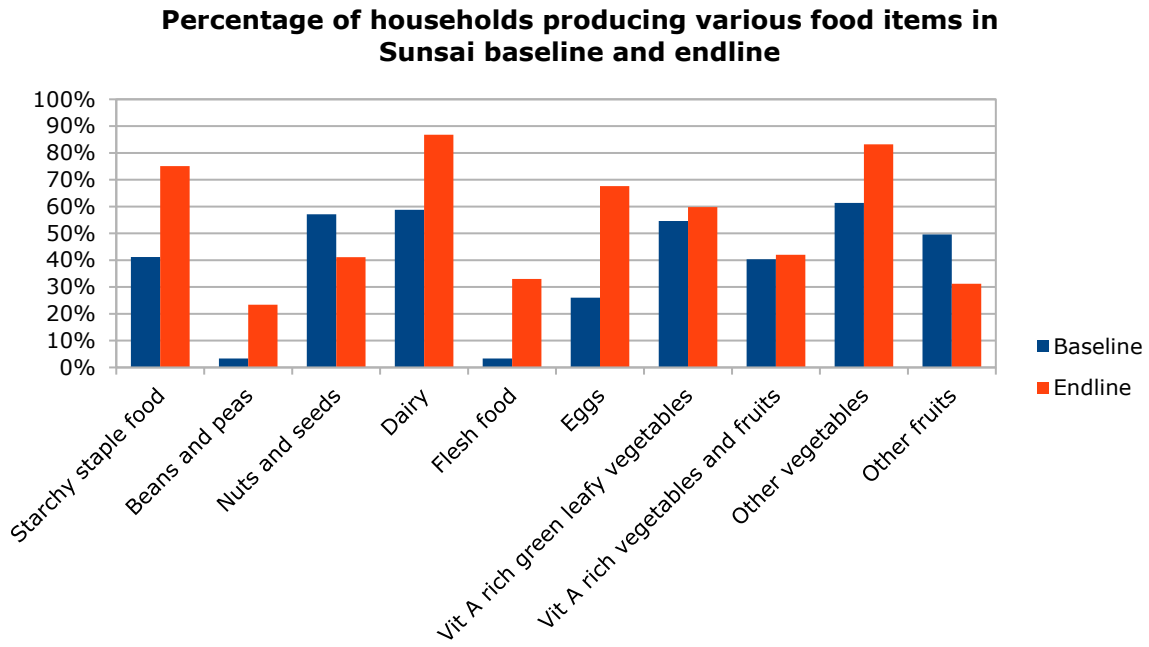

Figure 33 *Percentage of households producing each food group Pakistan SUNSAI interventions during baseline and endline*

The graph in Figure 33 compares the number of food groups produced by the households of the women respondents across SUNSAI interventions areas in Pakistan. During baseline and endline there was an increase in the average number of food groups produced by the household mainly for eggs, flesh food and dairy by 41%, 30% and 28% respectively. On the contrary there is decline in production of nuts and seeds by 16%, and other fruits by 18%.

The Government of Pakistan initiated a policy to support livestock improvement which supports private sector driven progress with public sector targeting the empowerment of livestock sector. (GoP, 2018-19). The measures seek to improve profitability of the livestock sector by improving rearing practices, checking animals for diseases and utilization of balanced diet in mountainous region such as Baluchistan. The government intervention along with active advocacy on nutritious food might explain the growth in the production as well as consumption of flesh food and eggs in the SUNSAI intervention area.

Key insights from Focus Group Discussions in Pakistan

Consumption behavior: The participants expressed that through NMA even smallholder farmers could afford to consume a diverse and balanced diet if resources are used well. They mentioned that increased understanding of the value of organic farming and nutrition sensitive agriculture influences them to grow diverse vegetables. In general, the dietary behavior of the people depends on the production, season and market purchase factors. The qualitative data suggests that for lunch vegetables produced from their gardens are consumed such as lady finger, tomatoes, eggplant, and carrots in summer season. Community members rely on locally produced wheat, maize, pulses, vegetables, home reared poultry. They grow wheat, maize, onions, garlic, tomatoes, okra, yams, turmeric, white bean, lentils and chickpeas. Nearly every household keeps livestock so the milk, butter and cream and eggs, are all fresh and nearly always in stock. Main items purchased from the market include wheat, rice, sugar, beans / pulses, vegetable oil, tea, spices, meat, and poultry. Winter is the lean season with limited supplies in the store so there is more reliance on stored fruits / dry fruits, wheat, vegetables, and meat. During the FGDs there was a consensus that the consumption of vegetables has enhanced the appetite of participants, indicating change in vegetable intake compared to baseline. There seemed to be changes in food choices after being sensitized on the impacts of vegetables intake in diets. This trend was also observed in children who consumed more junk food. However, in the mountainous regions women and children seemed to be most vulnerable and confront challenges of mobility, accessibility and malnutrition, poverty, lack of education and health related knowledge. The participants suggested several improvements including increased information and knowledge about the latest agricultural practices, increased involvement of multiple stakeholders in nutrition sensitive agriculture, and nutrition specific policies, programs, and actions.

Production system: The insights from FGDs suggested that the NMA intervention influenced how much people planted, when and how; with farmers taking more agency in these decisions. Cash crops like potato have rapidly become of the major sources of income. Factors such as natural resources with conducive environment for organic farming, traditional skills, practices, crop rotation and diversification seemed to have improved nutrition and dietary diversity. Due to interventions, participants seemed to be more aware and well trained in understanding the side effects of pesticides. The dietary behavior of the people seemed to have changed as participants value food they produce and consume. People have been trained throughout the project in utilizing organic farming increasing interest especially in kitchen gardening. However, the food productivity is not optimal due to small land holdings and other agriculture problems like scarcity of irrigated water, poverty, illiteracy, lack of awareness of nutritious food production and nutrition sensitive agriculture practices. In winter the situation worsens as roads get blocked due to snow and landslides which discontinues the supplies to markets. Similarly, there prevalence of human-wildlife conflict such as wild boars that eat/ruin crops especially maize seems to be a major challenge. Likewise, similar to baseline findings, reliance on seeds and products such as wheat, poultry from other provinces seemed to have reduced dependency on own production and increased exposure to low quality, unhealthy food. Participants suggested a number of potential solutions including promotion of organic farming systems, utilization of natural resources, provision of inputs for organic farming / NSA practices and increasing demand of fresh vegetables and fruits by promoting commercial production practices.

Gender roles in decision making: From the participant's insights gender role seemed to be predefined traditionally. Culturally, male dominate decision making, but in some families, there seemed to be more gender equality in general decision making. Buying food is mainly done by the male members of the household. Female household heads are responsible for preparing the food. Female members also seemed to be responsible for feeding and taking care of the children. Regarding food choices, the whole family eats the same meal, but male members are prioritized with the best parts of the meal. Both men and women are active throughout the cropping season following the norms and values with farming. Women are an integral part of the farming system and their involvement in kitchen gardening activities has further added to their roles and responsibilities in the agriculture cycle.

Public and private institution collaboration: During the baseline, participants expressed that there was low collaboration between organization and service providers to improve agriculture diversification and farming practices. Towards the endline, situation appeared to have improved as participants expressed that NMA project arranged a wide platform to sensitize the people in nutrition, change dietary habits and fight against malnutrition. Local staff of health, education and agriculture department were engaged to stimulate a joint collective mechanism for NSA. Although there were a number of organizations working for decades, Helvetas through NMA engaged the local RSPs and farming communities through trainings, exposure visits, linkages with RSPs, livestock and horticulture experts, government departments, local and national market and value chain players played a vital role in behavioral change strategies. NMA engaged Agriculture department and the Karakoram International University in the CDP program and helped establishing linkages and trust with the farming communities especially the females in the district. Engagement with families by targeting female community members was successful. Through agriculture departments, effective collaborations were established with health and nutrition departments. Besides, a number of private sector stakeholders were also involved with farmers especially for apricot production and marketing. Aga Khan Foundation funded Mountain Area Research Centre could also have a key role to play to help improve current farming practices, help in diversification of the existing crops, and promote importance of maintaining a balanced diet. Other local organizations played vital role in ensuring collaboration amongst the local government and non-governmental stakeholders. Besides, wildlife and forest departments, local organizations, activists, progressive farmers, and local government representatives seemed to collaborate and respond. To improve current farming practices and diversify the existing agriculture cycle improved collaboration between vocal service providers, relevant government departments, local NGOs and donor funded projects focusing on agriculture diversification should be sustained.

COVID-19 impact: Although the process is still new and will take time to benefit the participants, some transformations related to dietary diversity and NSA were observed. COVID-19 pandemic lockdowns had a negative impact on the overall progress, yet from the FGDs insights it seemed that this contributed to the understanding and realization on the importance of nutritious food and balanced diets.

5.7 Peru

Overview of nutrition situation

According to the 2020 Global Nutrition Report, Peru is 'on course' to meet three global nutrition targets. There has been some progress in achieving the target of reducing anemia among women of reproductive age. The country is also 'on course' to meet the target for stunting, for children under 5 years of age. No progress has been made towards achieving targets on low birth weight and breastfeeding. The country has shown limited progress in achieving targets related to non-communicable disease (NCD). with an estimated 24.2% of women aged 18 years and over women live with obesity and 8.1% of adult women suffering from diabetes.

In the context of WDDS, Peru scores higher compared to other project countries under NMA II as well as in Latin American countries. According to Gomez et al., 2020 Peru has one of the highest Minimum Dietary Diversity for Women of 4.82 ± 1.12 among the women of childbearing age. Likewise, Peru also

scores higher DDS among normal-weight and under-weighted women from the high socio-economic status. Although, none of the country in the region consume foods from all groups, the higher WDDS score in Peru indicates highest percentage of women with a diverse diet in Latin America with an enhanced probability of adequate micronutrient consumption. The following section presents an overview of the dietary intake of women of reproductive age for SUNSAI baseline-endline Analysis.

Consumption

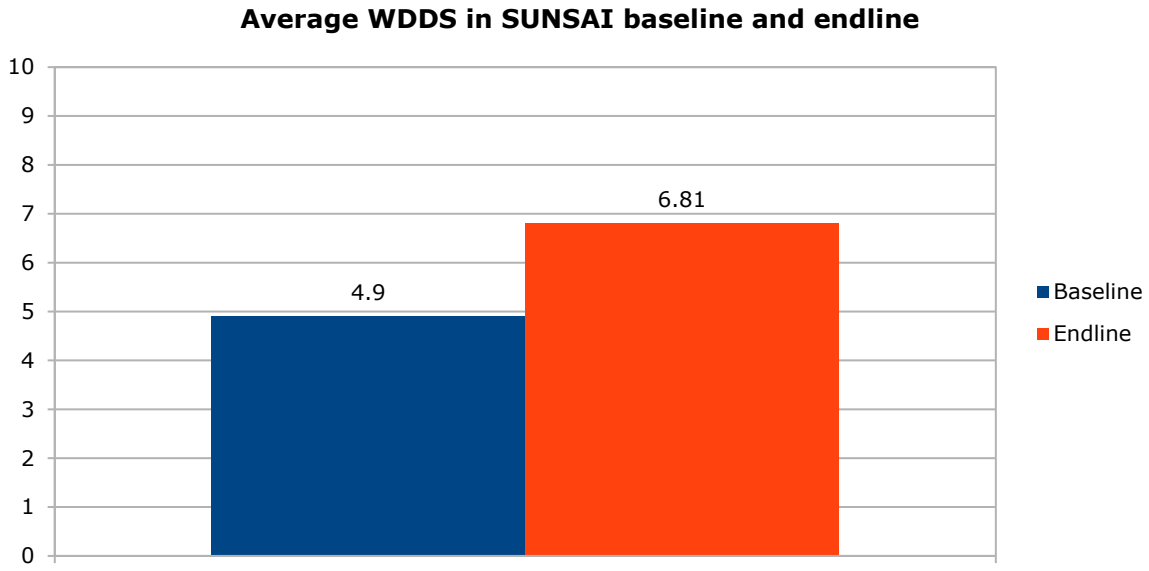

Figure 34 *Comparison of average WDDS in Peru SUNSAI baseline and endline*

Peru has achieved an overall increase in food consumption within SUNSAI intervention, where WDSS increased from 4.9 in baseline to 6.81 in endline. The average WDDS score for endline in Peru increased significantly as compared to the baseline (P<0.05).

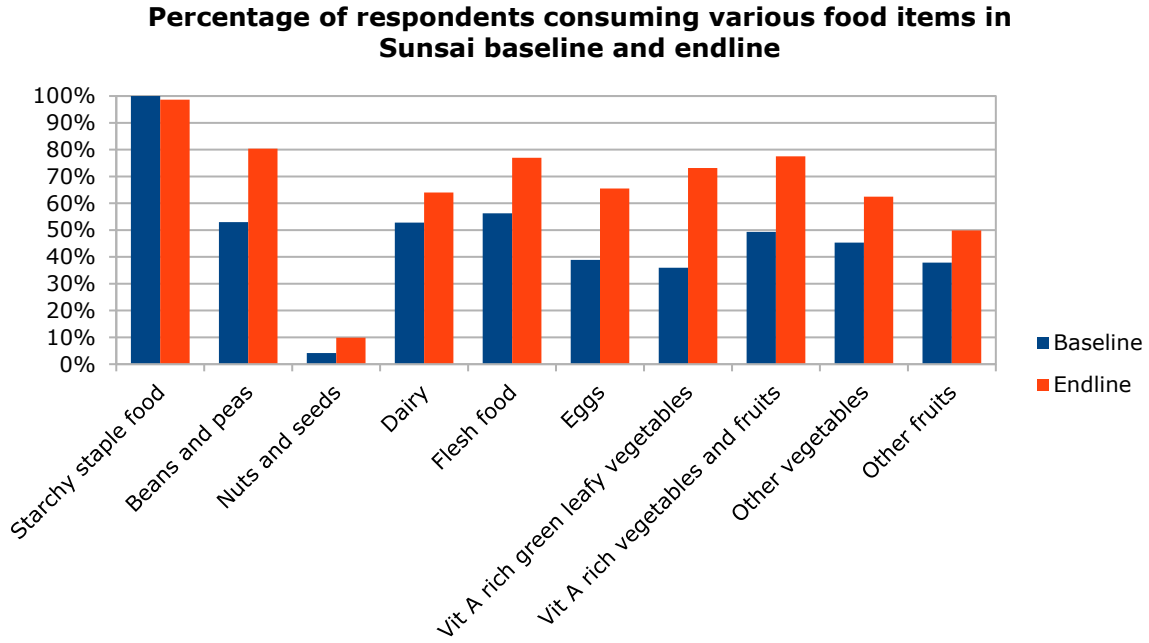

Figure 35 *Percentage of women consuming various food groups in Peru SUNSAI baseline and endline*

As seen in the Figure 35 there is diverse consumption of food groups in Peru. In everyday life, there is significant consumption of beans and peas, vegetables, fruits indicating fulfillment in consumption of micronutrients. The seasonality factor seems to be less influential since both baseline and endline were collected during harvesting on May- 2019 and May-April 2021. However, the percentage of women flesh food and eggs increase from 56% to 76% and 39% to 65% respectively as they could understand the importance of protein enriched food to strengthen immunity system to prevent from Covid-19 pandemic.

Production

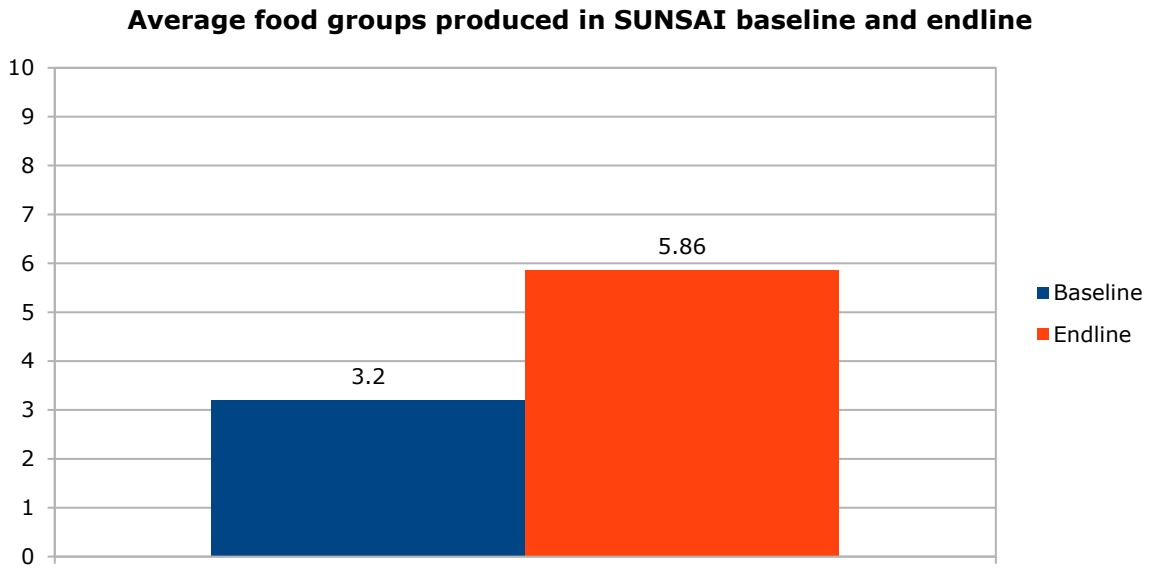

Figure 36 *Comparison of average produced food groups in Peru SUNSAI baseline and endline*

For the endline data, the average number of food groups produced by households was also analyzed. According to the graph, in Peru SUNSAI there has been an increase in the average produced food groups from 3.2 in baseline to 5.86 in the endline. Overall, the average number of food groups produced in Peru increased significantly ($P<0.05$).

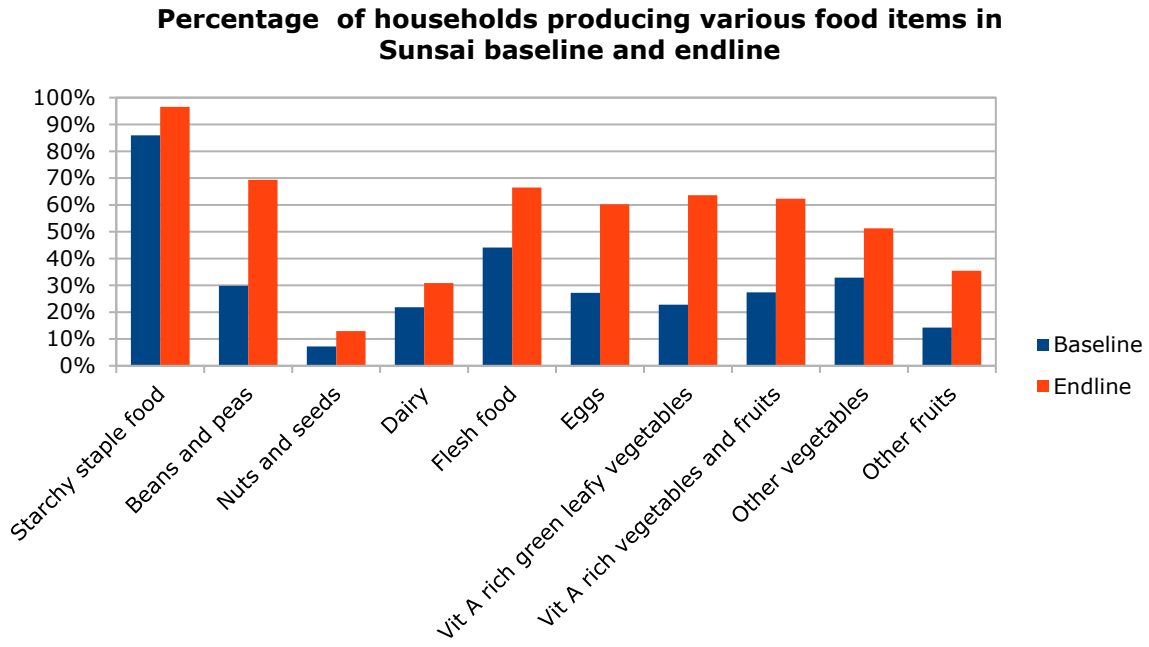

Figure 37 *Percentage households producing each food group Peru SUNSAI interventions during baseline and endline*

According to the analysis of the average number of food groups produced by households of the women respondents, there has been increased in the average food produced under every food groups. There has been the significant increase in percentage of production under Vit A rich green leafy vegetables the production of which increased 41% between baseline and endline, followed by egg, beans and peas production. The increase of the percentage of food groups can be attributed to the use of organic fertilizers and promotion of diversified production with agroecological practices. Likewise, the increased rate of returnees, mostly youth who involved themselves in agriculture labor could have increase the production rate of all food groups in Peru.

Market survey

The table below contains the information about the market survey in Peru after the SUNSAI were completed.

Farmers	
Choice of crop promoted in the SUNSAI	Guinea pigs, carrots, lettuce, raddish, eggs, strawberry, chards, potatoes, quinoa, beans, wheat etc. because they are profitable, easy to grow, nutritious and is a good source of income
Approaches used to introduce new products	• Promotion through social networks, some fairs have their fan pages in social media • Means of a perifoneo (loudspeaker) and the delivery of solidarity baskets at the fair. • Other sources such as flyer, tv and radio
Challenges	• Remoteness of the community resulting in high operative costs and customers remaining unaware of products • Risk of infection by COVID-19 pandemic in the cities or at fairs due to crowd instead local market is preferred • Implementation of the participatory guaranteed system (locally focused quality assurance systems), which is initiated in some agroecological fairs after the SUNSAI project
Market sell	• Allocation of quantity for self-consumption and prices for sales varies per family • Some farmers charge higher prices because they are agroecological, natural and the pandemic fluctuated the prices • Some places have local and national companies and collectors who sell the product to national and international markets.
Additional income generated	• In some places the total collection in volume for white quinoa is 943688 kg resulting in total sales of 5,748,497.78 sol (1400 USD) in 2020
Availability of the product after project ends	The market demand is high for the products such as fruits and fish are undergoing good profits, if continued availability can be sustained
Vendors	
Reason for selling crops promoted in the SUNSAI	• Agroecological products and their varieties. • Good control of safety guidelines to control Covid-19 pandemic during fairs • The products are cheap and there is no middleman to sell them • Products are free of chemicals and pesticides. and therefore healthy
Feedback to farmers/suppliers	• Product sales can be improved by providing more convenience, vending sales and by promoting it. • Guarantee the supply of products and to sustain the price of these agroecological products
Response from the costumers	• Satisfied with their purchases because they consider the products to be natural, organic, fresh and of high quality.
Intermediaries	
Promotion of new crops/products from the farmers	• Products presented in new way to indicate that the products they offer are organic • Provide sample so that they can sell in an efficient way.

Key insights from Focus Group Discussions in Peru

Consumption behaviour: In the baseline, most of the families consume commodities which are produced locally such as potatoes, olluco, tarhui, quinoa, fava beans, peas, wheat supplemented with external products such as rice, eggs, sugar, noodles, flour, oils and salt. Factors influencing food consumption included lack of economic resources and lack of knowledge about the nutritional properties of foods in the diet. There was also limited knowledge about food diversification and the importance of a balanced diet. From the endline FDGs, the participants expressed that there has been increase in consumption of more vegetables and diverse food diets such as torrejas, omelets, sautéed foods, salads instead of carbohydrate-containing foods associated with increased knowledge related to nutritious diets. The participants were also positive about food consumed under agroecological production.

Production system: According to the baseline information, the availability of food depended on the climatic conditions. The preparation of food was only for eliminating hunger and the households focused on easy production method by using chemical inputs. There was a lack of knowledge about nutritional value of food, although the participants understood the importance of healthy diet for normal growth and development, especially for children. Towards the endline, there was transformation in the food production. There was an increase in use of organic fertilizers for healthy production associated with increase knowledge about nutrition. There was also an increase in rural agriculture labor and activities due to returnees to the communities. The involvement of young people in agriculture increased the perceived value of food production and self-reliance. The reinvestment of sales revenue for production went into education, purchase of equipment such as laptops, cell phones, payment of internet service), food and health.

Gender roles in decision making: Compared to other countries, the household decision making was more balanced in Peru. According to the comparison of the baseline with the endline FGDs, decisions on issues related to purchase, consumption or production were made by couples together, with improved communication between couples leading to better decisions for the household. This was more prominent in young couple where men also contributed to taking care of children. In the endline, the insights also showed there was increase in women participating in the agroecological affairs indicated more economic autonomy and allowed them to decide on these resources for family support. However, in traditional families the work that requires more effort is still done by the husband, such as agricultural activities, but with the support of wife, and in the home, the activities are done more by her, but also with the support of her spouse.

Public and private institution collaboration: Interpretation of the baseline and endline reflect that there is a need for more collaboration between the public and private sectors to promote campaigns and actions in favor of health and nutrition. There are Health center, schools, Qaly Warma to train how to feed children, JUNTOS (*Together* for *Peru*) Program for education and health needs for children by proving financial support and SICRA for garden production of healthy food. But the participants expressed that the alliance between public and private institutions needs to be strengthened. The participants also expressed that theoretical and practical training on the use, and balancing of food obtained from local production could assist them gain more increase understanding on the importance of nutrition sensitive agriculture.

COVID-19 impact: From the interpretation of endline data, it can be observed that the COVID-19 pandemic increased the importance of nutritional diets and nutrition-sensitive agriculture to remain heathy and safeguard against the virus. The participants expressed that they chose to diversify the production to improve the nutritional properties of food, in particular protein, to strengthen the body's defences to cope with the Covid pandemic. The production diversification was also aimed to manage food accessibility due to quarantine rules and other restrictions.

Baseline and endline analysis of each SUNSAI interventions

In addition to the baseline and endline analysis of the overall SUNSAI intervention in Peru this report also includes the analysis of individual SUNSAI categories (Appendix 3).

6 Baseline-endline comparison by country MI

6.1 Ecuador

Consumption

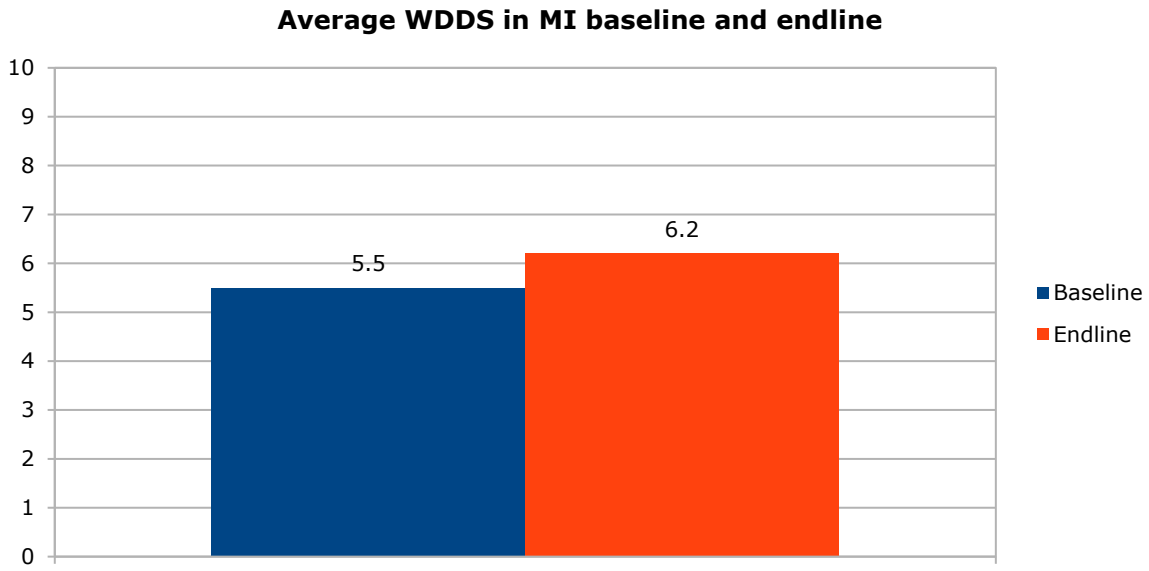

Figure 38 *Comparison of average WDDS in Ecuador MI baseline and endline*

Overall, in Ecuador, the average WDDS under MI increased by +0.7 in the endline, a significant increased from baseline to endline (P<0.05).

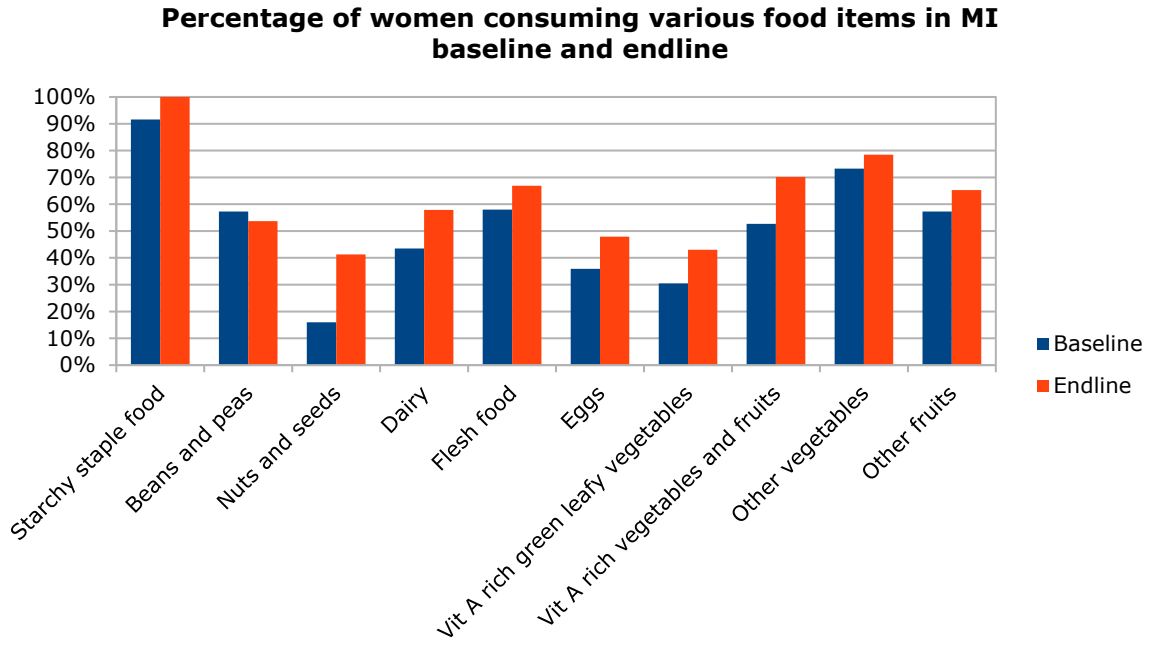

Figure 39 *Percentage of women consuming various food groups in Ecuador MI baseline and endline*

As can be seen in Figure 39, and evident in the focus group discussions, diets in Ecuador are based on starchy foods, mainly rice, potatoes, and cereals with the addition of vegetables based on seasonality. The consumption of other food groups including dairy, flesh food and eggs reflect a slight increase in the consumption of the animal's products, suggesting growing importance of dietary diversity compared to baseline. Vegetable availability is highly seasonal. The endline was collected during May-July 2021 comprising of mostly of harvesting season, hence more availability of food. The highest increase of consumption is under nuts and seeds with an increment of 25%, suggesting that the availability is better throughout the year.

Production

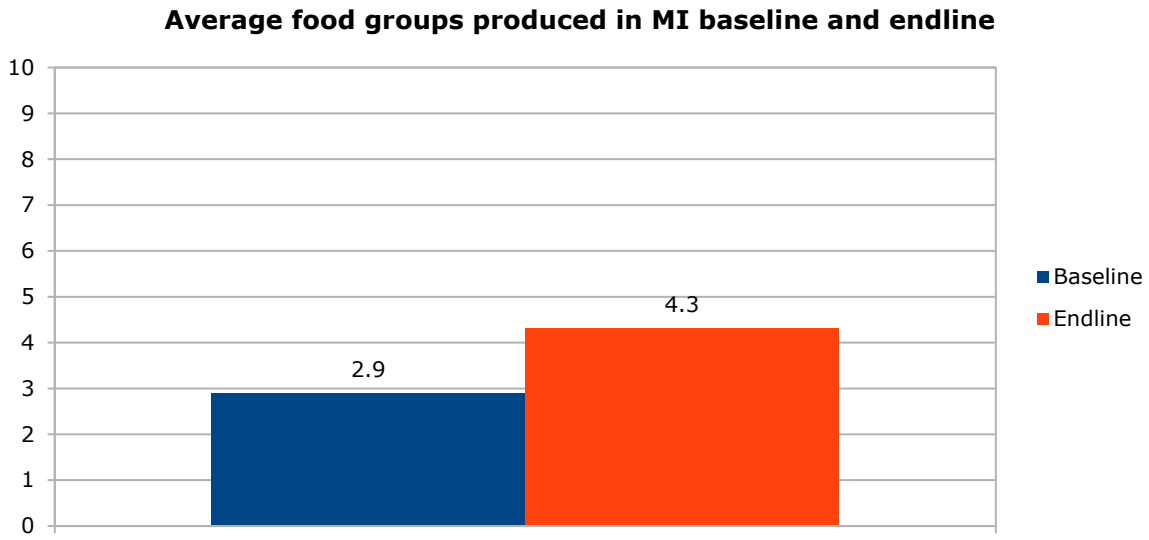

Figure 40 *Comparison of average produced food groups in Ecuador MI baseline and endline*

The average number of food groups produced by households participating in MI was also analyzed for the endline data. Overall, the average number of food groups produced in Ecuador increased significantly ($P<0.05$) from 2.9 at baseline to 4.3 during endline.

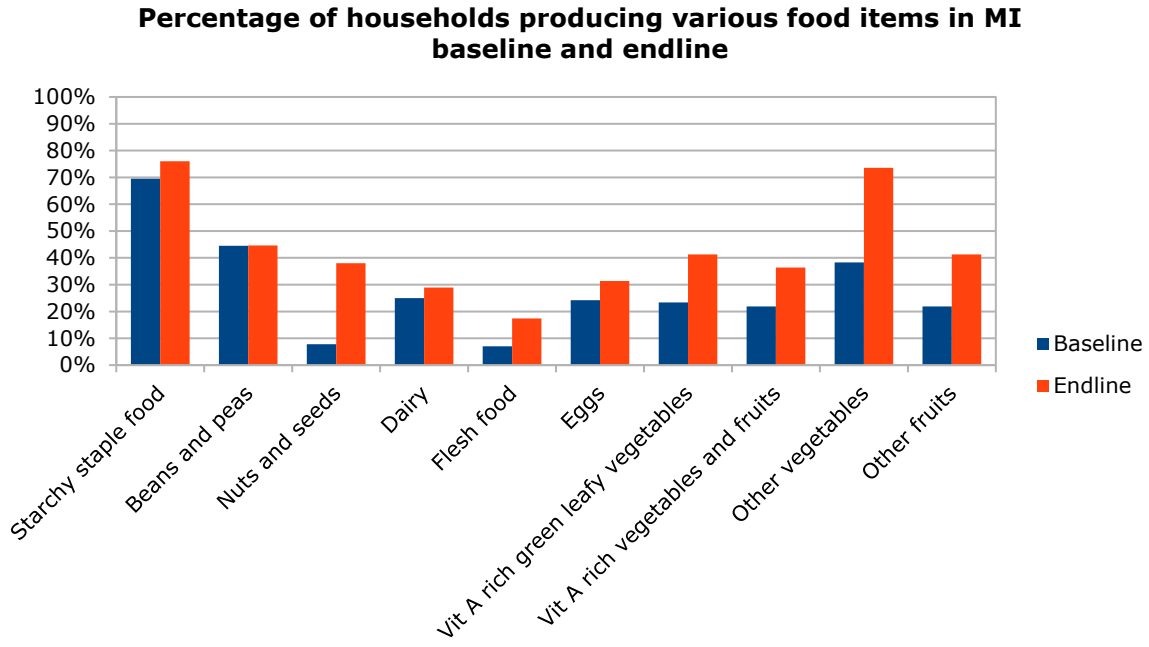

Figure 41 *Percentage households producing each food group Ecuador MI interventions during baseline and endline*

The Figure 41 shows that the average number of food groups produced during baseline and endline across the MI intervention areas in Ecuador varies. While starchy foods are consumed by almost everyone, not all households are engaged in their production. Many households produce other vegetables (73%), reflecting the tendency to grow vegetables based on the seasonality. The lower percentage of food production by the household, compared to the consumption patter suggests that most foods are bought from market, with home production adding additional diversity in the form of seasonal vegetables.

Key insights from Focus Group Discussions in Ecuador

Consumption behaviour: The insights from FGDs reveals the community has a good understanding of the link between diet and health and there is specific food that are prioritized for adults, pregnant and lactating women and seniors. The participants expressed that a good diet is different especially for children as they need to eat more times of the day, this helps to train and grow healthier. Cereals, root crops and vegetables are important for greater nutrition as they are organically grown products. The most important crops are rice, bean, noodle, eggs, chicken and beef because they contribute to maintaining good health and adequate nutrition. Other foods considered nutritious by the groups included grains, milk, eggs, fruits and vegetables as they allow well-being for all family members are used according to the harvest season. Cereals, and root crops are also considered crucial for consumption as it avoids risky diseases, as well as allow for greater nutrition as they are organically grown products. However, the challenge is its availability throughout the year. The other challenges include lack of diverse crops, production and low consumption of traditional foods, consumption of junk products and poor hygiene habits contributing to gastritis, stomach infections, anemia and overweight in children. During the endline, participants expressed that hand washing is frequently practiced during food preparation, cleanliness of kitchen, separation of animal space and there organic and inorganic waste garbage to ensure sanitation.

Production system: There are different agricultural crops produced by the households, among the main ones are cereals, beans, potato, tomato, avocado, apple, peach, mandarin etc. The production of food varies greatly based on the seasonality. For example, radish, beet, onion, broccoli, turnip, celery, parsley, cauliflower, broccoli are grown all year around. Whereas Corn, beans, peas and beans are mostly grown from September to June. The households also engage in animal husbandry such as sheep, hen, guinea pigs, goats etc. The main animal production is done through traditional and cultural management for the purpose of obtaining income to cover the basic needs of the family during the year. The production and seasonality of animals depends on the decision of each family for sale or self-consumption according to different months or times of the year. The main cash crops are chicken, vegetables, grains, peas, barley, avocado etc. The greatest difficulty identified are the lack of irrigation and the intense winters.

Gender roles in decision making: The FGDs suggested that the men are engaged in agriculture and labor jobs outside the home and make decisions on agricultural inputs, housing, education. Whereas women are engaged in selling products and buying food. They make decisions about food, clothing, basic services, as well as nutrition in for the household. The priorities of both the gender in the home are education, clothing, basic services, agricultural supplies and nutrition.

Public and private institution collaboration: In Ecuador, there are different organization collaborating to promote dietary diversity. Organization such as Heifer Ecuador support in training in Agroecological management, production of bio inputs, management of vegetable seeds, organizational skills, knowledge in nutrition and food groups, food handling, recipes within the NMA project. The municipality contributed to support in the loan of space for the producer fair and allowed more associative knowledge related to daily sales within organic agriculture for increased income. The training was provided by the provincial government to implement a fruit plantation project with drip irrigation, supported by the provincial government. Other activities included development of awareness of healthy eating nutrition, training and implementation of a project of fruit plantations with irrigation systems, promotion of local inputs for planting, as well as facilitating access to spaces for the commercialization of surpluses etc.

6.2 Ethiopia

Consumption

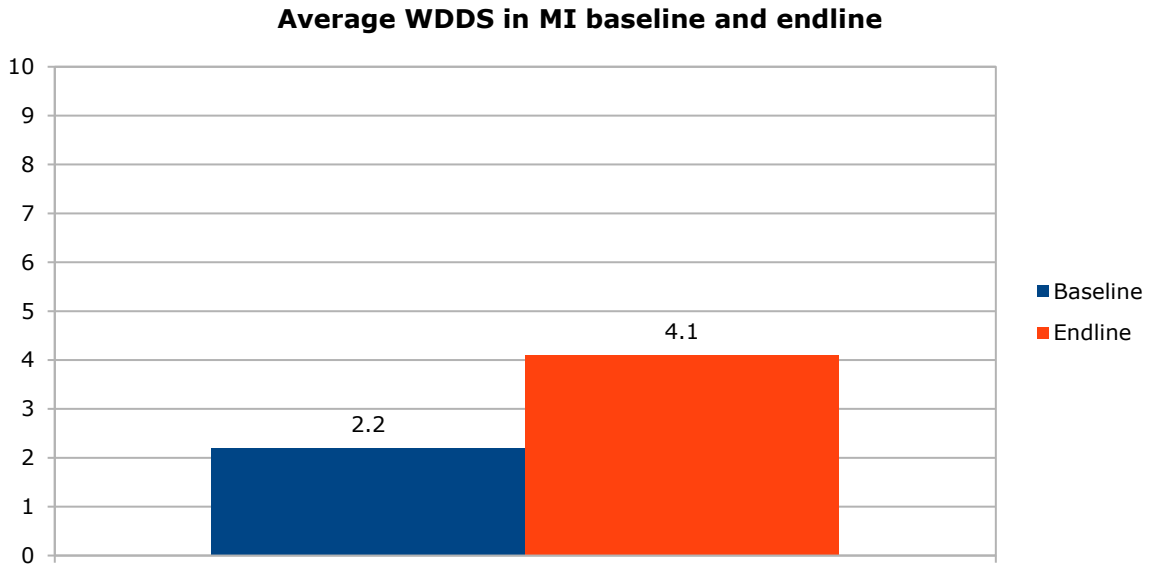

Figure 42 *Comparison of average WDDS in Ethiopia MI baseline and endline*

The graph in Figure 42 presents a comparison of the average WDDS score across MI intervention areas in Ethiopia during baseline and endline. The WDDS under the MI have increased by +1.9, although its lower compared to SUNSAI intervention which increase by +2.4 from baseline to endline. Overall, the increase in WDDs under MI is significant (P<0.05).

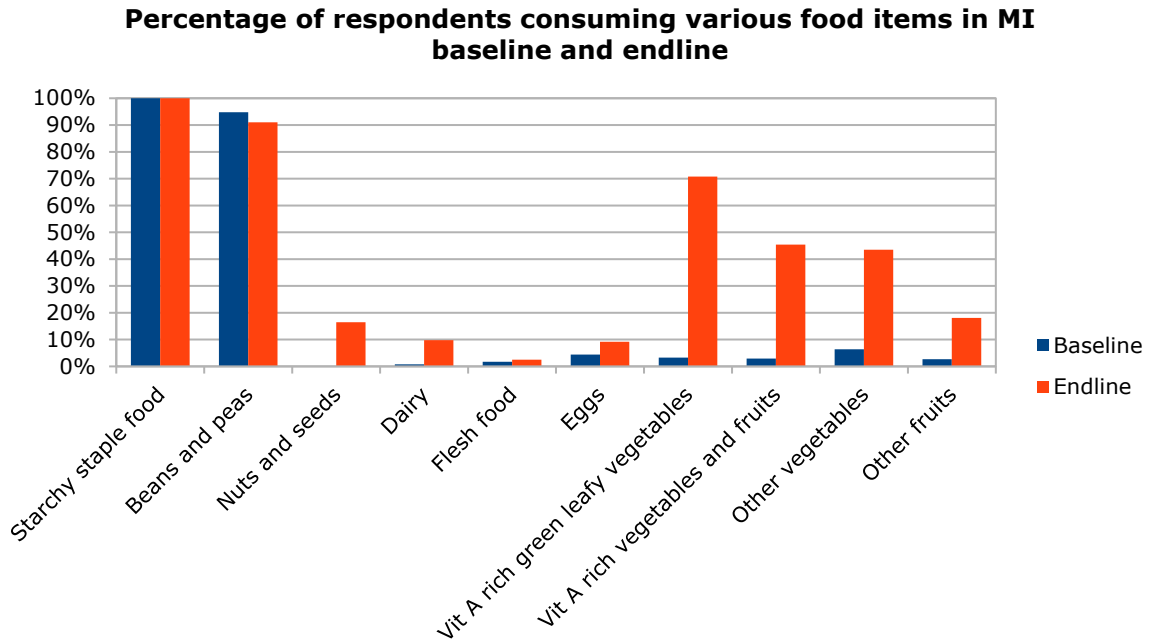

Figure 43 *Percentage of women consuming various food groups in Ethiopia MI baseline and endline*

Under the MI in Ethiopia, there seems to be variation in the consumption of the food groups. Although, the overall consumption improved from baseline to endline, consumption of specific food groups such as nuts, seeds, dairy, flesh food and eggs consumption remains low. There seem to be no difference

under starchy food, as they are the staple food. The highest increase in consumption is seen in the Vit A rich green leafy vegetables (67.5%) food group which may be explained by the fact that most of the interventions under MI focused on the awareness and increased production diversity.

Production

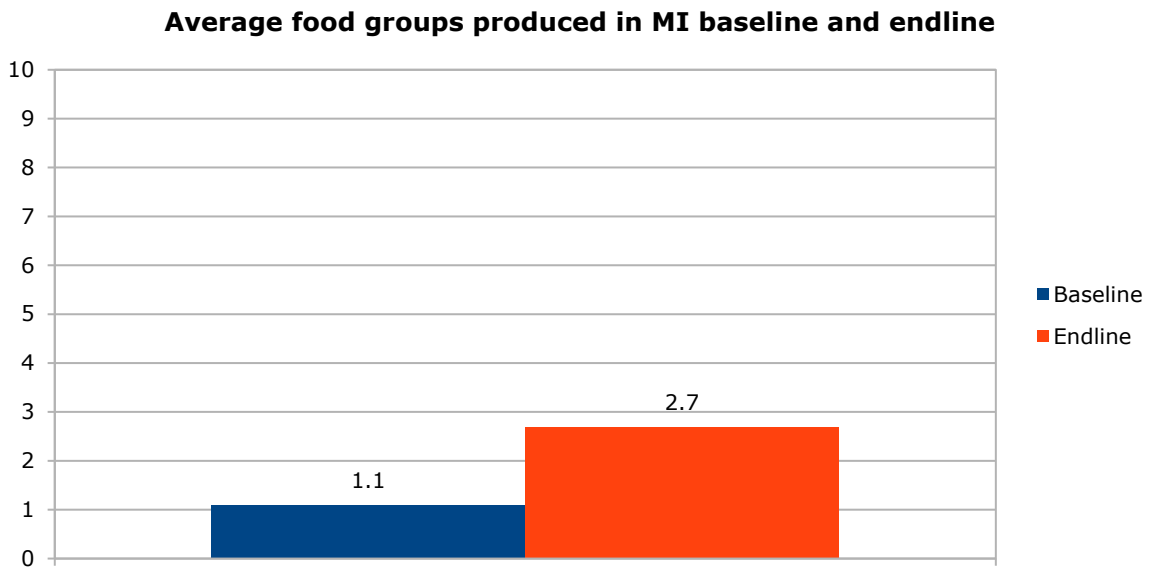

Figure 44 *Comparison of average produced food groups in Ethiopia MI baseline and endline*

Under MI, Ethiopia has the lowest score for average produced food groups in both baseline and endline. The differences between the scores at baseline compared to the endline is statistically insignificant (P>0.05).

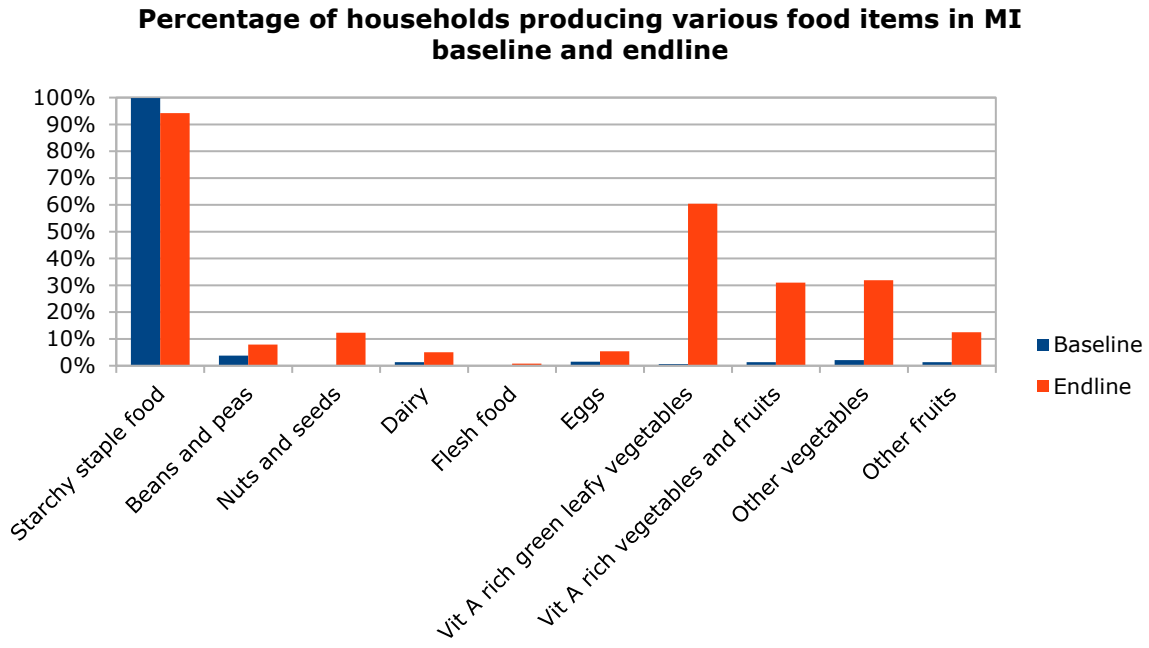

Figure 45 *Percentage households producing each food group in Ethiopia MI interventions during baseline and endline*

Similar to the consumption pattern, the production pattern among the household seems to be focused more on Vit A green leafy vegetables, Vit A rich vegetables and fruits, other vegetables and fruits. Although the baseline and endline were collected during the same season Oct/Nov 2020 and 2021, the reflections from the FGDs under SUNSAI in Ethiopia suggests that the contributing factors for low productivity and dietary diversity diet includes low incomes and trade-offs on how income is spent between household needs. The other factors include crop diseases, lack of water, land degradation, limited land size, nutrition awareness and skill gap which could have affected the impact of MI.

6.3 India

Consumption

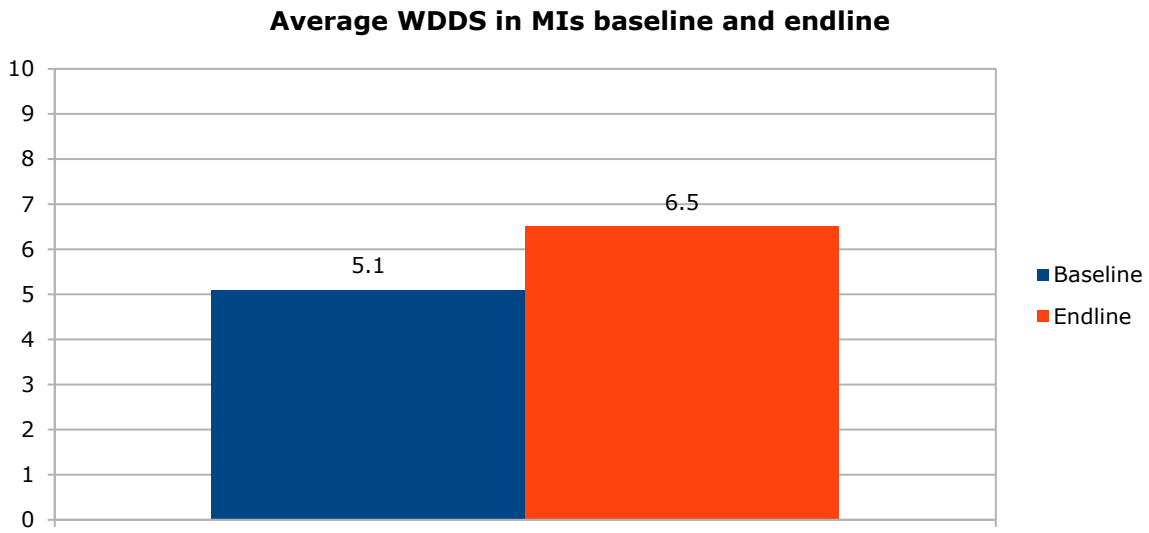

Figure 46 *Comparison of average WDDS in India MI baseline and endline*

The graph in Figure 46 presents a comparison of the average WDDS score across MI intervention areas in India during baseline (October 2019) and endline (July 2021). There was a total increment of +1.4 in the WDDs. The increase was statistically significant as $P<0.05$, although given the large variation in season when the survey was carried out, this result should be interpreted with caution.

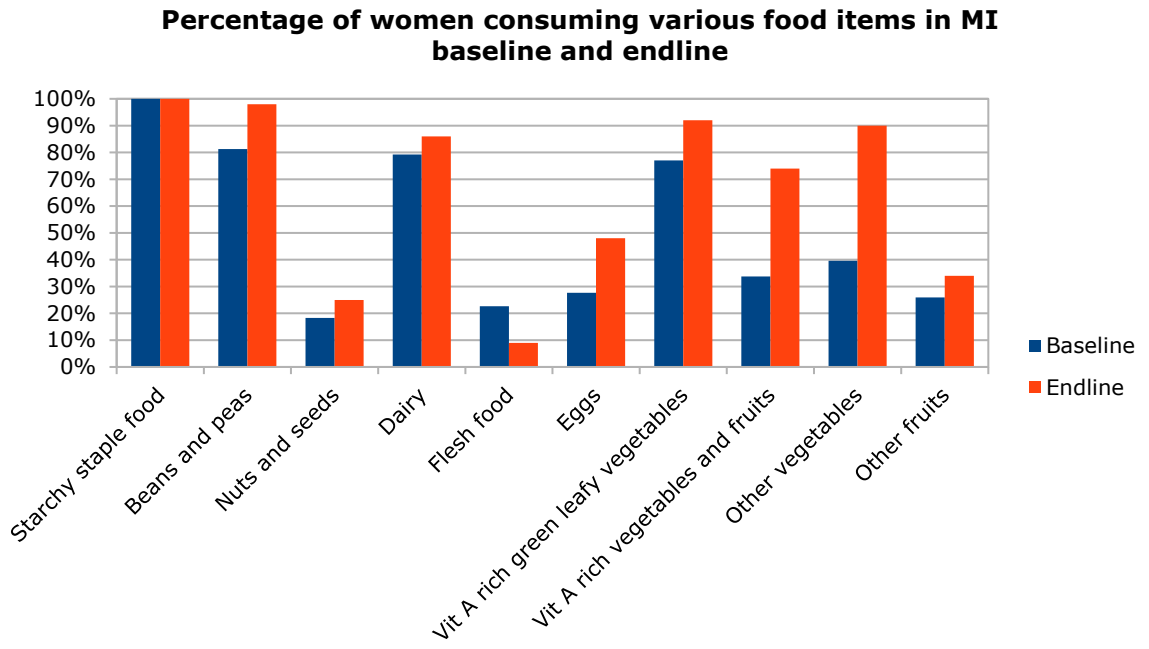

Figure 47 *Percentage of women consuming various food groups in India MI baseline and endline*

As can be seen in Figure 47, Indian diets are based on starchy staples and beans, often with the addition of vegetables when they are in season. Consumption of other food groups including flesh food, eggs, nuts, seeds and other fruits is low. The low production of the overall food groups compared to the consumption pattern indicates that most of the items are brought from the market. Vegetable availability is subject to seasonal variation and many only consume vegetables when they are in season, meaning that many women are regularly consuming a diet containing only three food groups starchy staple food, beans, peas and dairy.

Production

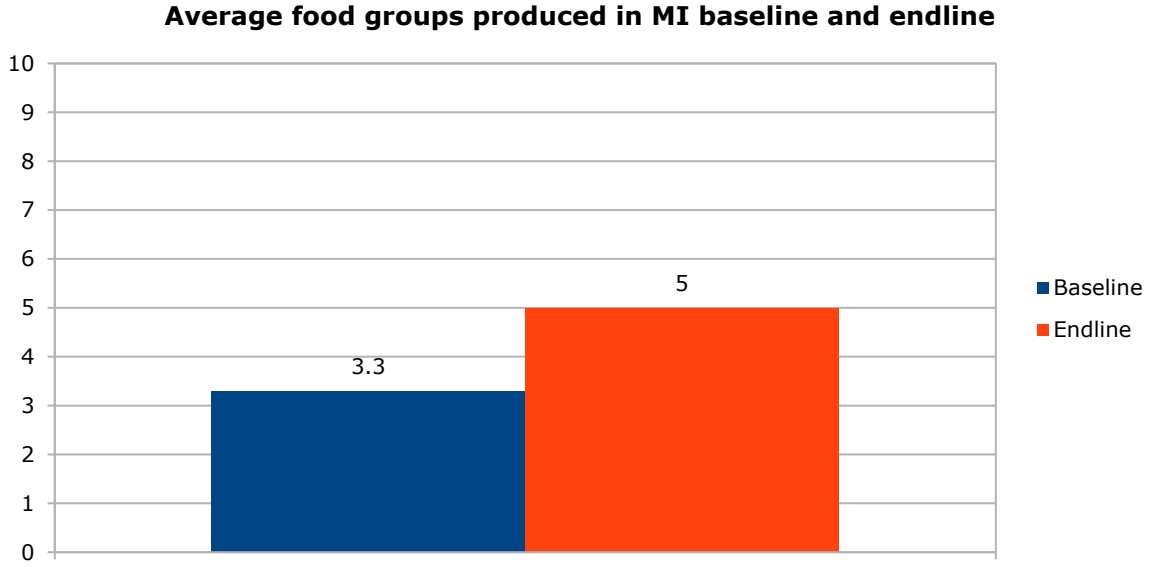

Figure 48 *Comparison of average produced food groups in India MI baseline and endline*

The average number of food groups produced by households was also analyzed for the MI during baseline and endline. In India, the average produced food groups increased from 3.3 in baseline to 5 in the endline. Overall, the average number of food groups produced in India under MI increased significantly ($P<0.05$), which may also reflect, in part, the different seasons in which the data was collected.

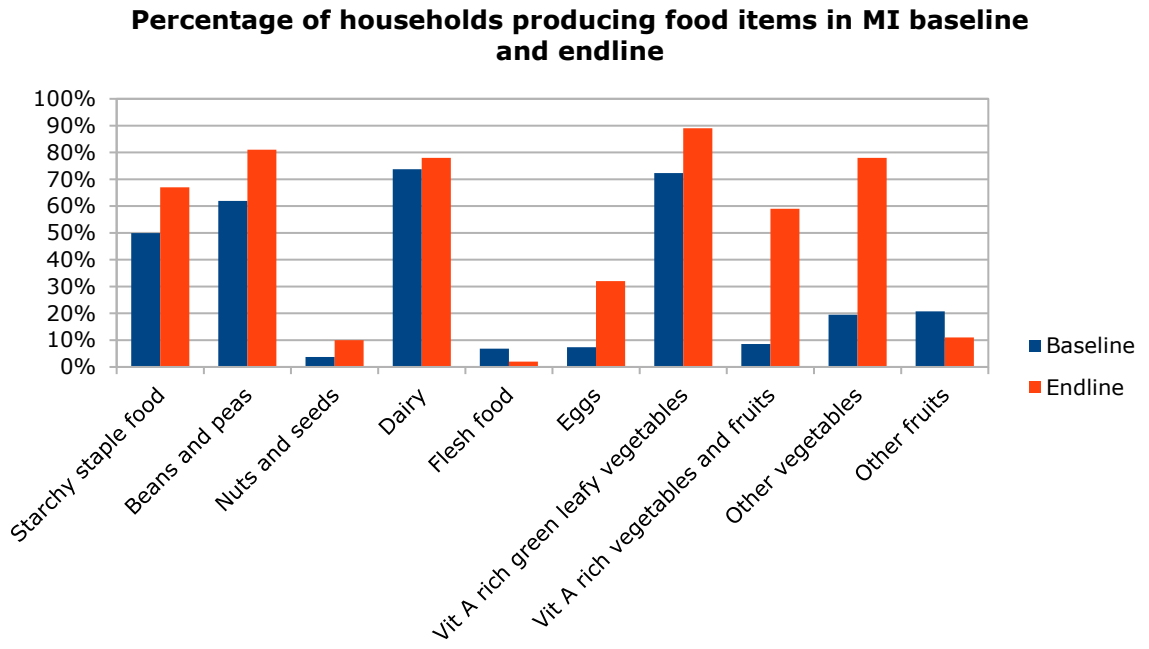

Figure 49 *Percentage households producing each food group in India MI interventions during baseline and endline*

As seen in the Figure 49, the overall production trend is lower compared to the consumption pattern. Although between baseline and endline the percentage of households producing various food groups have increased for all food groups except for other fruits and flesh food. As suggested in the FGDs under SUNSAI, the increase in Vit A rich vegetables and fruits and other vegetables could reflect the introduction of new crops to be sold at the market. Likewise, the overall production pattern could have also been affected due to the seasonality as the endline was collected in July 2021, which is sowing season and could result in low food availability.

6.4 Kyrgyzstan

Consumption

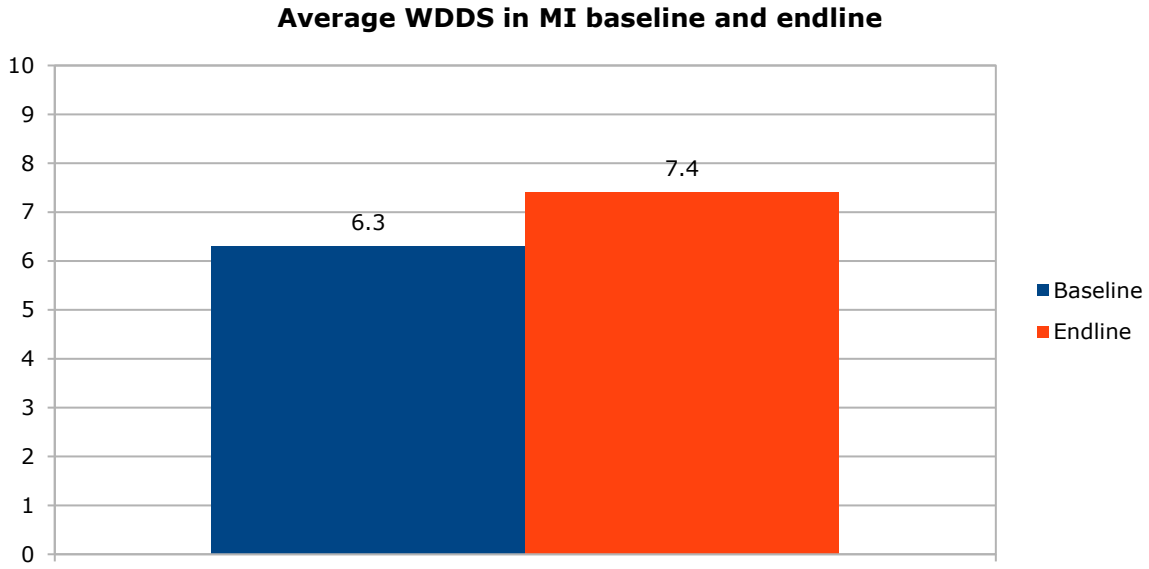

Figure 50 *Comparison of average WDDS in Kyrgyzstan MI baseline and endline*

Figure 50 show the difference in total WDDS within the MI project implementation period in Kyrgyzstan. The graph shows a trend of improvement in the dietary diversity of the women. There was an increment from 6.3 to 7.4 from baseline to endline. The increase was statistically significant as ($P<0.05$).

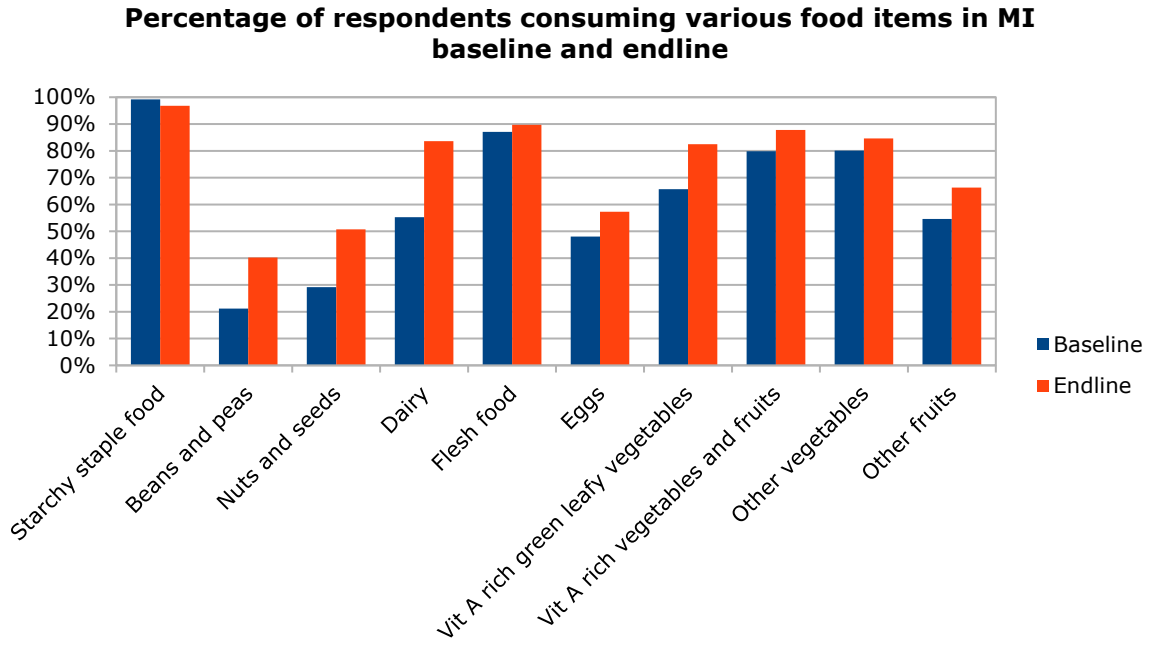

Figure 51 *Percentage of women consuming various food groups in Kyrgyzstan MI baseline and endline*

As can be seen in Figure 51, the majority of women consume at least a staple food, dairy and flesh food daily. A reasonable number also consume, fruits and vitamin A rich foods and vegetables. Nuts and seeds like bean and peas, do not seem to be a dominant part of the diet, although the consumption has increased from baseline to endline. This could be as a result diversification of diets by replacing beans with meat, as reflected in FGDs. The food group with the highest increase was dairy (28%) could be an impact of increased livestock rearing. The endline results depict that consumption of diverse food groups, which may also reflect the overall increment in production level.

Production

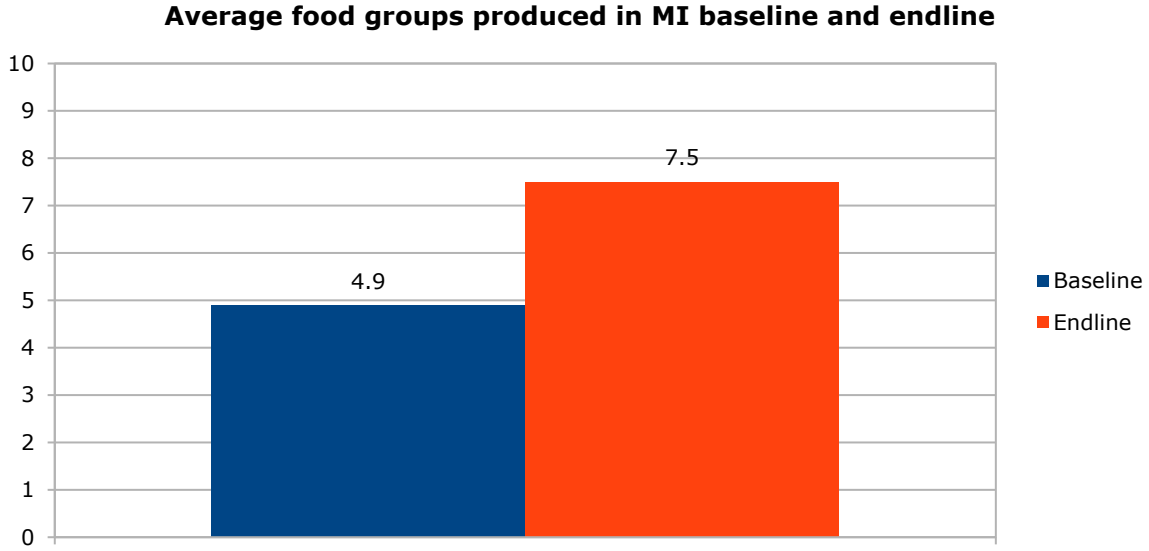

Figure 52 *Comparison of average produced food groups in Kyrgyzstan MI baseline and endline*

Compared to WDDS, the average food groups produced was higher in MI Kyrgyzstan compared to SUNSAI. There was an overall increment of +2.6. The increase was significant as P<0.05.

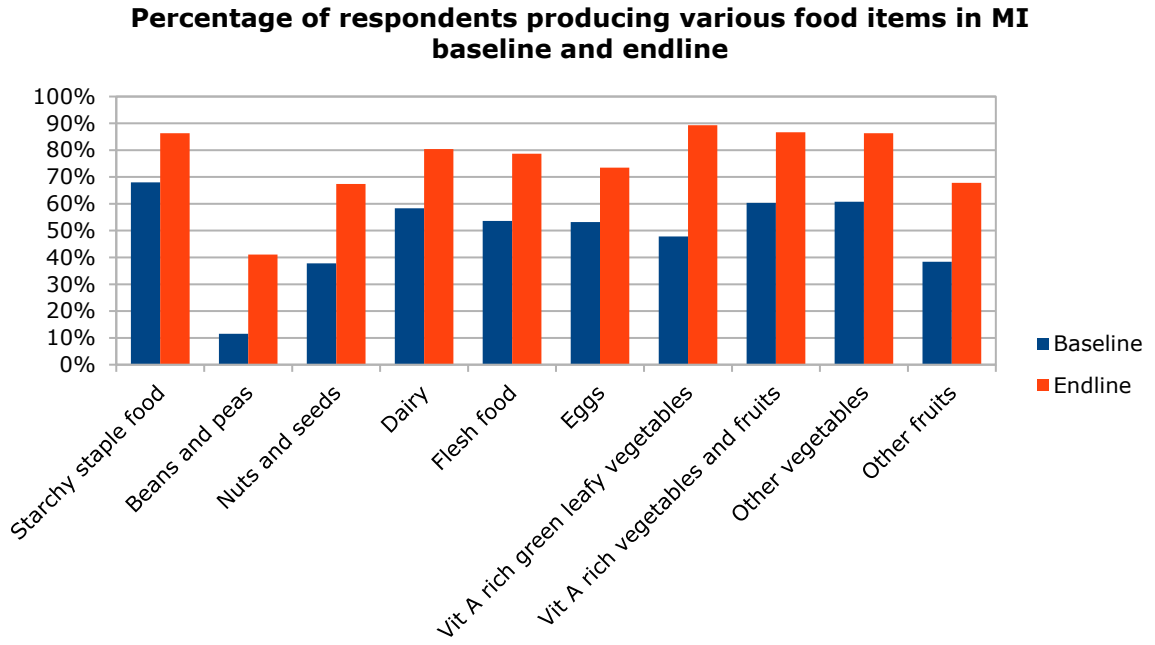

Figure 53 *Percentage households producing each food group Kyrgyzstan MI interventions during baseline and endline*

Figure 53 presents comparison between the average number of food groups produced during baseline and endline across MI intervention areas in Kyrgyzstan. There has been consistent increase in each food groups, indicating that the interaction with RSPs had influenced production of diverse food groups amongst the participating households. The FGDs also supports these findings as participants highlighted that they produce food based on the market demand and to ensure the quality of the products as well as securing additional income. The increment in Vit A rich leafy vegetables and other vegetables coincides with the qualitative data that the growth of cucumbers, cabbage, cauliflower etc. are consumed often, motivating the participants to produce themselves.

Key insights from Focus Group Discussions in Kyrgyzstan

Consumption behavior: The qualitative data suggests that after RSP meetings and trainings, people began to pay more attention to the quality and diversity of their diets, rather than merely focusing on the quantity. The participants acknowledged that it is crucial to have a varied, healthy, nutritious diet which they defined as including items such as potatoes, rice, pasta, butter, cotton oil, pomegranate, honey, soybeans, pasta, bread, sugar, mandarin, nuts, watermelon, etc. for healthy living and avoiding overweight and different diseases. This also contributes to save money that would have been wasted in buying medicines. Although, after COVID-19 pandemic, the food has become more expensive. The participants also seemed to be aware of every person's foods needs depending on age and physical conditions. Low-calorie food is preferable for the elderly, but with a balanced content of fats, carbohydrates and proteins. However, while people understand the importance of consuming a nutritious diet, income level and education level of women, determines if the food requirement of family members can be fulfilled. Even so, factors such as lack of information may mean people place a lower priority on healthy diets. The prevalence of low soil fertility, lack of irrigation water and uncontrolled cattle grazing creates challenge to maintain the quality of food. People are eating more fast food, especially the children. There is a need to provide information on the pyramid of nutrition, balanced diet, promotion of healthy eating through media, shows and workshops. Training on food production, processing and storage are also significant. Moreover, participants expressed awareness on "proper and varied diet" would be improved by training parents and schoolchildren.

Production system: The participants in the FGDs highlighted that as a result of NMA project more people are trying to grow foods in the garden stimulated by concerns over food safety as well as opportunities to expanding income opportunities and be less dependence on markets. People who have good access to land use and irrigation water are the ones to produce their own food. Participants expressed that they produce cucumbers, tomatoes, cabbage, raspberries, strawberries, wheat, grain, corn, ayran, melted butter, cheese, eggs, chicken, walnuts, seeds etc. Similarly, they sell carrots, potatoes, cucumbers, pumpkins, onions, corn, cotton, wheat, peach, plum, broccoli, mushrooms, tomato, nuts etc. The reason these products sold is because of the market demand. However, participants also mentioned a number of production related challenges including lack of irrigation water, limited knowledge of cultivation technology, poor quality of seeds, poor soil fertility, and lack of crop price forecasts.

Gender roles in decision making: The participants expressed that usually women make a list of food, and men buy them from the markets which are found mainly in villages. But there are no significant restrictions on the purchase of food between women and men. About cooking it is mainly decided by women although sometimes mothers-in-law, children and men are also involved in decisions about what will be produced. Regarding sales, it is mainly men who decide what to sell, sometimes father-in-law and women will be involved in making the decisions. Women and men tend to make decisions together, sometimes men decide, and women advise. In most families it is the men who decide. The decision for growing food in a home garden is often made by women. The money from the sales are used for clothing, food, school fees, utilities (light, gas, water), weddings, memorials, other household needs.

Public and private institution collaboration: Village Health Committees (RHCs) together with the Sanitary Epidemiological Station check the families' diets and conducts training on healthy/balanced diets more than once a year. Related to nutrition, the health care system pays attention to improving nutrition of pregnant women by providing information during pregnancy, child feeding and childcare. Within the framework of the projects, villagers are trained to produce nutritious food such as growing vegetables, keeping chickens, greenhouses, gardens, breeding of dairy goats, bees and fish. There is also a programme on state TV promoting good and balanced nutrition, which is broadcast once a week. In cooperation with donors, there are cartoons for children about good nutrition. At the district level, healthy eating activities have been initiated. Village Health Committees led meetings with households on the theme "The role of nutrition during pandemic". The district sanitary station controls the cleanliness of public spaces and sanitary requirements for children's meals in schools.

The participants mentioned there is no separate budget in the local administration for improving nutrition. The main areas of concerns that needs attention includes: Government monitoring of project implementation, training of local authorities involved in food security and nutrition programs, improving access to irrigation water, training of the population in effective water use, media coverage on healthy nutrition, logistic centers to process agricultural waste, equipping the drying shops for local nut harvesting, as well as mini-shops for processing meat and dairy products and finally support for the development of poultry farms.

COVID-19 impact: The provision of information on good nutrition and related topics were provided by rural health committees. For 2021, there was a plan to organize meetings with women of other villages, to discuss topics associated with nutrition to discuss topics associated with nutrition but because of the COVID-19 pandemic this activity was not possible. Food is more expensive after the pandemic, and there was already a concern about limited information about the quality of the food and if it was produced organically. After the pandemic the uncertainty about quality of products and limited supporting information to guarantee the quality has become an issue of concern.

6.5 Nepal

Consumption

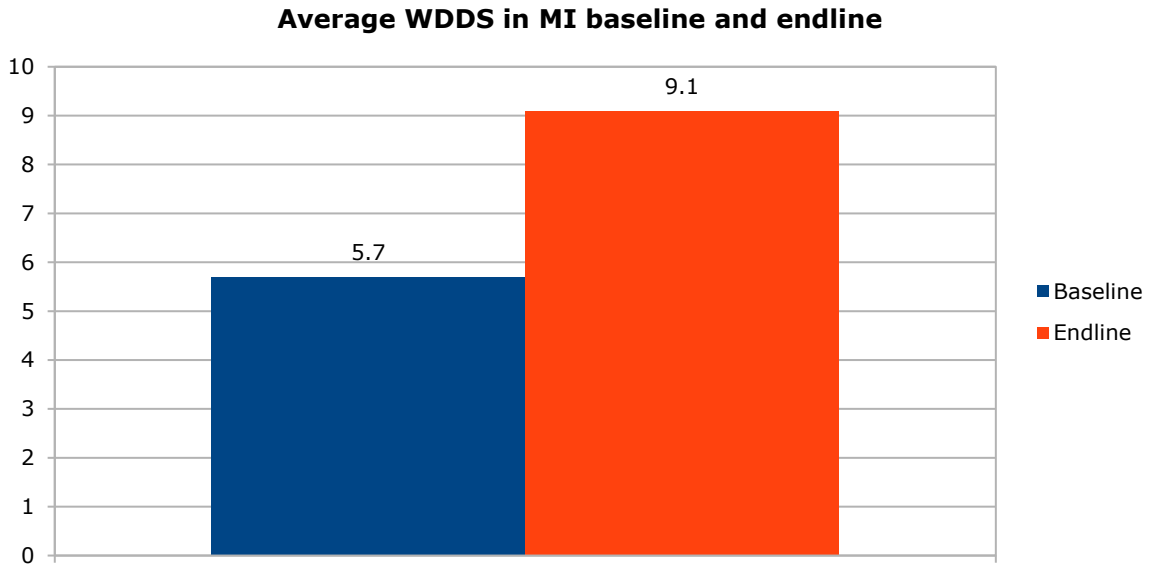

Figure 54 *Comparison of average WDDS in Nepal MI baseline and endline*

In Nepal, there has been an overall increase in the WDDS of +3.4 between baseline and endline. Compared to the SUNSAI, the increase is greater for the MI and the increase is significant as P|<0.05. The result indicates that the participants were more aware about NSA and implementing dietary diversity practices in the diet.

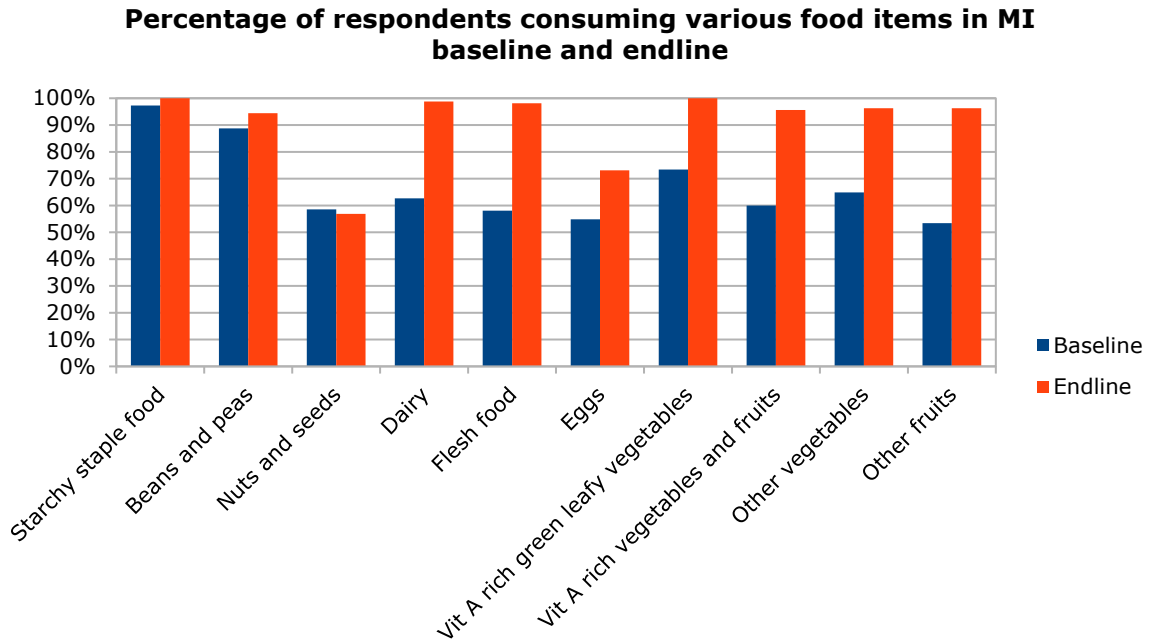

Figure 55 *Percentage of women consuming various food groups in Nepal MI baseline and endline*

Compared to baseline, there has been increase in the consumption of all food groups. The highest increase in for dairy (36%). According to the analysis, all the women participants consumed starchy staple food and Vit A rich green leafy vegetables. As reflected in the FGDs, rice is perceived as a

source of food security, and is thus regularly consumed. Interventions such as school and kitchen gardening, conservation techniques to promote indigenous crops, organic fertilizers and pesticides could have influenced the consumption of Vit A rich vegetables and fruits, other fruits and vegetables. Another explanation for the higher consumption in the endline can be attributed to seasonality. The baseline was collected during August 2019, which is generally sowing season, whereas the endline was collected during April-June 2021, which is harvesting period, hence more availability.

Production

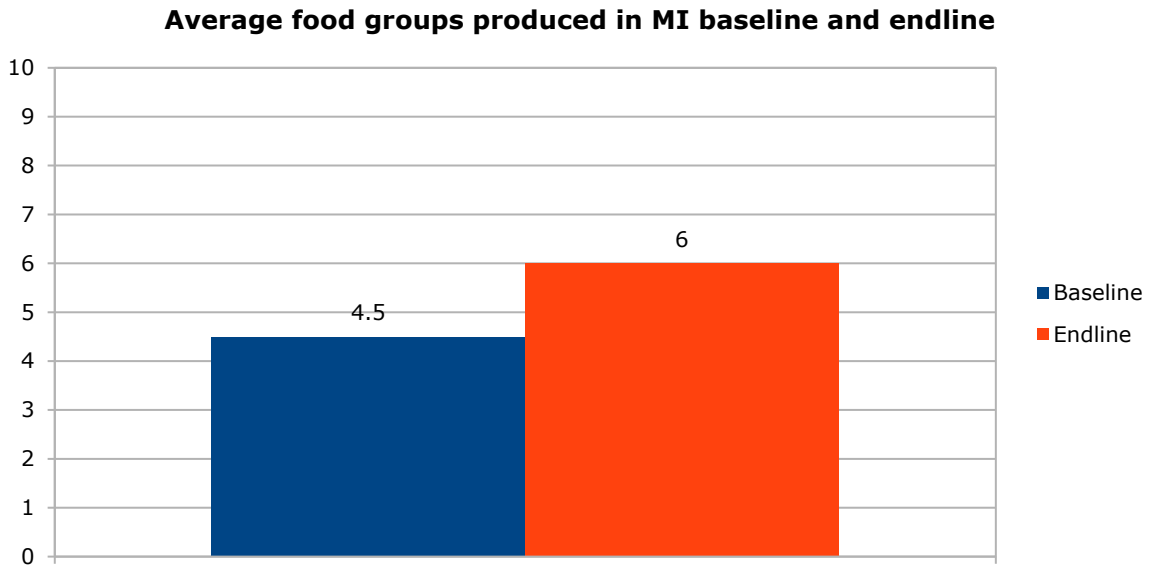

Figure 56 *Comparison of average produced food groups in Nepal MI baseline and endline*

According to the analysis, the average number of food groups produced by the households increased from 4.5 to 6 (+1.5). The average number of food groups produced increased significantly($P<0.05$).

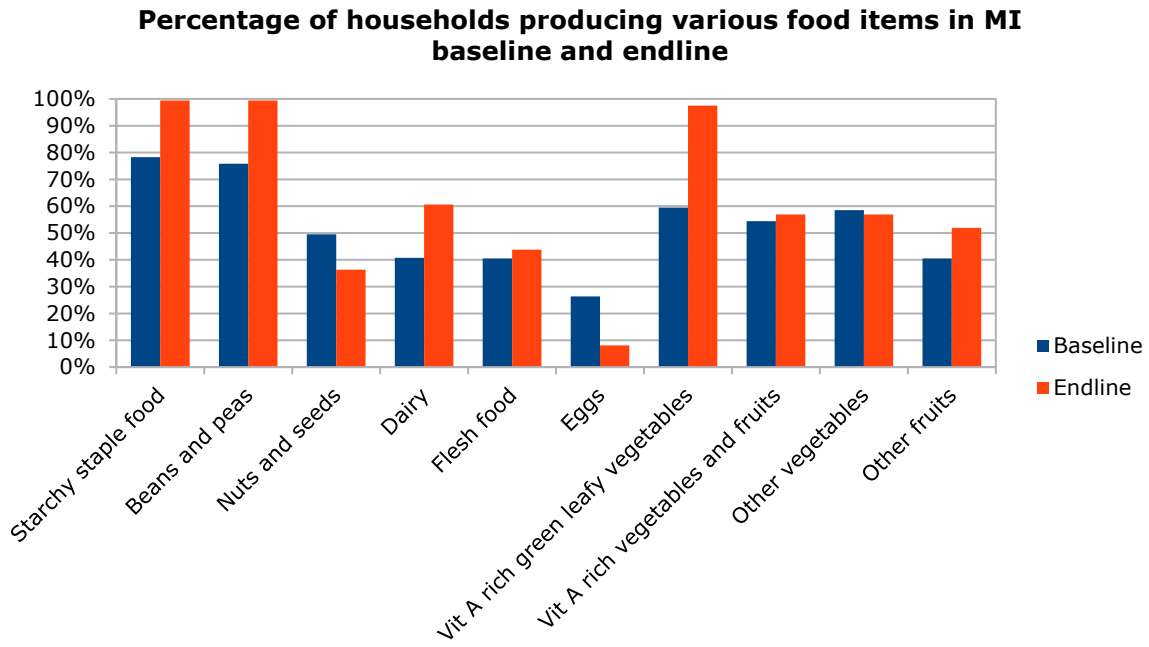

Figure 57 *Percentage households producing each food group Nepal MI interventions during baseline and endline*

Between baseline and endline, there appears to be an increase in the production of all food groups, except nuts, seeds and eggs. The highest increment under Vit A rich green leafy vegetables by 38% suggest the influence of seasonality as the endline was collected during the harvesting period (April-June). The largest increase in consumption of eggs, contradicts the production of eggs suggesting they were bought from market, although the low production of eggs is somewhat surprising as poultry farming was one of the interventions. The decrease on production of poultry may also be explained by the decreased number of participants between endline and baseline. The other factors suggested during FGDs small increases in production could be lack of knowledge about proper use of pesticides, lack of production technologies, agricultural processing unit and market centre, geographic condition and irregular and unreliable water supply.

6.6 Pakistan

Consumption

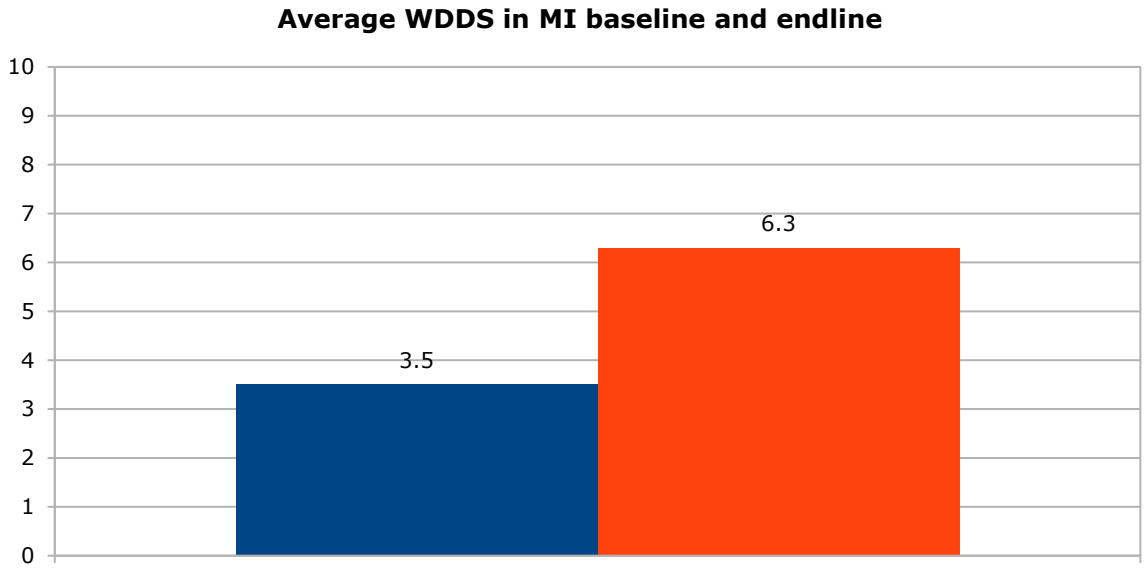

Figure 58 *Comparison of average WDDS in Pakistan MI baseline and endline*

The graph in Figure 58 compares the average WDDS score across MIs intervention areas in Pakistan during baseline and endline. The WDDS under the MI have increased by +2.8, higher than the SUNSAI (+1.4). Overall, the increase in WDDs under MI is significant ($P<0.05$).

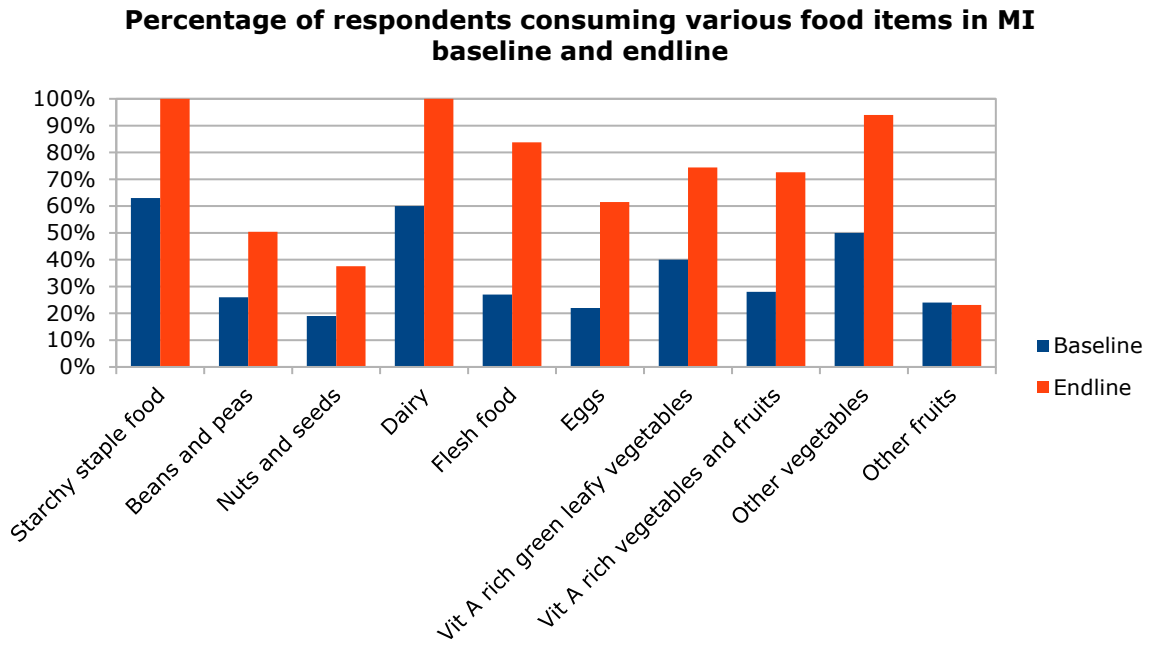

Figure 59 *Percentage of women consuming various food groups in Pakistan MI baseline and endline*

The Figure 59 shows that the average food consumption has increased in the MI intervention areas. The highest increase was in the food group starchy staple food, dairy, flesh food and eggs. Consumption of all other food groups has also increased. Similar to the SUNSAI, the increase in production in the dairy, flesh food and eggs suggested that various governmental programs focusing on livestock improvement programs and the awareness of changing dietary habits based on nutritious food could have also influenced the food consumption of flesh foods and eggs.

Production

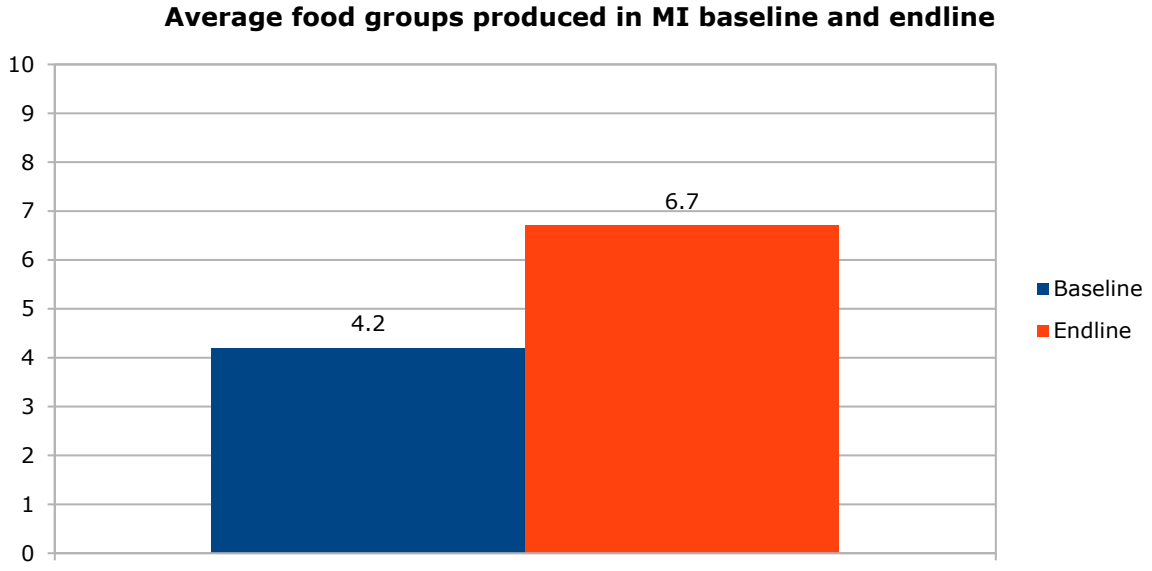

Figure 60 *Comparison of average produced food groups in Pakistan MI baseline and endline*

Overall, the average number of food groups produced by the household of the respondents increased from 4.2 to 6.7 at the endline. The increment in food production was significant for as the p-value is $P<0.05$.

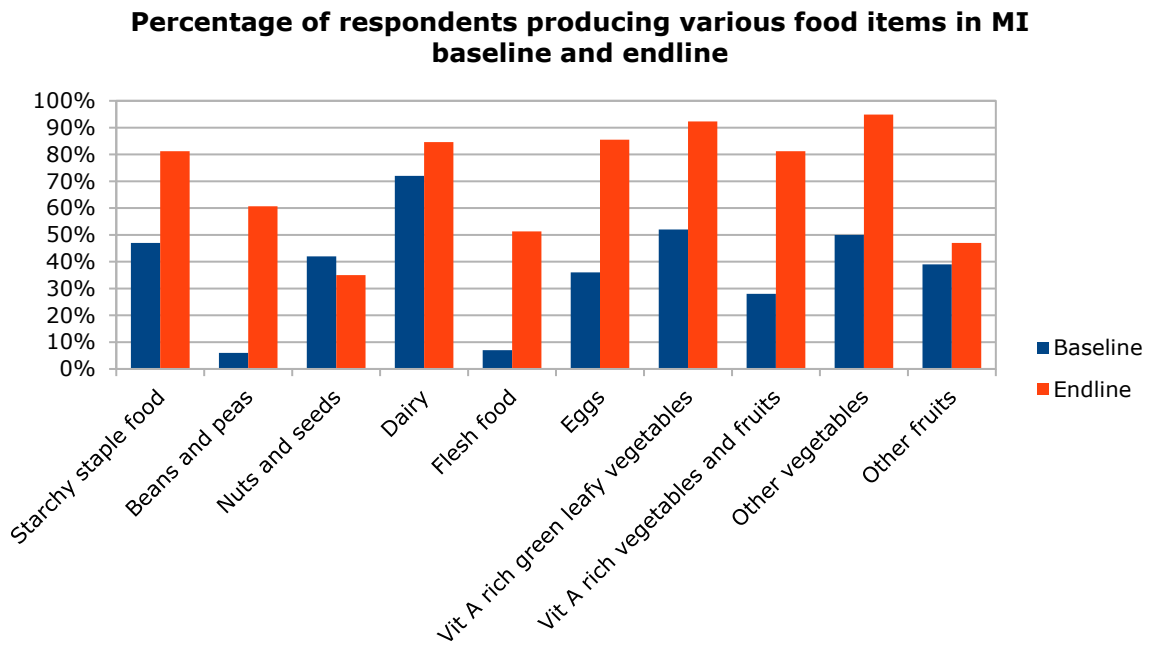

Figure 61 *Percentage households producing each food group Pakistan MI interventions during baseline and endline*

The graph in Figure 61 compares the number of food groups produced by the households of the women respondents across SUNSAI interventions areas in Pakistan. During baseline and endline there was an increase in the average number of food groups produced by the household mainly for eggs, flesh food, Vit A rich vegetables and fruits and other vegetables. Based on the FGDs under SUNSAI, factors such as natural resources with conducive environment for organic farming, traditional skills, practices, crop rotation and diversification seemed to have improved nutrition and dietary diversity. Likewise, awareness and training in understanding the side effects of pesticides might have influenced the dietary behavior of participants as they value food they produce and consume.

6.7 Peru

Consumption

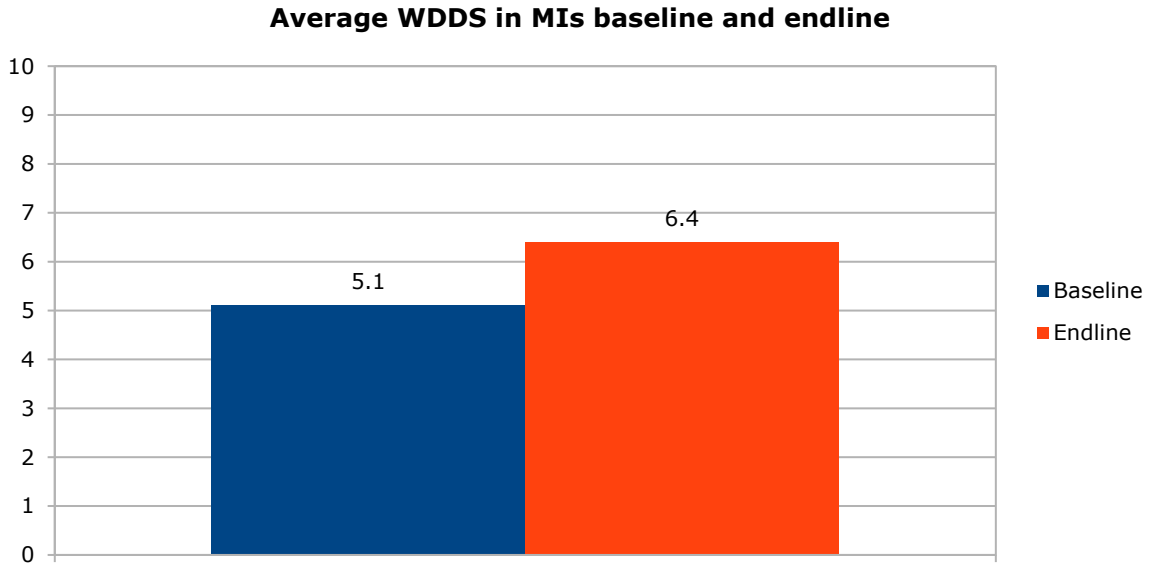

Figure 62 *Comparison of average WDDS in Peru MI baseline and endline*

In Peru, the analysis shows that the increase in WDDS is similar in the MI compared to SUNSAI. Overall, the average WDDS increase by +1.3 from baseline to endline which is found to be significant (P<0.05).

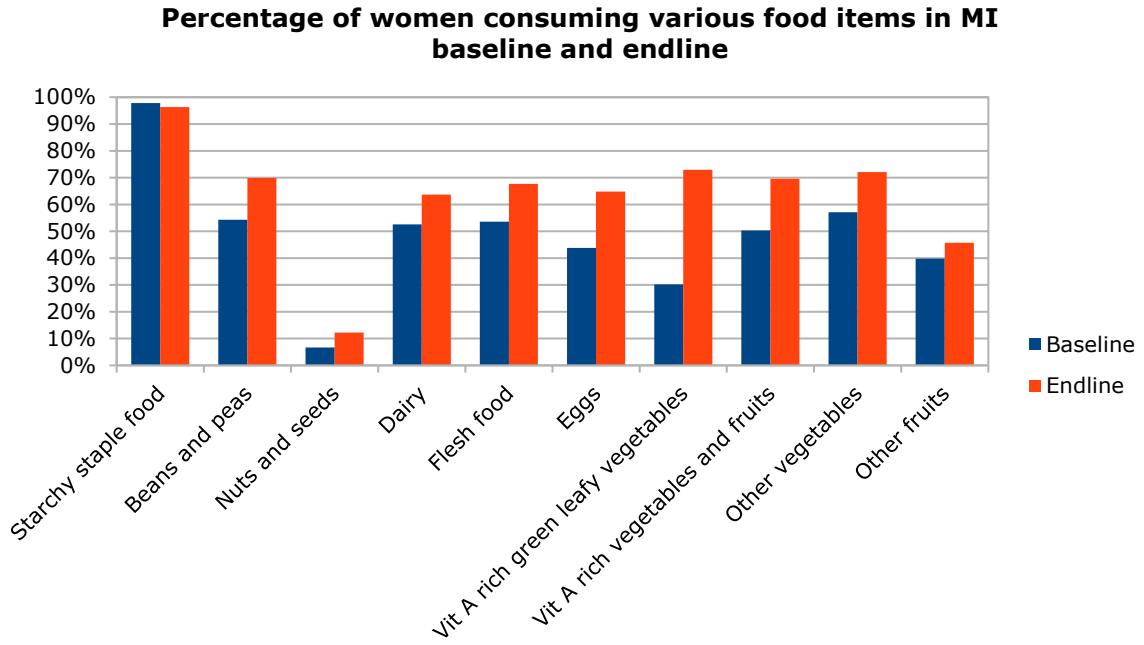

Figure 63 *Percentage of women consuming various food groups in Peru MI baseline and endline*

The largest increment related to food consumption among women was seen under green leafy vegetables, Vit A rich vegetables and fruits and eggs. The results are shown in the Figure 63. The results suggest that the micro-interventions involved in awareness-raising and promotion of agro-ecological production have influenced people's food choice practices and increased dietary diversity in Peru with the largest increase in green leafy vegetables compared to other food groups. Although, there is not large difference in consumption of 10 food groups compared to other countries, most likely because the baseline was collected on August- 2019 generally harvesting and endline during March-April 2021, sowing season indicating less availability of food.

Production

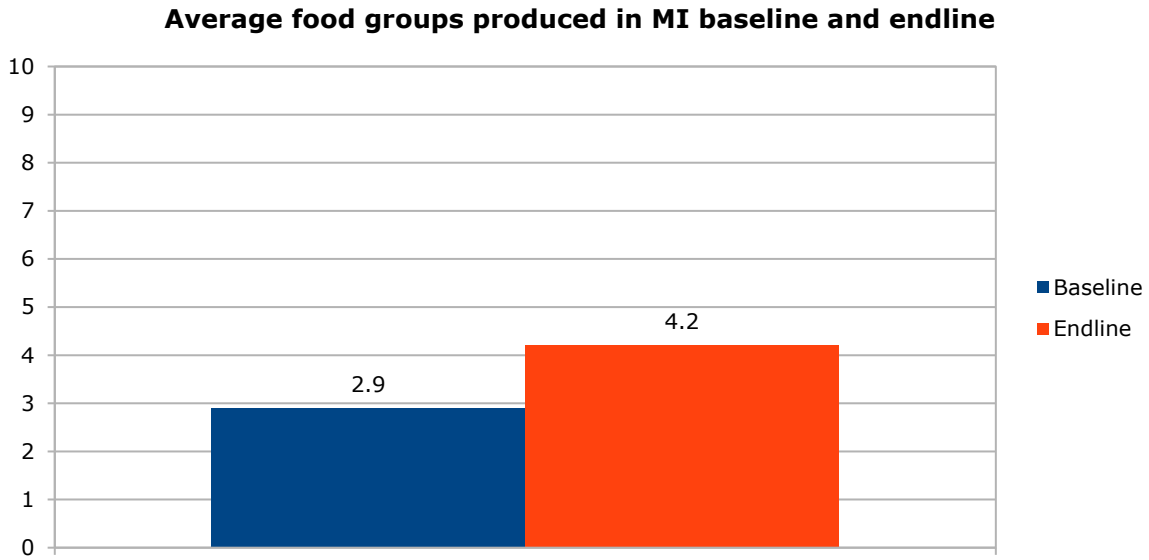

Figure 64 *Comparison of average produced food groups in Peru MI baseline and endline*

The average number of food groups produced by households of the women respondents under MI was also analyzed for the endline data. The Figure 64 above shows that the average number of food groups produced by the households increased from 2.9 to 4.2. The average number of food groups produced increased significantly (P<0.05)

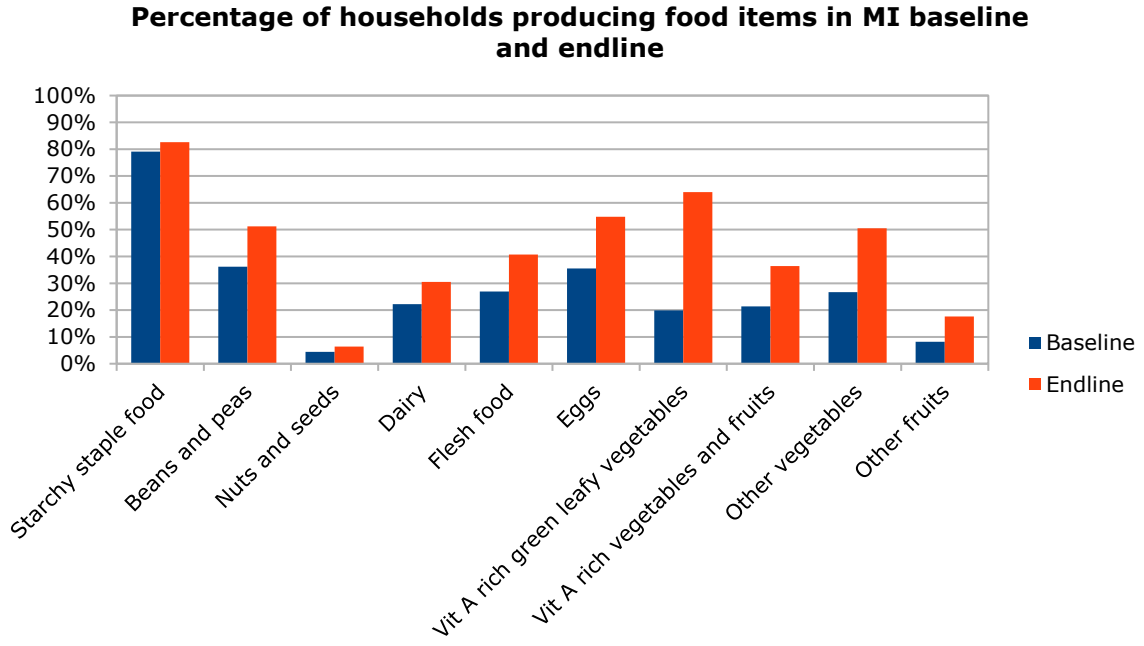

Figure 65 *Percentage households producing each food group in Peru MI interventions during baseline and endline*

Production increased between baseline and endline across the micro intervention areas in Peru. The highest increase in production was reported for green leafy vegetables, other vegetables and eggs. The fact that the increase was in the same food groups where there was also an increase in consumption suggests that the respondents consume the vegetables that are grown by themselves and indicated understanding of dietary diversity. The types of MI implemented related to production of the organic, traditional and heirloom vegetables indicate increasing recognition of more nutritious vegetables. Similarly, the FGDs in other SUNSAI intervention areas in Peru highlighted that due to the COVID-19 pandemic, it was evident that there was a greater productive diversity with leafy vegetables, vegetables rich in vitamin A and other vegetables and greater care in healthy eating to improve the defenses of household members. To encourage and sustain the production of nutritious vegetables and local crops it is crucial to disseminate relevant information, strengthening the role of community seed banks, consumer awareness, and upgrading local value chains (Meldrum et al., 2018).

6.8 Tajikistan

Overview of nutrition situation

Tajikistan is 'on course' to meet two targets for maternal, infant and young child nutrition according to the 2020 Global Nutrition Report. Compared to other project countries, Tajikistan has made good progress towards global nutrition targets. The country has reduced anemia among women of reproductive age between 15 to 49 years, with 30.5% of women now affected. Likewise, there is some progress towards achieving the low-birth-weight target and breastfeeding of infants aged 0 to 5 months. The country is 'on course' to meet the target for stunting for children as well as for overweight of children under 5 years, but no progress towards achieving the target for wasting. Following the similar trend, Tajikistan has shown limited progress to achieve the diet-related non-communicable disease targets, where an estimated 16.7% of adult women and 9.9% of adult women suffer from obesity and diabetes, respectively.

Another health-related issue in the country is the marked increase in overweight and obesity leading to a double burden of malnutrition. The double burden of malnutrition represents increasing under nutrition, overweight and obesity in women and children who consume too much energy (calories) but not adequate quantities of nutrients. In rural areas, population are more likely affected by under nutrition and in the urban areas, increase in overweight. According to National Nutrition survey (2016), the mean dietary diversity score for Women of Reproductive Age is 6.3.

Consumption

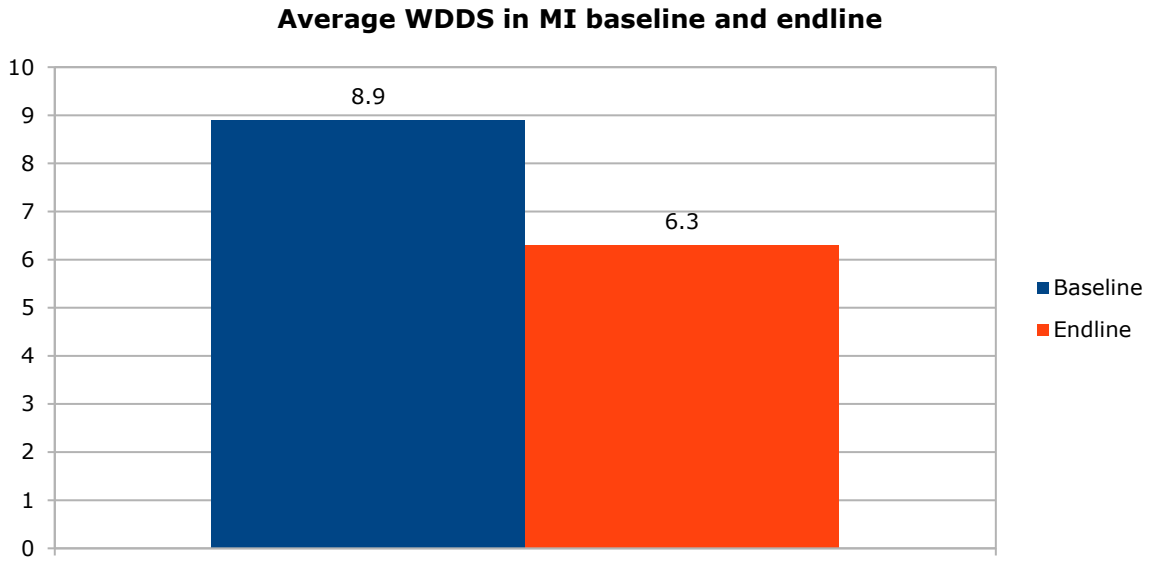

Figure 66 *Comparison of average WDDS in Tajikistan MI baseline and endline*

In comparison to other countries, the findings suggest that Tajikistan WDDS reduced by -2.6 between the baseline and endline. The decrease in the score is significant as P|<0.05. The number of participants had deceased (from 160 to 105) in the endline compared to baseline, although this may not fully explain the finding.

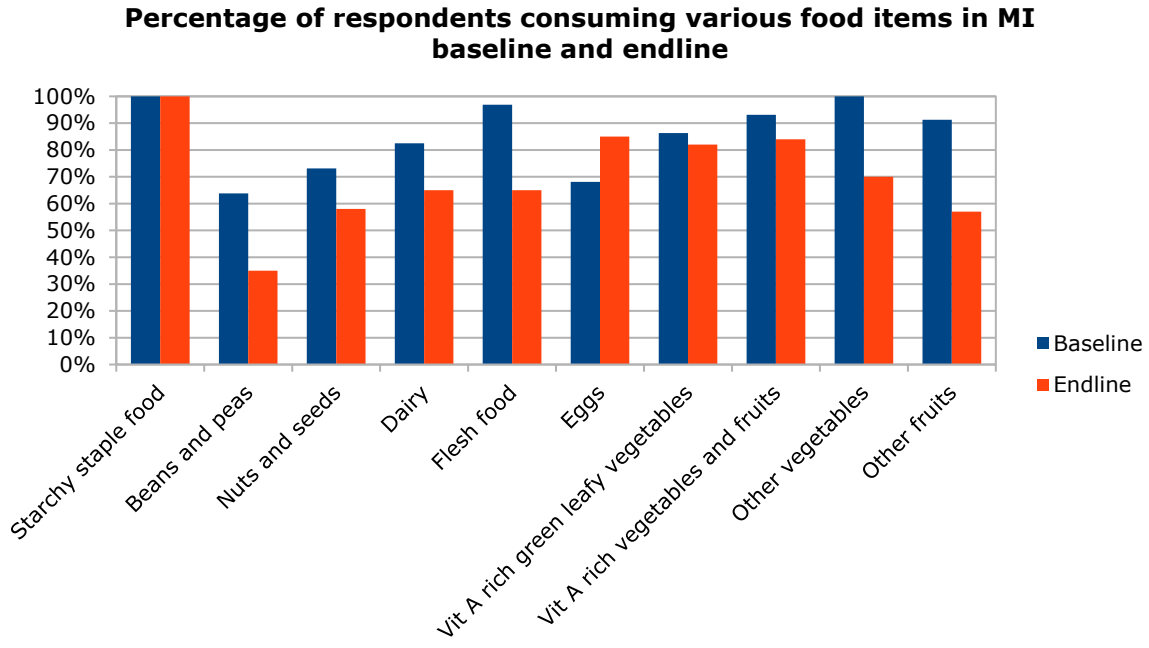

Figure 67 *Percentage of women consuming various food groups in Tajikistan MI baseline and endline*

Figure 67 indicates the variation in consumption of ten food groups between baseline and endline. Except for starchy staple diet and eggs, there is decline in consumption of food groups. The findings may have been affected due to the negative impact of the COVID-19 pandemic on income, employment, remittances and food market prices influencing households' ability to acquire quality nutritious diets. According to FAO special report on Crop and Food Security Assessment Mission (2020) women-headed households are reportedly to be more vulnerable compared to the male counterparts. Although there were no notable differences in food consumption associated with frequency and diversity, greater proportion of women-headed households reportedly to have less household food stock, limited access to market and consumed smaller food portion size.

Production

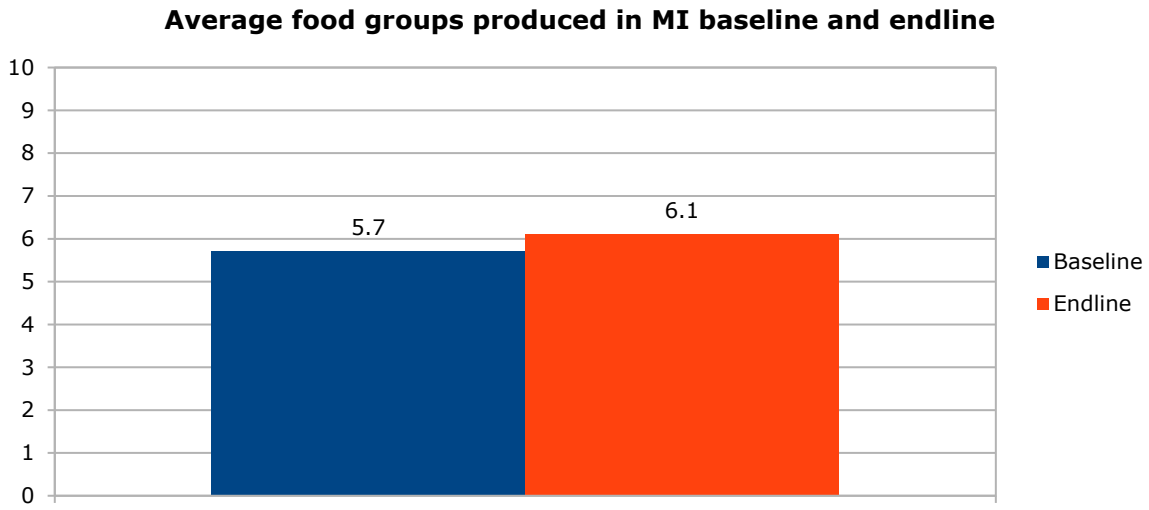

Figure 68 *Comparison of average produced food groups in Tajikistan MI baseline and endline*

Compared the consumption, the average number of food groups produced by the households increased from 5.7 to 6.1 (+0.4). However, the increment in the average number of food groups produced is insignificant (P>0.05).

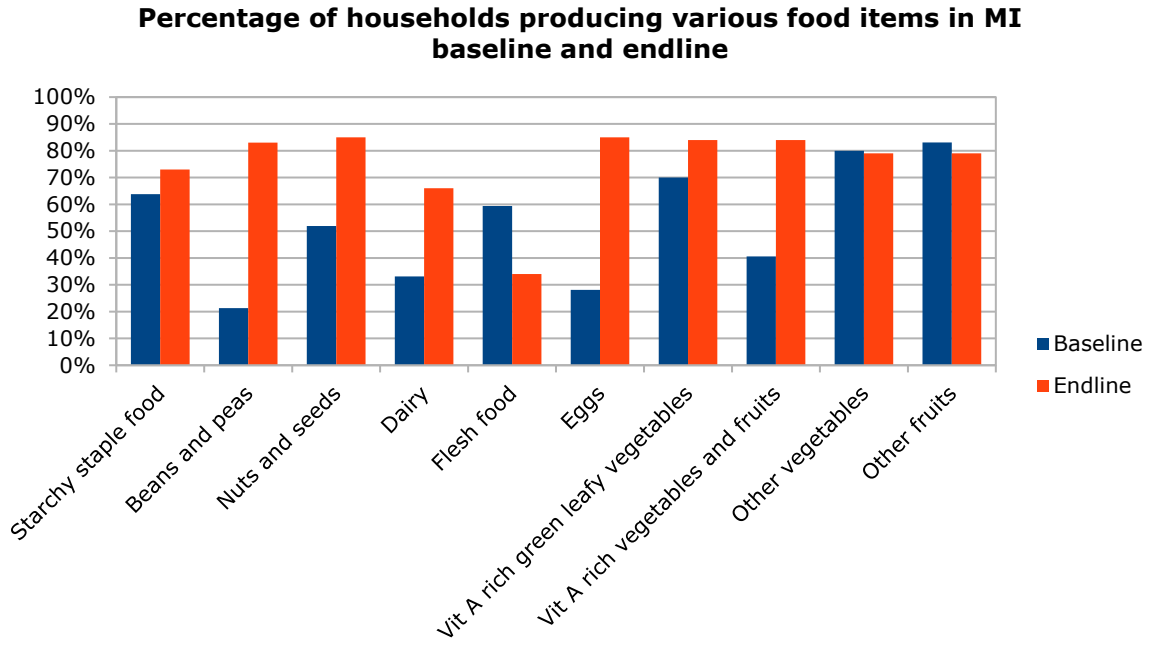

Figure 69 *Percentage households producing each food group Tajikistan MI interventions during baseline and endline*

Overall, there has been increase in food groups produced by households except for flesh food, other vegetables and fruits. The increase in production compared to consumption suggests that the households tend to sell their production rather than consume them. Although, the baseline and endline data were collected around the same season August 2020 and 2021, the agricultural is not optimal and is constrained by repeated natural disasters, dependence on weak agricultural infrastructure, poor technology, accelerative cost of agricultural inputs, inadequate land tenure structures and high taxation (Kawabata et al., 2020).

7 Discussions

7.1 Ecuador

Ecuador is a new addition to the NMA project. An analysis of the SUNSAI and MI under NMA phase II suggests that there has been improvement in the WDDS by +0.7 under both the interventions. This finding indicates improvement in knowledge about the NSA among women in Ecuador. The most consumed food groups are starchy food, animal product, nuts, seeds and other vegetables. Based on the market survey, a family earn between 50-120 USD monthly by selling the crops produced through the intervention. The consumption of food may have varied because of the Covid-19 pandemic. One study looking at changes in food consumption practices as a result of COVID-19 found women had a greater decline in food consumption compared to men and, the rural population was impacted more than the urban population. The changes in the consumption pattern were due to the Covid-19 pandemic and its effect on the perception of food as harmful or beneficial (Ramos-Padilla et al., 2021).

The findings from SUNSAI and MI interventions suggest that the consumption and production of crops depends on the seasonality variation. The qualitative data suggests that in Ecuador there are many challenges mainly associated with geographic marginality that prevents diverse crop production including the extreme climate which prevents crop production in winter, irrigation problems and availability of junk food contributing to double burden of malnutrition. Regarding gender balance in decision making, the women and men tend to perform tasks that are specific to gender roles, suggesting unbalanced gender equality under both the SUNSAI and MI. The role of collaboration between multiple organizations seems to be working well as activities related to enhancing nutrition awareness, commercialization of crops and hygienic approach are promoted to ensure nutritious diets. However, the collaborations can be improved.

7.2 Ethiopia

The comparison of baseline and endline data for NMA phase II indicates an increase in the WDDs score and production diversity (using the 10 food groups) in both SUNSAI and MI. Overall, under the SUNSAI, WDDs score increased by +2.4 and under MI by +1.9. The greater increase in WDDS could be attributed to a greater number of participants in both baseline and endline under SUNSAI (2140) compared to MI (1914). Also, the score for baseline under MI was already the lowest (2.2) compared to SUNSAI (4.3) which could have caused the differences in scores between two main interventions.

Along with the changes in diets and production system, both the interventions seem to change knowledge, attitudes and practices associated with food consumption and production leading towards improved diet and nutrition, although its more prominent under SUNSAI. The market survey indicated that farmers earn additional income approximately between 44-66 USD by selling produced products in the market. Based on the suggestions from NMA phase I report, in Ethiopia awareness was as a key limitation in terms of diets, so strategies to increase awareness could be strengthened. In NMA II phase, the emphasize in awareness and knowledge especially with the collaboration of multi stakeholders regarding NSA resulted in improvement of the diverse diet as reflected from the FGDs.

Although, the analysis suggests improvement in consumption of nutritious food, it seems that the focus of consumption of nutritious food is prioritized to children, instead of women themselves. Furthermore, the Covid-19 pandemic has been disrupting food systems, livelihood and nutrition security of households through market closure, high food prices and loss of income. In relation to consumption, there has been changes in diet of mothers' and children with significant decline of animal source foods (Abay et al., 2020). This finding is consistent with both SUNSAI and MI interventions, where the consumption of meat products increased from baseline to endline, but not as

significant as other food groups. To ensure maternal, infant and young child nutrition, with focus on mountainous regions it is important to recognize the importance of improving access to food for all family members, especially women. Food and nutrition security for women could be strengthened through education, expanding employment opportunities and enhancing household income (Dagnew and Asresie, 2020). In the process, the support from Women affair office is critical. Although, the collaboration between public and private sectors have shown improvement, it is essential to reinforce support to and from women affair office to benefit the targeted women.

7.3 India

In India, the overall WDDS for SUNSAI and MI has increased. The food production by households also follows the same pattern. The overall increase between baseline and endline under SUNSAI was +2 and under MI +1.4. The difference in the score may be linked to seasonality as the MI data for baseline was collected during Oct 2019 (harvesting) and endline July 2021 (sowing) meaning more food availability during baseline compared to endline.

The FGDs provided insights that the participants were consuming more meals than before and understood more about dietary diversity which they introduce in their everyday meal. Same goes with the production as the qualitative data suggested that the participants also introduced new cops, mainly cash crops to gain extra money. However, the estimated increase in the income was unavailable during the market survey credited to the Covid- 19 pandemic. According to FAO et al. (2020), the pandemic has disrupted the harvesting and planting of various crops such as wheat and paddy signifying the two major staple foods in the region cannot be properly harvested and processed (also found in the SUNSAI analysis). This has led to the additional shocks from the pandemic deepening the existing challenges of malnutrition and food insecurity in the region disturbing the agricultural production activities, income-generating activities, trade, accessibility, food and inputs supply chains.

Another interesting finding from India is that the participants seemed to be critical about the quality of food provided by the government food distribution program, the Public Distribution System, suggesting increase in the comprehension related to dietary diversity. In terms of gender, the findings suggested that women have better frequency and availability of food and also seemed to have positively influenced their health linking good nutrition with good health. The participants seemed to be confident to continue growing and eating nutritious crops even after the program is over.

7.4 Kyrgyzstan

Kyrgyzstan has the highest WDDS in SUNSAI compared to the other NMA countries. The WDDS under SUNSAI increased by +1.4, whereas under MI by +1.1. Although, the score for Kyrgyzstan was already higher compared to other countries because of food and nutrition programs implemented by government, therefore the differences between baseline and endline under both SUNSAI and MI were not significantly different. However, the higher sore under SUNSAI could be explained by the focus on only two interventions namely practical workshops for the construction and use of mobile fruit driers and expansion of fisheries to improve and diversify by promoting NSA compared to eight different MI.

The market survey revealed that the participating family earned (236-1.032 USD) each as an additional income by selling the organic products such as fish and dried fruits after SUNSAI were completed. In both SUNSAI and MI, the consumption and production of all food groups seemed to have improved. One possible reason could be a combination of both SUNSAI and MI intervention, along with broader socioeconomic and political transformations in the country which is developing food, health and nutrition sectors across all Obalts in the country. Although, similar, to other NMA countries, the increased consumption of junk food, especially by children, is an issue of concern. Regarding gender, the decision making seems to be divided fairly equally between females and males, but slightly more influenced by males, suggesting some imbalance in gender power hierarchy. The

collaboration between different organizations involved in nutrition sensitive agriculture seems to be working well, however the involvement of private sector and civil society along with improved monitoring could help improve nutrition promotion.

One of the main theme that constantly came up in the analysis of both SUNSAI and MI was the concern with quality of the food and hygiene of the products that are purchased. Although, prioritizing quality over quantity seemed to have improved after RSP training and meetings, yet the information to ensure higher quality of food products seems to be inadequate for production and purchase. Likewise, regarding consumption, the Covid-19 pandemic made people more curious to learn about food quality while purchasing, however, lack of information means people remain uncertain about the quality of foods purchased. In addition, in the context of the pandemic, rising unemployment, reduced purchasing power due to higher prices (also reflected during FGDs), loss of remittances are jeopardizing the food security of vulnerable households, and increasing the risk of falling into poverty. Therefore, it is crucial to continue monitoring food security in the country and emphasize food security and social protection systems to ensure country's stability (WFP, 2021).

7.5 Nepal

In Nepal, both the SUNSAI and MI interventions seem to have improved the WDDs and increased the number of foods produced in the endline compared to baseline. The WDDS score under MIs increased significantly by +3.4 (highest under MI category) compared to SUNSAI by +0.3. The seasonality could be a contributing factor as the baseline was collected during Aug-2019 whereas endline was collected during April-June 2021, meaning during endline due to the harvest season the food availability was higher. Another reason could be lower number of participants under MI (1140) compared to SUNSAI (3612) suggesting more in depth focus on the participant engagement under MI leading to improvement in dietary diversity.

According to the market survey, 2,370- 4,052 USD per family is generated by selling home produced products. However, the paired t-tests shows that the increase is statistically insignificant for SUNSAI. Awareness and knowledge about nutritious food and NSA seem to have improved, as participants were more aware of the importance of the food diversity and also understood the nutritional value of food based on age and gender requirement.

Nepal has a comparative advantage in terms of contribution of multiple association and collaboration from international and local organization, which could help explain the improvement in nutrition awareness and dietary diversity. However, the country has rigid social and cultural traditions that prevent women and children from consuming nutritious foods since the men have more privilege under the prevailing gender norms. Likewise, a number of specific challenges affect the mountainous areas including marginality, migration and soil fertility imposing challenges for NSA. In addition, new emerging challenges such as increased consumption of junk food and impact of climate change on water supply have created more barriers improving dietary diversity.

Furthermore, in the HindKush Himalayan country such as Nepal, COVID-19 pandemic and lockdowns have impacted food systems and agriculture, affecting production, marketing, transportation, distribution and supply chain resulting in decline in dietary diversity amongst mountain people (ICIMOD, 2020). Under the prevailing social norms, the patriarchal systems discriminate against women and girls in the allocation of food as they eat the leftovers and face greater risk for malnutrition (Goodrich et al., 2017). This behavior was also reflected in the insights from FGDs both in baseline and endline.

In the NMA phase I, the interventions focus on increasing accessibility of nutrient rich food. From the phase II analysis it seems that Nepal has a huge potential to tap into nutritional advantages of traditional and local crops grown in mountainous regions itself, given the growing interest and awareness of nutrient dense crops. The local crops contribute to dietary diversity through increasing variety available for human consumption with minimal interference on the ecosystems and biodiversity. To continue supporting the availability of indigenous crops, a shift towards sustainable consumption is

crucial. This can be supported by valuing local food chains and shifting towards a more circular food economy (FAO, 2021a). To increase the value and utilization of traditional crops it is crucial to promote them by introducing subsidies, creating brands and changing the narrative around them. However, there are major constraints in production system such as lack of adequate choices and quality seeds, lack of women friendly processing technologies, poor market development, absence of awareness, poor investment in research and weak seed regulatory frameworks (Gauchan et al., 2020).

7.6 Pakistan

The overall SUNSAI findings in Pakistan suggest that knowledge and awareness related to the diversifying crops have improved between baseline and endline. Under SUNSAI, the WDDS increased by +1.4 and under MI by +2.8. The main contributing factor for the differences in scores under two interventions could be the larger scale implementation of MI with 20 different intervention areas compared to 6 interventions focus under SUNSAI.

Compared to other NMA phase II countries, the increment in meat and dairy consumption is prominent in Pakistan. This could be attributed to the focus on dietary diversity associated with the project intervention as well as external factors such as government initiatives focusing on livestock improvement and effect of income on the consumption and production of meat. In NMA phase I, it was suggested to focus on increased consumption of cheaper fruits and vegetables, such as not commonly consumed. From the SUNSAI analysis, the salient increase in consumption and production of other vegetables might suggest the progress. Likewise, transformation related to food choices such as reduced consumption of junk food amongst children seem to be effective related to sensitizing importance of vegetables intake in diets, an improving pattern.

Regarding production, although there has been improvement in the production of ten food groups, there are few critical issues limiting the overall protection system. The small land holding seems to be limiting the possibility of application of diverse NSA. Likewise, the human-wildlife conflict, harsh winter conditions and reliance on food supply from other provinces seems to compromise the quality of food intake. Moreover, the lockdown situation caused by Covid-19 pandemic has imposed challenges market accessibility in terms of earning income from agriculture. In, mountainous Gilgit-Balistan, harvesting of winter food crops such as wheat and barley had been delayed which might have affect availability of locally produced food (ICIMOD, 2020).

Regarding gender and balance decision making within household, the traditional and cultural norms seems to dominate and make females role in decision making passive. This was also more prevalent in behavior such as prioritizing males to best part of food, than females. However, kitchen gardening activities have contributed to the roles and responsibilities of women in the agriculture cycle. Regarding, the collaboration between stakeholders, the NMA phase II intervention seems to have improved the communication, engagement and cooperation between multiple governmental and non-governmental agencies to advocate for improved dietary diversity compared to baseline, but this needs sustainability. Similarly, in the context of Covid-19 pandemic, although it affected the market accessibility in the mountainous regions, the participants seemed to have become more aware of the importance on NSA and improved diet to remain healthy.

7.7 Peru

The NSA phase II SUNSAI and MI interventions in Peru indicate that there has been an overall increase in the WDDS and production diversity. Under SUNSAI the WDDS increased by +1.9 and under MI by +1.3. The largest participants in comparison to other countries was under MI in Peru with 4384 number of participants, whereas under SUNSAI it was only 2149. Compared to the 17 different areas under MI, the score under SUNSAI might have improved better due to small focus on 5 intervention areas that might have positively influenced the participants to gain more in-depth knowledge about NSA and dietary diversity.

The interventions support improvement related to micronutrient adequacy, nutrition, food access and economic well-being of the targeted women. In comparison to other countries. Peru's performance related to NSA interventions and its impact on the increase in consumption and production of diverse food is relatively better compared to other NMA phase II countries as a result of improvement in knowledge related to dietary diversity, adoption of better production practices, focus on traditional vegetables and effective collaboration between multiple institutions. According to the market survey, for product such as white quinoa the total collection in volume is 943688 kg with total sales of 5,748,497.78 (1400 USD) sol in 2020. Most interesting, the effect of the pandemic on the food intake and production behaviour seems to be positive as it influenced the realization of the nutritional values to dietary diversity that have direct impact on the health status and well-being. Canari-Casano et al. (2021) suggested that in Peru after the Covid-19 pandemic people were reporting that they ate less processed food due to an increase in foods prices. This can be an opportunity to promote consumption of more nutritious diets.

The NSA phase I report suggested that the program focus in the second phase for Peru should be on the traditional diets and opportunities to engage with schools or health posts to support the development of healthy alternatives to processed foods. NMA phase II analysis indicates that there has been increase in the consumption and production of traditional vegetables and fruits, but the qualitative data highlights that there is an increase in the consumption of carbohydrate containing food. There are still challenges to achieve good diet such as inability to produce food traditionally like the ancestors and growing trend of consumption of processed products due to its availability. To develop a holistic and nutrition-sensitive approach involving underutilized crops requires knowledge systems, supportive structures, cooperation and partnerships with community members (Padulosi et al., 2019).

Similarly, compared to baseline, there has been increase in collaboration between the public and private sectors to promote campaigns and actions to promote health and nutrition. Still, there is a need to build more alliances between public and private institutions to work in a coordinated manner to overcome poor nutrition.

7.8 Tajikistan

In the NMA phase II countries, Tajikistan is the country where only MI were implemented by RSPs at the local level such as crates and beehives, egg-incubators technology, milk separators, grain crusher and butter churn. These are smaller interventions to increase the accessibility and availability of nutritious foods in mountain areas, where RSPs are the catalyst for change. The RSPs were influencing dietary diversity and NSA. During the intervention period in everyday food consumption and production, the RSPs served the women and their households to use skills, tools, techniques and knowledge for effective use of the resources available to them (Jansen and Vellema, 2011). The focus was in the process of using skills and knowledge in situated action to achieve nutritious diet in the mountain regions.

In Tajikistan, there was an opposing trend where the WDDS was higher in baseline compared to endline. The factors leading to decline in the WDDS was not comprehensible as the FGDs was unavailable. However, based on the studies conducted in the country, it was suggested that Covid-19 pandemic could have affected the WDDS, especially with women households' heads. Similarly, to produce food groups, the structural factors such as environmental conditions, technological advancement, land systems and tax charges could have led to low productivity. Furthermore, high prevalence of micro-nutrient deficiencies and double burden of nutrition among women and children demands sustained need for specific actions. Multiple approaches across diverse sectors such as education, agriculture, education, economy and trade are required to tackle nutritional issues for women in Tajikistan (Barth-Jaeggi et al., 2020).

8 Suggestions for Future Programmatic focus by country

8.1 Ecuador

In Ecuador, the dietary diversity increment was not consistent in all food groups. Qualitative data from the endline survey suggests there has been improvement in the issues with hygiene, but in future additional resources could increase hygiene awareness. Another area of concern, similar to Nepal, is the growing intake of junk food and convenient food. To improve the situation, emphasize can be given to enhancing knowledge about the disadvantages of junk food and increasing awareness of locally produced food. Due to the difficult topography and extreme winter, year-round food availability is another major source of low dietary diversity. To alter the situation, the future program can focus on food availability through improving food processing. Furthermore, to strengthen the food production, increasing access to irrigation should be considered.

8.2 Ethiopia

While there was improvement in consumption and production of dietary diversity in Ethiopia, there is still needed to focus on few areas. From the qualitative data it was pointed that to diversify production multi-sectoral collaboration and joint action plan with syllabus-based nutrition awareness raising is crucial. In addition, food subsiding policy by the government to stabilize the market price and market access for animal product like meat and milk, for fruit mainly avocado, mango and pineapple could improve the situation. Therefore, the future program can look into how to continue and improve role of each organization and sustain support in continuation of the activities done so far. Likewise, emphasize should be given to NSA by proactive involvement of all relevant stakeholders particularly women affair office. Improved collaboration with civil society and women's right organizations could be a way forward to influence and prioritize women's decision-making capacity within households for equal power sharing between genders. Emphasis can be given to provide consistent and documented nutrition education targeted at the mothers on what, when and how to feed children to support dietary diversity for both mothers and children. In the context of pandemic, to ensure nutritious diets for mothers, the focus could be on the ways to utilize traditional food storage methods throughout the year, as accessibility of food is a major concern. To improve the production and distribution of diverse food, the physical and social barriers should be removed. In addition, strategies to sustain the knowledge and continue awareness related to NSA and dietary diversity targeted at women needs to be ensured for the continuous improvement of nutritious foods.

8.3 India

In India, the overall WDDS and the food groups produced seemed to have increased, but there are some issues that needs to be considered. The main issues are mostly environmental including frost and pests, changing weather patterns, and drying streams. Socially, out migration have affected self-sufficiency in terms of agriculture in the regions. The issue of human-wildlife conflict can also be another area of focus. Like other countries in the Himalayas such as Nepal and Pakistan, the climate change could have serious implications for the dietary diversity. Therefore, changes related to climate change adaptation to ensure food security is essential. India has already initiated to change the vegetation pattern and introduced new crops. Efforts should focus on continuing these programs. Likewise, knowledge and awareness related to NSA and dietary diversity should be sustained.

8.4 Kyrgyzstan

The analysis of the SUNSAI and MI interventions in Kyrgyzstan indicates that the country is performing well compared to other NMA countries. Nevertheless, there are some areas that require attention to improve the dietary diversity. Information and knowledge enhancement about the quality of food products that are imported could be explored to fulfill the knowledge gap between consumers and producers. Similarly, regarding awareness on nutrition and dietary diversity, the use of media coverage (TV, radio and newspaper) could be enhanced. Likewise, awareness programs in schools could be emphasized to demonstrate the disadvantages of eating junk food and influence change in mindset and attitude towards locally produced food targeted at children. Another area to focus could be in increasing the training for the government officers and local authorities involved in the implementation of the food security and nutrition program for effective implementation of interventions. In addition, ways to integrate more private civil society and women's rights organization could be investigated. In terms of the gender dimension, women's empowerment through education for equal participation in decision making could be strengthen. Regarding the availability of products to sell in the markets, focus should be on maintaining the quality of the organic products through proper storage and processing facilities to sustain demand from consumers. Finally, regarding food production, the challenges of issues such as lack of water irrigation, cultivation technology, soil fertility and financial incentives needs to be addressed to improve productivity to ensure dietary diversity.

8.5 Nepal

In Nepal, the major concern around dietary diversity is linked to geographical and cultural aspects. Geographically, challenges around movement and accessibility limits both consumption and production of diverse food groups. Culturally, the rigid social norms around food distribution reduce dietary diversity especially among young girls. In future, more focus can be directed towards behavioral changes and gender sensitive nutrition awareness to influence gender norms. For these strengthening alliances with civil society and women's rights organizations could be a way forward to empower women to use their voices and challenge societal restrictions that are biased towards women. Other programmatic focus to improve production could be on the process to improve knowledge on nutritional values of traditional foods, niche markets, women-friendly production method and marketing system.

As highlighted in the FGDs, there is collaboration between international, national and local organizations to strengthen NSA. The government could be better supported to lead the process of aligning all the stakeholders working on NSA in the country. Another focus for future programs can be to minimize the intake of junk food, especially amongst children. For this, innovative way to build a creative narrative around dietary diversity and nutritious food through marketing could be emphasized. Similarly, more investment and support for production/marketing of traditional crops and mountain niche products could be focused. Furthermore, future interventions could focus on climate resilient agriculture methods to increase food productivity under climate variability with proper understanding of use of pesticides.

8.6 Pakistan

The challenges such as human-wildlife conflict, import of low quality food from other provinces, water shortage, climatic conditions seem to be biggest challenges, that requires attention. The FGDs, highlighted that improvement in understanding side effects of pesticides, value of organic farming and nutrition sensitive agriculture have influenced food choices leading towards improved dietary diversity. Nevertheless, there are some areas in the context of Pakistan that requires focus for further improvement in the NSA. In the next phase of the project focus could be on improvement in information on latest agricultural practices, promotion, utilization of natural resources and increasing demand of fresh vegetables and fruits by promoting commercial production practices. Likewise, improvement in storage units and food that can be consumed all year round could contribute to

survive harsh winters with ease. Although, the interventions seemed to have increased women's contribution and value in agriculture calendar, there is room for improvement to empower them, which can be done through collaboration with women's right organization. Similarly, way to sustain the collaboration between multiple agencies based on the transforming issues and requirements on NSA accordingly can be improved.

8.7 Peru

The overall dietary diversity increased in Peru, with a significant intake of food from diverse food groups in both SUNSAI and MI. The main concerns around diet, seem to be around more focus on theoretical and practical training on the use, hygiene and balancing of food obtained from local production, that can shift focus from the intake of junk food. There is room for improvement to increase nutritional diet and prioritizing traditional food by disseminating information on the nutritional properties of each food can increase the consumption of traditional food. This is particularly important during the pandemic as people are learning the nutritional values of traditional food, which can change the perception of junk food.

While Peru still struggles with low birth weight and exclusive breastfeeding, non- communicable diseases and obesity, the future phase of the program could focus on incorporating nutrition into food processing for making nutritionally rich foods available year-round. This can particularly reduce food preparation time and enable women to spend more time in breastfeeding. Likewise, the next phase could also highlight the underlying causes of inadequate diets beyond food access. It would be interesting to look for more insights such as coordination and gaps within multiple sectors including public, education, health and social safety nets which can help to improve diets.

8.8 Tajikistan

The findings in Tajikistan suggests that there are many systematic and structural factors associated with the low WDDS and food production by the households. To improve the NSA interventions for better dietary diversity access, there is a need to address different underlying causes of low dietary diversity, namely improved health system, taxation, resilience against natural disaster and advanced technology. The impact of Covid- 19 on food consumption cannot be overlooked. Therefore, ability to bounce back from lack of food availability such as storage units and food access throughout the year is required. Furthermore, combining multi sectoral agencies, women's empowerment, non-food production related income, food prices and strengthening of local institutions can influence improved nutritional status among women in Tajikistan.

9 Conclusion

The NMA phase II countries have different geography, economic, social and environmental situations. The baseline and endline findings of the eight countries are very context specific, yet there are some general trends that were observed across the mountain regions. The SUNSAI and MI findings suggest that overall, there has been improvement in enabling men, women and children in mountain areas to consume more diverse diets containing sufficient, safe and nutritious food. This is more prevalent is some countries with higher score such as Kyrgyzstan, Nepal and Pakistan under SUNSAI. Likewise, Nepal, Kyrgyzstan and India under MI. Similarly, under MDD-W the findings suggested all the intervention countries have the high percentage of woman who reported to consume more than 5 food groups in the endline. The highest increase under SUNSAI were reported for India, where in the endline 90% of the women and under MIs Peru where 91% of women consumed food from more than 5 food groups.

Across the countries, there were several themes that were notable. First, the knowledge and awareness about the nutritious food and NSA seemed to have improved in every intervention country. In addition, the participants seemed to be more aware of the importance of the food diversity and also understood the nutritional value of food based on different age and gender requirements. This impact was attributable to the effective collaboration between multiple institutions including public and private sectors that promoted campaigns and actions to promote health and nutrition, which needs to be sustained.

Second, the value of traditional food and underutilized crops seems to be growing as participants were more aware about the NSA. This was more distinguished during the Covid-19 pandemic, where people seemed to have been aware about the nutritional benefits of the traditional food and reported to have decreased there consumption of processed/ junk food, due to an increase in market food prices. The market surveys also provide promising production sales as there is increasing demand for organic food. Therefore, future programmatic focus should be to disseminate information on the nutritional properties of traditional foods accompanied by developing creative narrative around dietary diversity and nutritious food through marketing. Similarly, more investment and support for production/marketing of traditional crops and mountain niche products could be a focus.

Third, socially only few countries seemed to be performing better in terms of balanced decision making between genders. This trend is more prominent in Ecuador and Peru. In other countries, the rigid traditional norms and social expectations seemed to have prevented women from participating in decision making. This is also true in the case of allocation of food, where girls are given less food and often do not receive the most nutritious foods. On other cases, such as Ethiopia, the children get priority for nutritious food, preventing women from consuming a diverse diet. However, in some cases such as Pakistan, kitchen gardening activities have contributed to the roles and responsibilities of women in the agriculture cycle. To improve the situation, it is essential to have active collaboration with all relevant stakeholders particularly women affair offices to influence behavioral changes regarding gender sensitive nutrition awareness to influence gender norms.

Fourth, the impact of climate change and its direct impact on irrigation is new issue that is observed in the NSA phase II. Across countries such as Nepal, India, Pakistan and Peru, the impact of climate variability seems more threatening as it is affecting the cultivation pattern, increased pests, decreasing soil fertility and imposing restrictions on crop choices. To mitigate this, future interventions could focus on climate resilient agriculture methods to increase food productivity under climate variability with proper understanding on the use of pesticides.

Other prominent findings include out migration affecting self-sufficiency in terms of agriculture in the regions. More availability of junk food, human-wildlife conflict, harsh winter conditions and quality of food intake that have contributed to barriers for improving dietary diversity. To alter the situation, the

future program should focus on food availability through improving food processing and storage units to ensure consumption of nutritious food and dietary diversity all year round.

Overall, the NMA phase II findings suggest having improved diets in mountain areas through SUNSAI and MI by ensuring the sustainability of the capacities of the RSPs. The results indicate improvement in the intake of a diverse diet among women as well as an increase in knowledge about the NSA in most intervention countries, except Tajikistan. The participants seemed to be consuming more meals than before and understood more about dietary diversity which they introduce in their everyday meal. The changes in diets and production systems seem to have added knowledge, better attitudes and improved practices associated with food consumption and production leading towards improved diet and nutrition under both SUNSAI and MI. In addition, with the extra income earned by selling the production the participants also had spillover effects in term of disposal income spent on health, education, clothing etc. Furthermore, the participants also seemed to be promoting the NSA and influencing others to adopt it.

Moreover, the diverse themes that were observed across the countries such as safe and nutritious food, climate change, rigid gender norms, human-wildlife conflict, increasing value of traditional food signifies issues that needs to be addressed to achieve healthier, sustainable and equitable food systems in the mountain regions. The sustainable food system in mountain regions requires economic, social, cultural, and environmental bases to contribute to food security and nutrition for present and future generations. Therefore, to improve the nutrition and dietary diversity status in mountain regions, the food systems thinking with broad set of actors and drivers could be implemented embedding the concept of sustainability within it.

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Appendix 1

The table below elaborates on the types SUNSAI implemented in NMA phase II intervention countries.

Countries	SUNSAI 1	SUNSAI 2	SUNSAI 3	SUNSAI 4
Ecuador	• UTOPIA community basket sought to support families to commercialize farm products			
Ethiopia	• Egg production and home gardening by using poultry manure, minimizing post harvest lost through market linkage and improving nutritional status via food processing and dietary modification			• Vegetable production using home gardening, minimizing post harvest lost through market linkages and improving nutritional status via complementary food (local name MITEN) preparation and dietary diversification • Improving organic production, market linkages, dietary diversity, post-harvest management and nutrition status of women and their children through nutrition education using health belief model and home based food processing technology • Enhancing production of vegetables for households and local community consumption • Backyard organic vegetable production to produce organic vegetables and consumption of dietary diversification • Keyhole gardens and small holder gardening to increase vegetable production, women nutrition and climate change resilience • Promotion of dietary diversity, diverse consumption and organic vegetable production
India				• Increase production of local crops and consumption of nutritious foods to improve diet diversity by diversified farming, school education, and market support for selected crops. • Improvement of diet diversity by diversified farming with an objective

Countries	SUNSAI 1	SUNSAI 2	SUNSAI 3	SUNSAI 4
				to increase production of local crops and consumption of nutritious foods among the children from 0-6 years, adolescent girls, pregnant women and lactating mothers through convergence with government program, enhancing production & consumption and awareness raising
Kyrgyzstan	• Practical workshops for the construction and use of mobile fruit driers to be shared in the community	• Expansion and promotion of fisheries to improve dietary diversity through increased fish consumption		
Nepal	• Construction of cost-effective post-harvest unit such as solar cool chambers and solar chimenies for processing crops • Capacity development of farmers about production and post-harvest technology of local crops for production, utilization, processing promotion, marketing and branding	• Establishment of a nutrition mill and operations support to produce flour at local level, and develop its local brand in the market • High value agriculture inclusive business (HVAIB) for improved technical knowledge and skills for bean farming	• Campaign for nutritious food consumption to produce and consume vegetables, fruits as well as local agricultural crops • Nutrition dedicated radio programme to promote consumption of nutritious foods	• School nutrition gardening to preserve and promote the local indigenous crops by linking to the local market with production, use and processing of the food products • Promoting organic school and home gardening for agriculture-based nutrition (POSHAN) for improved knowledge of agriculture-based nutrition
Pakistan	• Promotion of niche agricultural value chains for crop diversification, revival of traditional crop cultivation and integration of value chains in the cropping system	• Agriculture market support initiative to increase income, minimization of pre and post-harvest losses, product diversification and tree conservation • Mushroom Production, Preservation and Commercialization	• Advocacy for changing dietary habits among school children for increased awareness on nutritious food and reduced consumption of junk foods	• Compost making training and preparation of compost to promote vegetable production and consumption value chain based on sustainable agriculture principles • Diversity in local cropping for improved dietary diversity, amongst nutrient deficient women and additional income
Peru	• Development of sustainable food systems by establishing participatory Guarantee Scheme (PGS) to incentivise more farmers to grow organic food, integrating new NSA practices to increase the diversity of their diets • Capacity development in productive diversification to improve family nutrition levels and production value	• Diversification of production to increase production of local nutritious foods and improve production capacities	• Diet improvement to strengthen healthy eating, diversified diets and hygiene • Andean diversity and market initiative to construct greenhouses, include crop diversity in family diets, and sell farm products to local and/or high value ecological markets	• Promotion of sustainable food value chain to increase awareness about healthy diets

Appendix 2

The appendix below provides elaboration on the types of MI implemented in NMA phase II countries:

Ecuador

In Ecuador there were 6 MI implemented:

1. Implementation of family gardens
2. Implementation of organic gardens to improve the food diet
3. Implementation of organic vegetable gardens to improve the nutrition of families
4. Improvement of agricultural production with the incorporation of organic fertilizers to contribute to food security
5. Improvement of agricultural production with the incorporation of organic fertilizers to contribute to food security
6. Family gardens for nutrition and quality of life of women in rural households

Ethiopia

The MI are categorized into 11 types in Ethiopia:

1. Healthy organic poultry and vegetable production & consumption for self consumption, awareness and marketing
2. Improve awareness of child feeding for self consumption and awareness
3. Improve dietary status of pregnant and lactating mothers using a variety of recipes for self consumption
4. Improvement of child nutrition using organically produced diverse vegetable and fruit for self consumption, awareness and marketing
5. Awareness regarding the use of diversified food
6. Enhancement and sharing diverse food production and consumption in home yard for self consumption
7. Awareness on enhancement of diverse organic agriculture production for self consumption and awareness
8. Increase production and consumption of organic vegetable and dietary diversity for self consumption, awareness and marketing
9. Increase healthy organic vegetable and production & consumption of dietary diversity and market linkage for self consumption, awareness and marketing
10. Increase poultry Production, utilization of organic vegetables and poultry product for self consumption, awareness and marketing
11. Increasing Production of organic vegetables, utilization of organic fruits/vegetables and creating marketing linkages for self consumption, awareness and marketing

India

In India, the micro-interventions for nutrition-sensitive agriculture interventions are clustered into ten groups:

1. Cattle rearing for self consumption and market
2. Clean water for drinking in School for improved school hygiene and WASH
3. Composting and vermi composting for self use and market
4. Kitchen Garden for self consumption and market
5. Cooking competition for awareness raising on traditional food
6. Menstrual hygiene for awareness generation and supply of sanitary napkins
7. Nursery for plants and vegetable seedlings
8. Mushroom for self consumption and market
9. Poultry for self consumption and market
10. Seed Bank deed preservation and exchange

Kyrgyzstan

There are eight MI in Kyrgyzstan with the following topics:

1. Organic vegetable and dry fruits for self consumption & marketing
2. Livestock incubation of domestic animals
3. Bee keeping for self consumption & marketing
4. Vegetable greenhouses drip irrigation for self consumption and marketing
5. Fruits and vegetables drying for self consumption and marketing
6. Vermi compost production for promoting indigenous crops
7. Home pastry for self consumption and marketing
8. Dissemination of information to the media for nutrition

Nepal

In Nepal, there are seven MI to support nutrition-sensitive interventions:

1. Awareness raising on NSA through street drama, media mobilization
2. Bee-keeping for self consumption and marketing
3. Conservation techniques to promote indigenous crops, organic fertilizers (vermi-compost) and pesticides, etc
4. Fruit tree production to promote walnut nursery and fruit production for nutrition
5. Poultry farming for rearing back-yard poultry for self-consumption and marketing
6. School and kitchen gardening for vegetable production for self consumption and nutrition awareness
7. Value addition activities with local products for processing bean, nutrition mill and post harvest marketing

Pakistan

The nutrition sensitive interventions in Pakistan are clustered into 19 topics

1. Awareness raising regarding NSA
2. Hen rearing and eggs production
3. Kitchen gardening for self consumption
4. Livestock production for self consumption
5. Mushroom production for self consumption and marketing
6. Vegetable production & selling for marketing
7. Apple fruit nursery for marketing
8. Apricot drying for improved techniques
9. Fruit nursery, processing and production for commercial production, marketing and improved techniques
10. Medicinal herbs to use traditional medicine system
11. Organic dry fruit and orchard for marketing
12. Organic peas prod for self consumption and marketing
13. Organic veg. and herbs for self consumption and marketing
14. Olive production for self consumption and marketing
15. Organic beverages for self consumption
16. Organic fertilizer for self utilization and marketing
17. Food processing and technology for commercial production
18. Fermentor technology of organic farming and Drip irrigation technology
19. Garlic production for self consumption and marketing
20. Onion production for self consumption and marketing

Peru

In Peru, the MI were categorized into 17 clusters:

1. Vegetable greenhouses for self consumption and marketing
2. Organic vegetables and andean grains for self consumption
3. Strawberries production in greenhouse for self consumption and marketing
4. Campaigns in nutritious food preparation for self consumption
5. Agroecological garden vegetable for self consumption and marketing
6. Chicken raising and gardening for self consumption
7. Dairy product for self consumption

8. Awareness in good food practices for improving healthy diets
9. Heirloom vegetables for self consumption
10. Implementation of educational didactic material in educational sessions for improving healthy practices and healthy diets on schools
11. Hydroponics vegetables for self consumption
12. Guinea pig production for self consumption
13. PGS and marketing for improving agroecological practices and marketing
14. Integral Agroecological farm - agrobiodiversity for self consumption and marketing
15. Andean and native fruit for self consumption and marketing
16. Mushroom production for self consumption and marketing
17. Technical irrigation for improve water use for improve use of water on farming

Tajikistan

There were 6 MIs implemented in Tajikistan for NSA under MI:

1. Fruit dryers tray or frame for quick and convenient and high-quality drying of vegetables, fruits, herbs
2. Crates and bee hives to increase the number of hives and honey production
3. Egg-incubators technology for hatching egg production for reproducing pure-bred birds and producing eggs for hatching hybrid birds according to agricultural requirements
4. Milk separators for the domestic production of cream from milk
5. Grain crusher for easy and quick fodder preparation for animals at home
6. Butter churn to produce home-made butter from natural milk.

Appendix 3

Peru disaggregated analysis for the each SUNSAI categories

The following section presents changes in the WDDS and production of food groups under each SUNSAI category reflecting the changes in the consumption/production and its impact on the food groups.

SUNSAI 1 (Whole value chain focus with focus on nutritional improvements through increased incomes)

Consumption

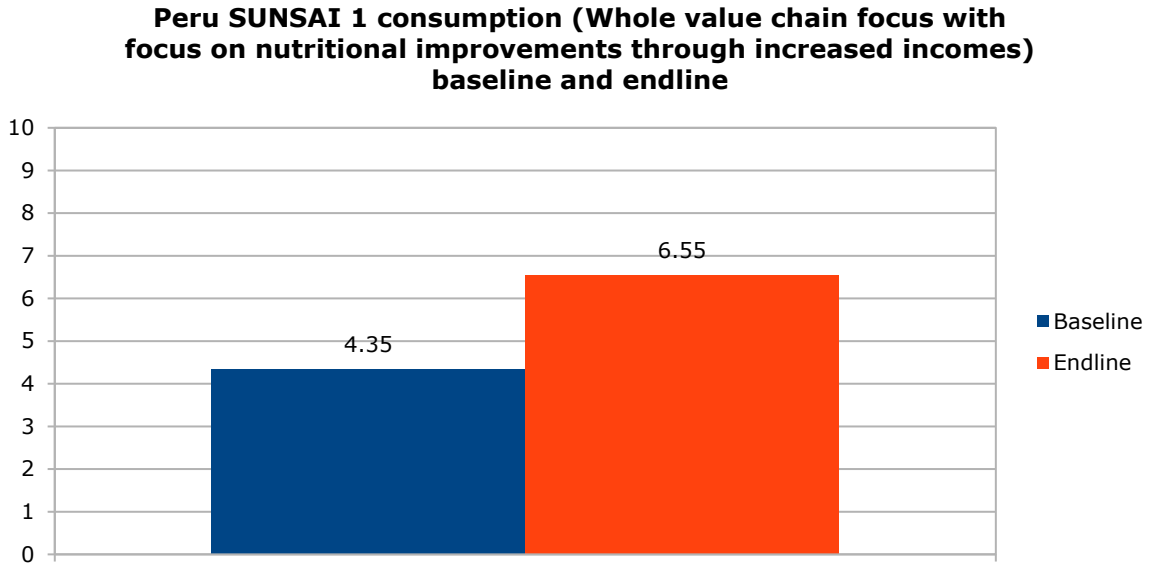

Figure 70 *Comparison of average WDDS in Peru SUNSAI 1 baseline and endline*

The focus of SUNSAI 1 is to improve the whole value chain for a number of nutrient dense crops, with the assumption of nutritional improvements coming from increased production diversity and incomes. The total number of respondents were 250 in the endline. The results reflect a trend of improvement in the dietary diversity of the women under SUNSAI 1. There has been a significant increase in the average number of food groups consumed under SUNSAI 1 between baseline and endline with P=0.02.

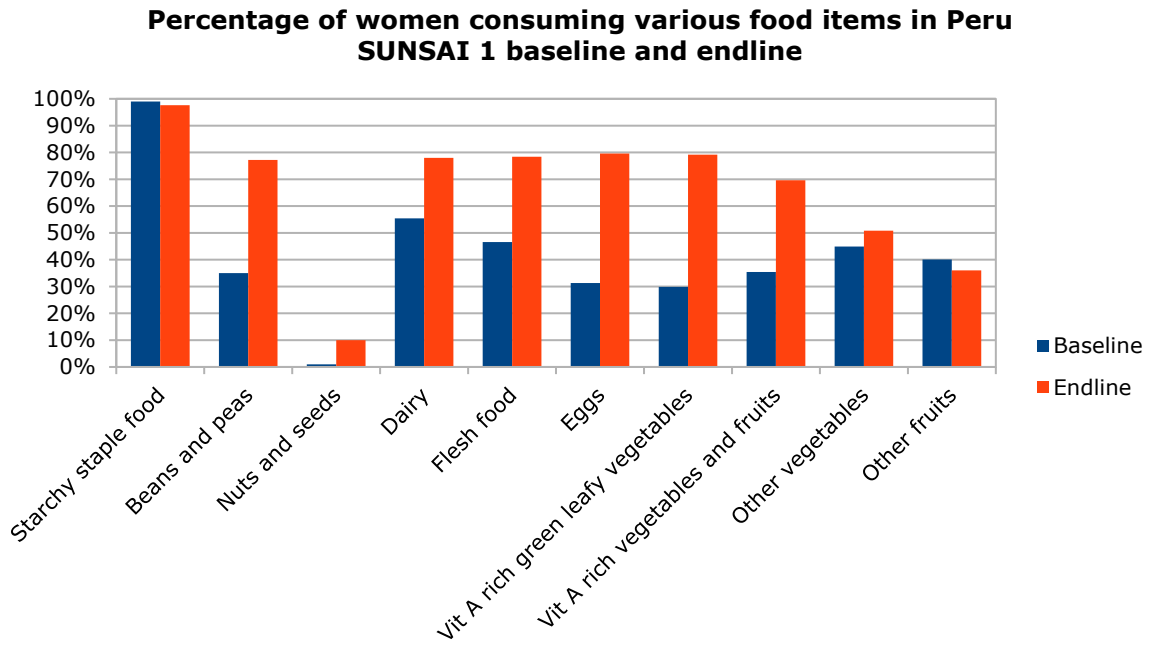

Figure 71 *Percentage of women consuming various food groups in Peru SUNSAI 1 baseline and endline*

The Figure 71 shows the categorization of consumption of ten food groups in Peru SUNSAI 1. There is an increase in women's diets based on a beans and peas, eggs, green leafy vegetables. The consumption of nuts, seeds, other vegetables and fruits have not increase in significant quantities compared to other food groups under SUNSAI 1. The number of women who reported to achieve the MDD-W (foods from 5 or more than 5 food groups out of 10) reached more than 97% in the endline, an increase from38% during baseline. The insights form FGDs under SUNSAI 1 suggest a positive behavior associated with increment in feeding activity as the main priority caused by income growth from selling agricultural products.

Production

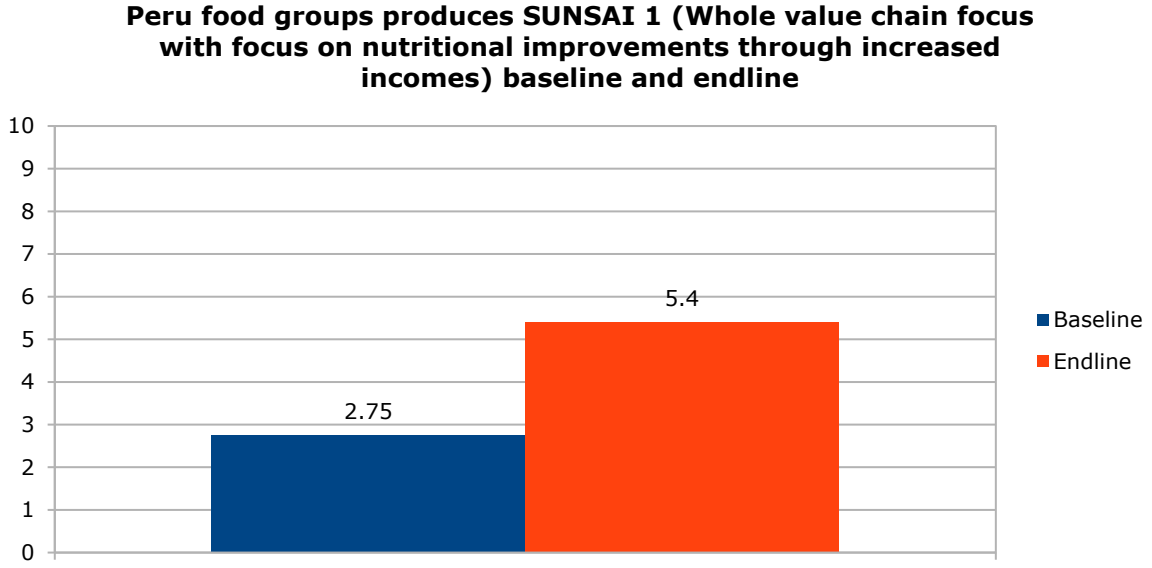

Figure 72 *Comparison of average produced food groups in Peru SUNSAI 1 baseline and endline*

The average number of food groups produced by the household of the respondents was significantly increased for SUNSA 1 after the baseline (P=0.00). The graphs show an increase in the production of food groups from 2.75 to 5.4 in endline among the 245 respondents.

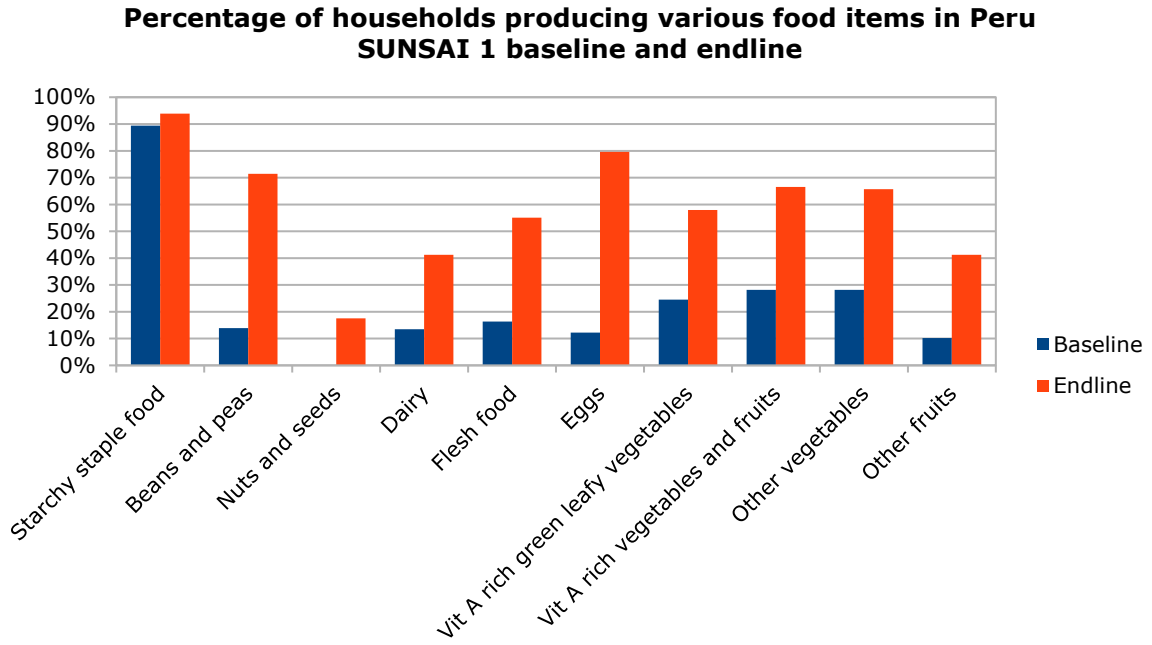

Figure 73 *Percentage households producing each food group Peru SUNSAI 1 interventions during baseline and endline*

The graph in Figure 73 compares the number of food groups produced by the households of the women households across the food groups in Peru. The largest increase was observed in egg production followed by beans, peas, vitamin A rich vegetables and fruits and vegetables.

Under SUNSAI 1, the intervention supports the consumption and production of protein enriched eggs, beans, peas and vegetables. The results in Peru show a positive correlation between value chain focus on nutritional improvements through increased incomes and dietary diversity. Other studies show similar finding. In a study conducted in India, there was an association between crop, income diversity and dietary diversity. The findings have important implications for understanding how crop specialization and increased income diversity from two pathways: consumption of variety of food crops and sale of crops in the market for income generation that can be used to buy broader variety of foods from markets (Singh et al., 2020). The results suggest that the income pathway to nutrition can support dietary diversity among women.

Peru SUNSAI 2 (Whole value chain focus on specific crops with focus on nutritional improvements through increased incomes)

Consumption

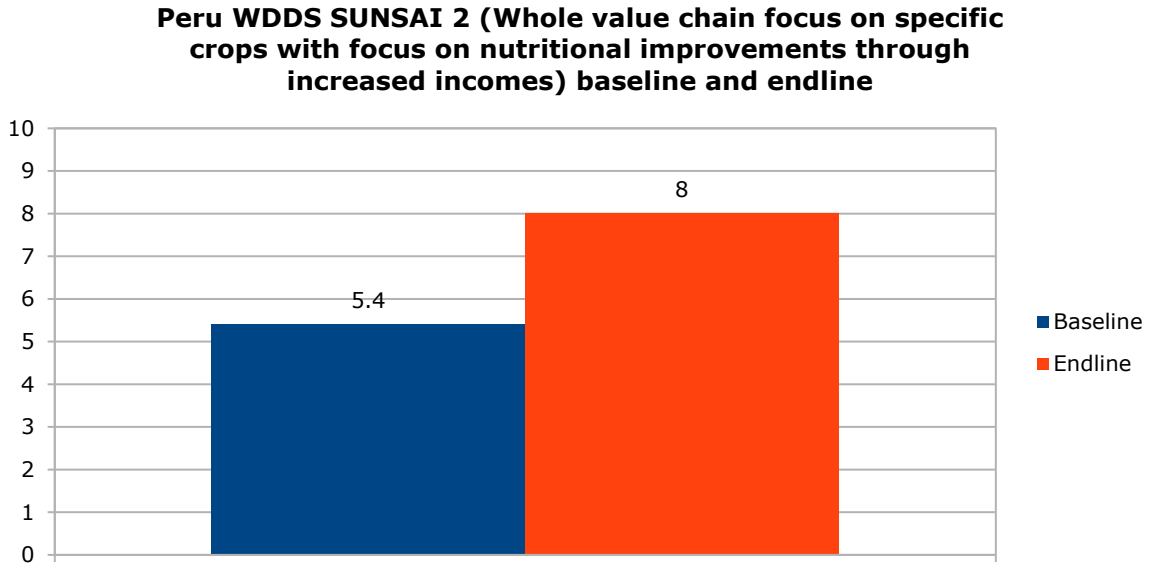

Figure 74 *Comparison of average WDDS in Peru SUNSAI 2 baseline and endline*

SUNSAI 2 has the highest overall WDDS score of all SUNSAI interventions in Peru. The overall average WDDS score for SUNSAI 2 increased significantly of +2.6 as compared to the baseline based on 56 respondents. SUNSAI 2 also had the highest overall average WDDS during endline (8). The average number of food groups consumed by women under SUNSAI 2 increased significantly (P=0.00).

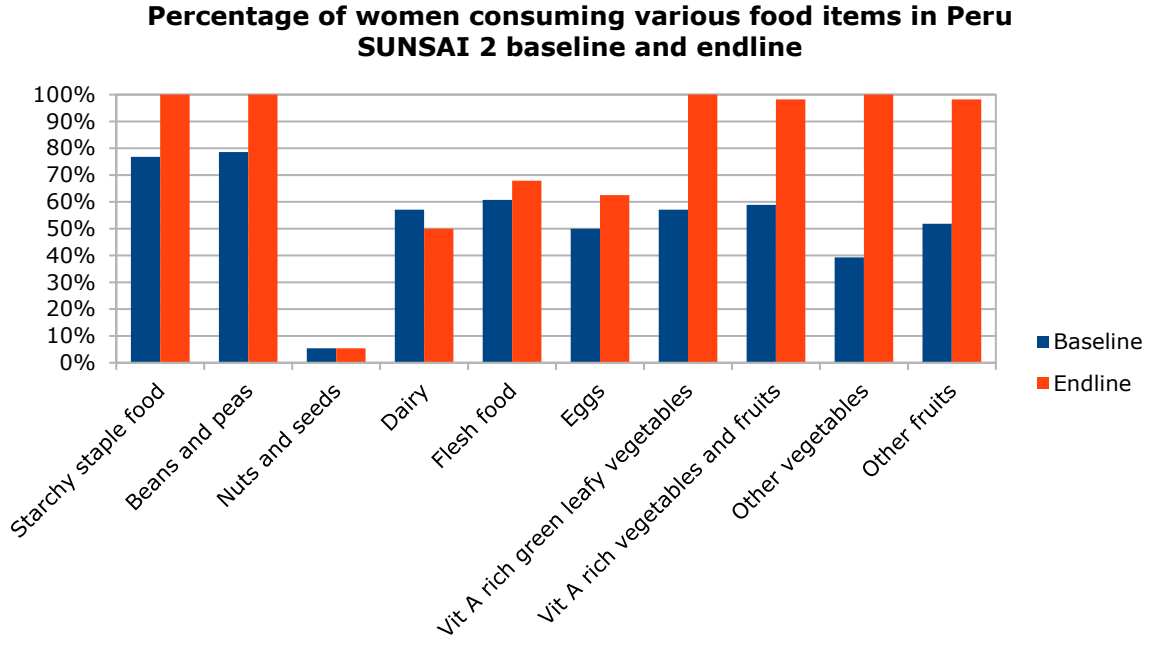

Figure 75 *Percentage of women consuming various food groups in Peru SUNSAI 2 baseline and endline*

Under the SUNSAI 2 intervention, the targeted crop was beans and peas. The largest increment was observed in other vegetables and fruits. The impact the intervention low for nuts, seeds, dairy, flesh food and eggs. Similarly, under MDD-W, the number of women who reported to achieve the adequate diet (foods from 5 or more than 5 food groups out of 10) reached 100% during endline. The highest increase under SUNSAI in Peru. The FGDs confirmed that in Peru beans and peas are a part of the main daily production that are consumed. The increase in the consumption in other vegetables and fruits can be because of seasonal production of fruits and vegetables in addition to beans and peas.

Production

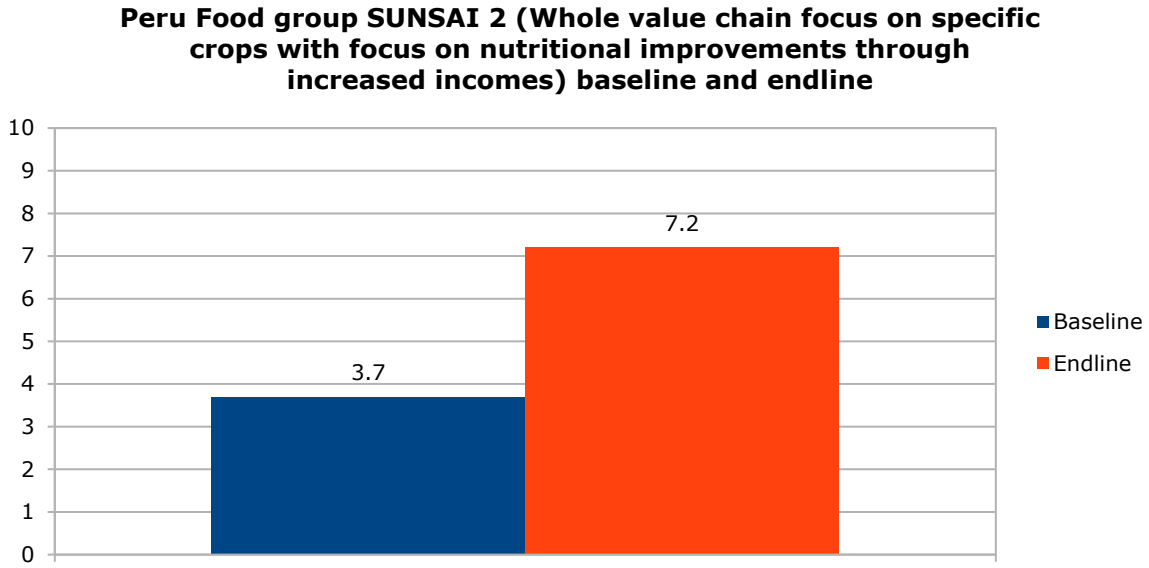

Figure 76 *Comparison of average produced food groups in Peru SUNSAI 2 baseline and endline*

The average number of food groups produced by households of the 56 women respondents under SUNSAI 2 increased from baseline to endline. Overall, the average number of food groups produced in Peru under SUNSAI 2 increased significantly ($P<0.05$) from 3.7 at baseline to 7.2 during endline.

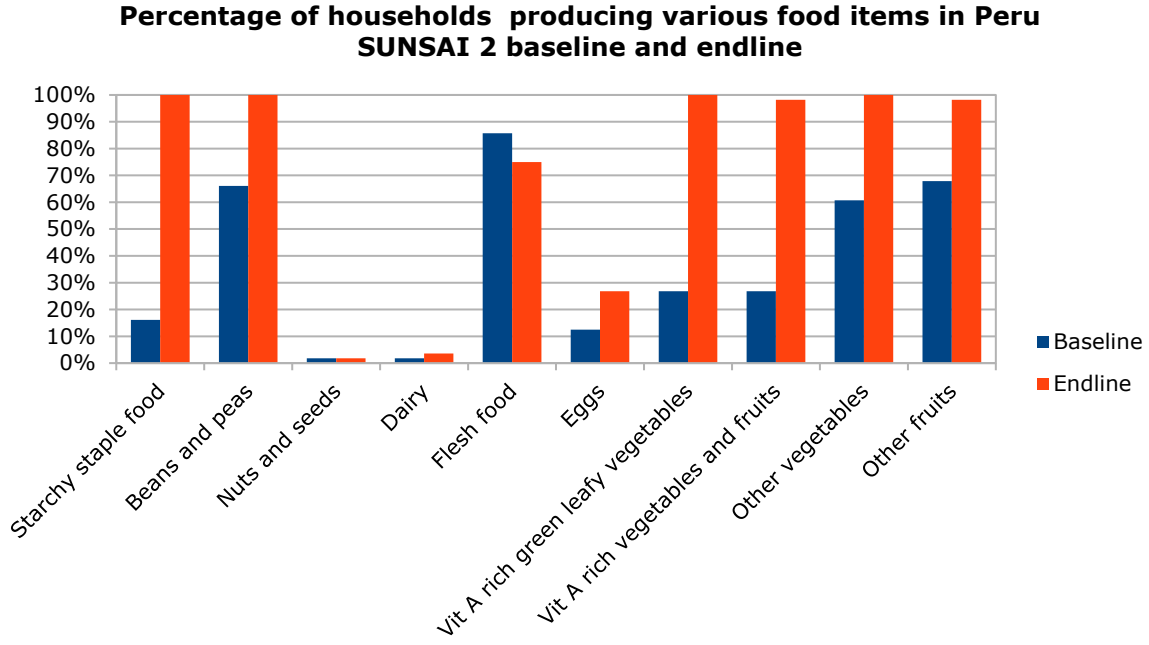

Figure 77 *Percentage households producing each food group Peru SUNSAI 2 interventions during baseline and endline.*

The graph in Figure 77 compares the number of food groups produced by the households of the women respondents under SUNSAI 2 intervention. The largest increase was observed for leafy vegetables and Vitamin A rich fruits and vegetables. The production of targeted specific crop beans and peas also increases. Nuts, seeds, dairy and eggs are the least produced under SUNSAI 2 intervention.

In Peru, the findings from the SUNSAI 2 - whole value chain focus on specific crops such as beans and peas with focus on nutritional improvements through increased incomes suggest this type of intervention has the highest score for WDDS and food production. The spillover effect of the targeted food group could be linked to seasonality, as seasonality contributes to food insecurity in mountain regions. It is crucial to focus on neglected and underutilized crops to balance to local food systems and improve farmers' income through a proper value chain (Rasul et al., 2019). Prioritizing local food systems by promoting underutilized crops based on seasonality can generate income from increased from local market as well as reduce dependence on external food items such as junk food. Therefore, it is important to focus on the specific food group based on the seasonal condition.

Peru SUNSAI 3 (Nutrition BCC / consumption promotion)

Consumption

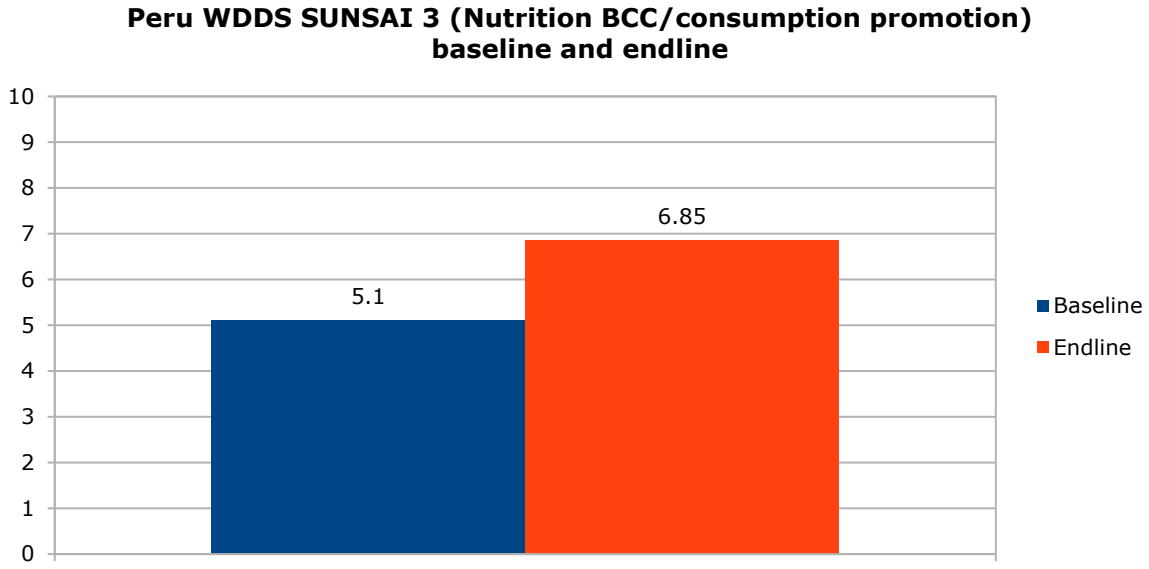

Figure 78 *Comparison of average WDDS in Peru SUNSAI 3 baseline and endline*

The Figure 78 shows the comparison between the average number of food groups consumed by 146 women of reproductive age under SUNSAI 3 in Peru. The graph shows a trend of improvement in the dietary diversity of the women. The increment in WDDS score from 5.1 to 6.85 shows significant increase (P= 0.02).

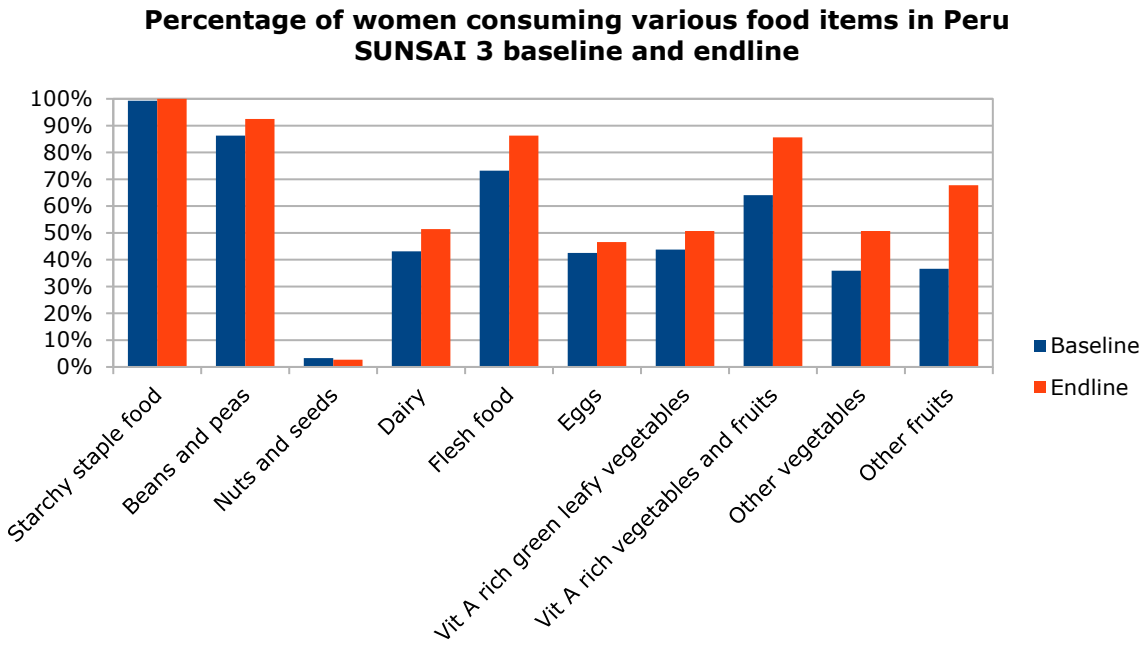

Figure 79 *Percentage of women consuming various food groups in Peru SUNSAI 3 baseline and endline*

The graph shows a trend of improvement in the consumption of food groups except for nuts and seeds. The increment is most remarkable in other fruits and vitamin A rich vegetables and fruits. The evidence from FGDs in baseline indicates that there was lack of knowledge about the properties of foods to include in the diet, limited, food diversification and balance diet in daily food intake. In the endline, the significant increase in vegetables and fruits indicate acquiring additional knowledge through consumption promotion about the nutritional properties that could have increased the consumption. This trend is also reflected in MDD-W, where in the endline the number of women who reported to achieve the MDD-W (foods from 5 or more than 5 food groups out of 10) reached more than 93%, an increase of 18% compared to the baseline.

The findings are similar in another context related to household dietary diversity and nutrition BCC. Ambikapathi et al. (2021) supports that in Ethiopia, women's nutrition knowledge positively associated with improvement in households' dietary diversity. Furthermore, men's nutrition knowledge could be complementary to women's nutrition knowledge and interventions that expand men's role in NSA can improve household nutrition outcome.

Production

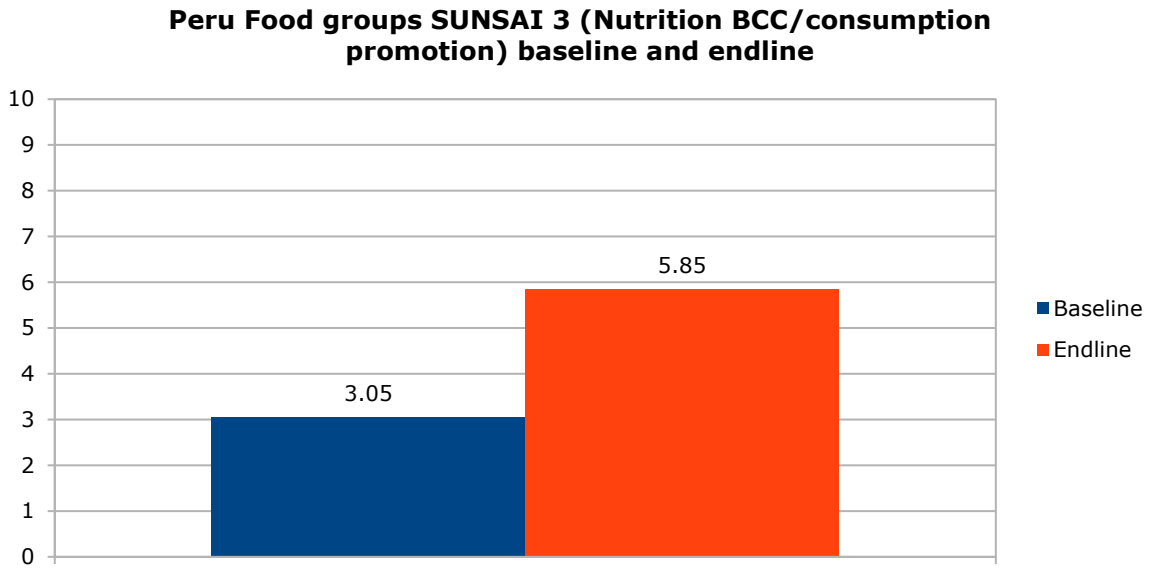

Figure 80 *Comparison of average produced food groups in Peru SUNSAI 3 baseline and endline*

Overall, there was an increase in food production under SUNSAI 3 (from 3.05 to 5.85). However, the analysis from the paired t-test suggests that there has been no significant increase (P>0.05).

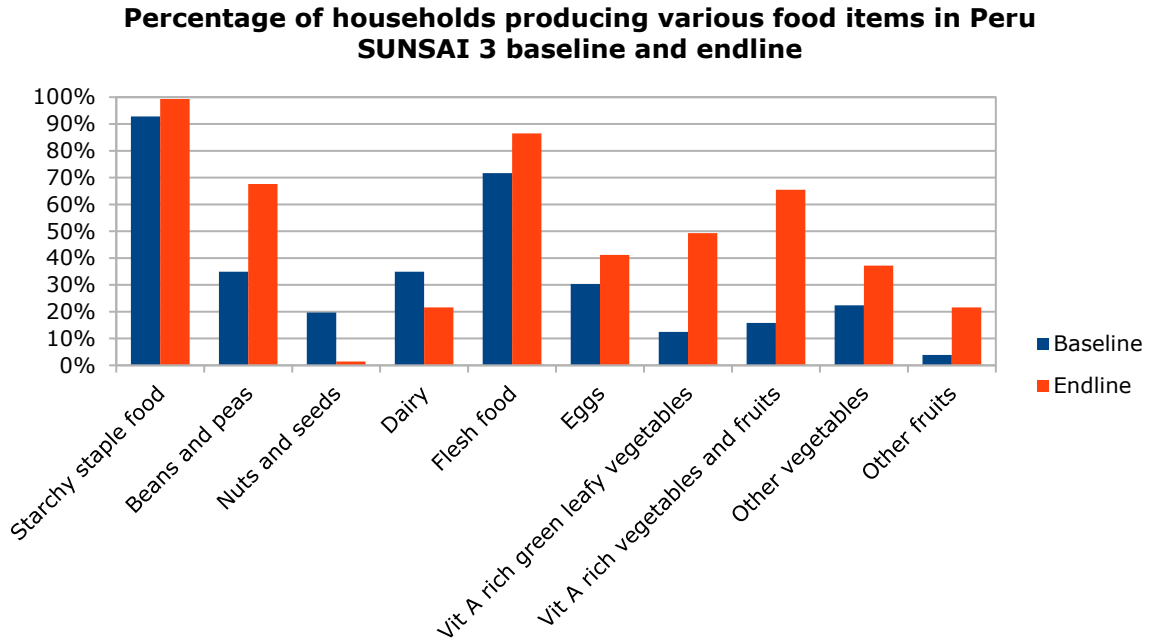

Figure 81 *Percentage households producing each food group Peru SUNSAI 3 interventions during baseline and endline*

Figure 81 above shows that the average number of food groups produced increased from baseline to endline amongst 148 respondents. The highest improvement in production was observed in vitamin A rich vegetables, fruits. beans, peas, flesh food and leafy vegetables. The impact of intervention was insignificant for nuts and seeds due to time taken to mature, and dairy food group. The growth in consumption as compared to production of food groups is different in SUNSAI 3. The difference could

be contributed to the growing use of organic fertilizers implemented in behavior change based on market demands in addition to increase knowledge about dietary diversity.

Peru SUNSAI 4 (promoting the Sustainable Food Value chain in High Andean Communities)

Consumption

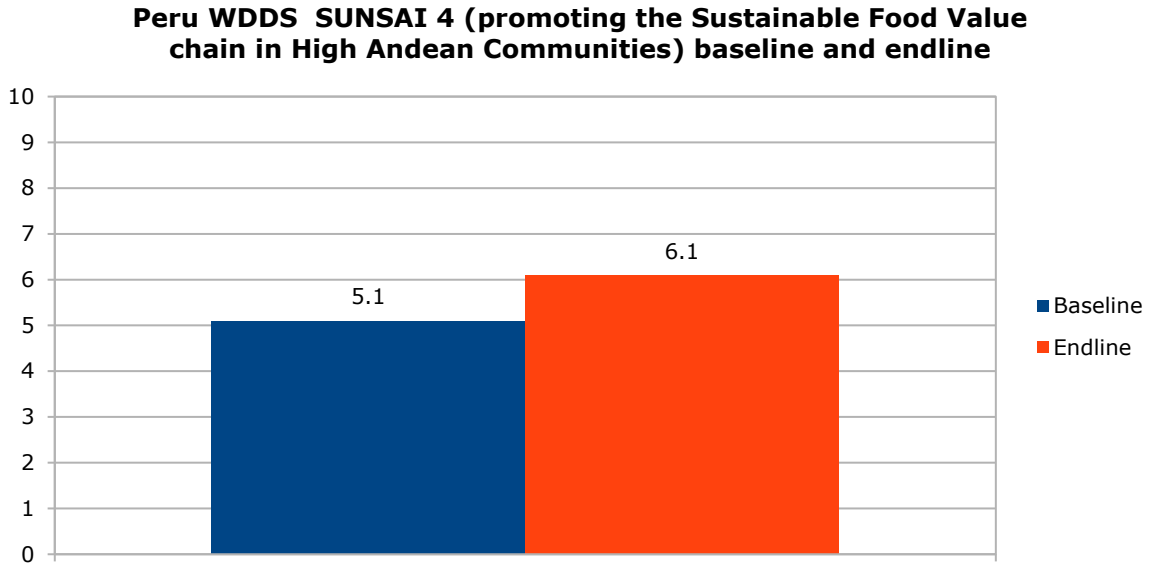

Figure 82 *Comparison of average WDDS in Peru SUNSAI 4 baseline and endline*

Under the SUNSAI 4 intervention, there is an increase in WDDS score from 5.1 to 6.1. But the increase is insignificant (P value>0.05). The SUNSAI 4 linking value chains to improve nutrition from both demand and supply sides has the least score compared to the rest of the interventions.

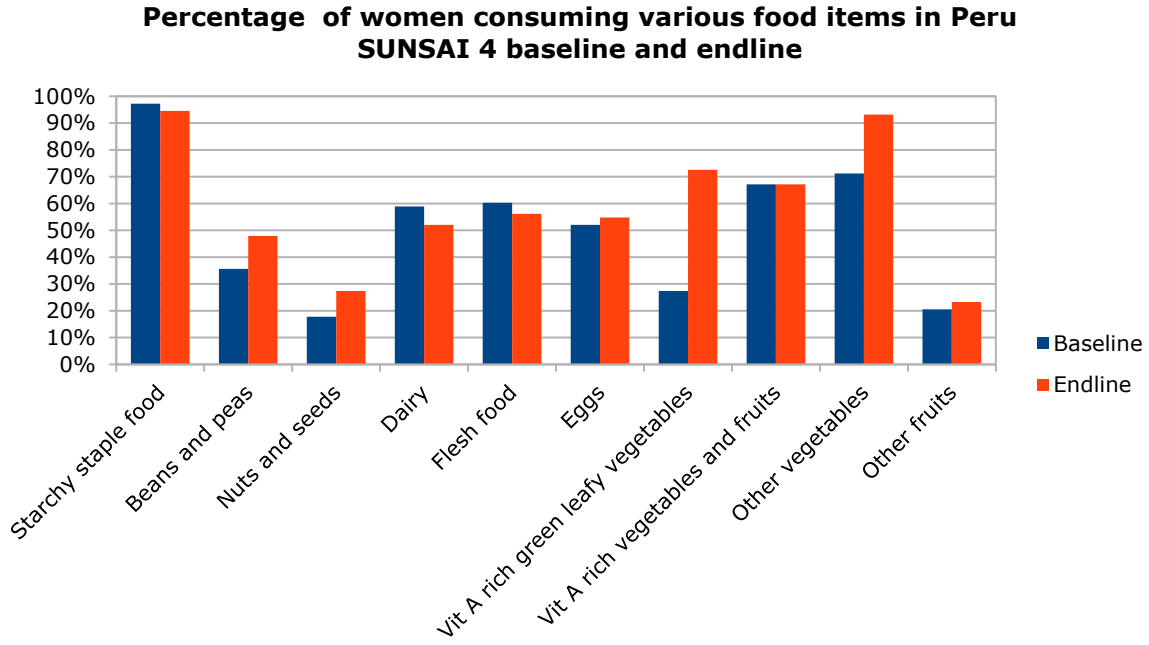

Figure 83 *Percentage of women consuming various food groups in Peru SUNSAI 4 baseline and endline*

Figure 83 shows the total consumption in terms of consumption of ten food groups in SUNSAI 4 intervention with 73 respondents. Consumption wise, there is increase in leafy vegetables and other vegetables compared to other food groups. Nuts, seeds and eggs are not consumed in significant quantities, which could reflect several challenges such as too expensive costs or local preference. The number of women who reported to achieve the adequate diet (foods from 5 or more than 5 food groups out of 10) reached 97% in the endline. The qualitative data suggest that compared to baseline, there was an increase in the consumption of vegetables in the family diet from their own home gardens. Especially during the quarantine stage due to the pandemic.

Production

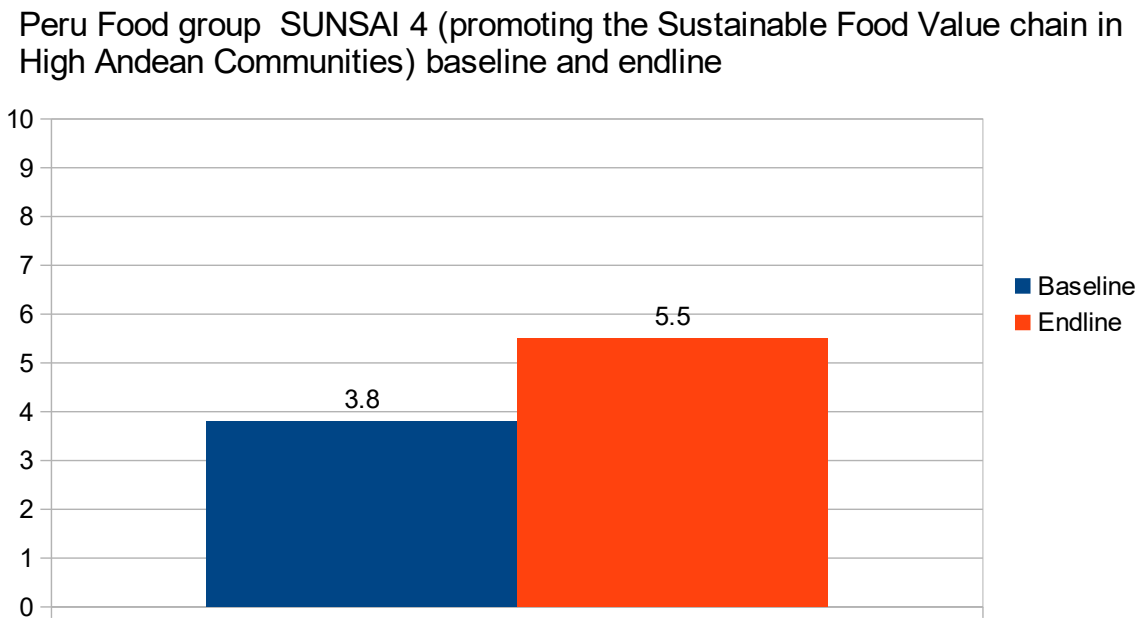

Figure 84 *Comparison of average produced food groups in Peru SUNSAI 4 baseline and endline*

The average number of food groups consumed by women under SUNSAI 4 increased significantly increased for Peru ($P<0.05$). The graph in Figure 84 compares the of food groups produced by the households of the women respondents in baseline and endline that increased from 3.8 to 5.5 indicating more intervention impact compared to consumption.

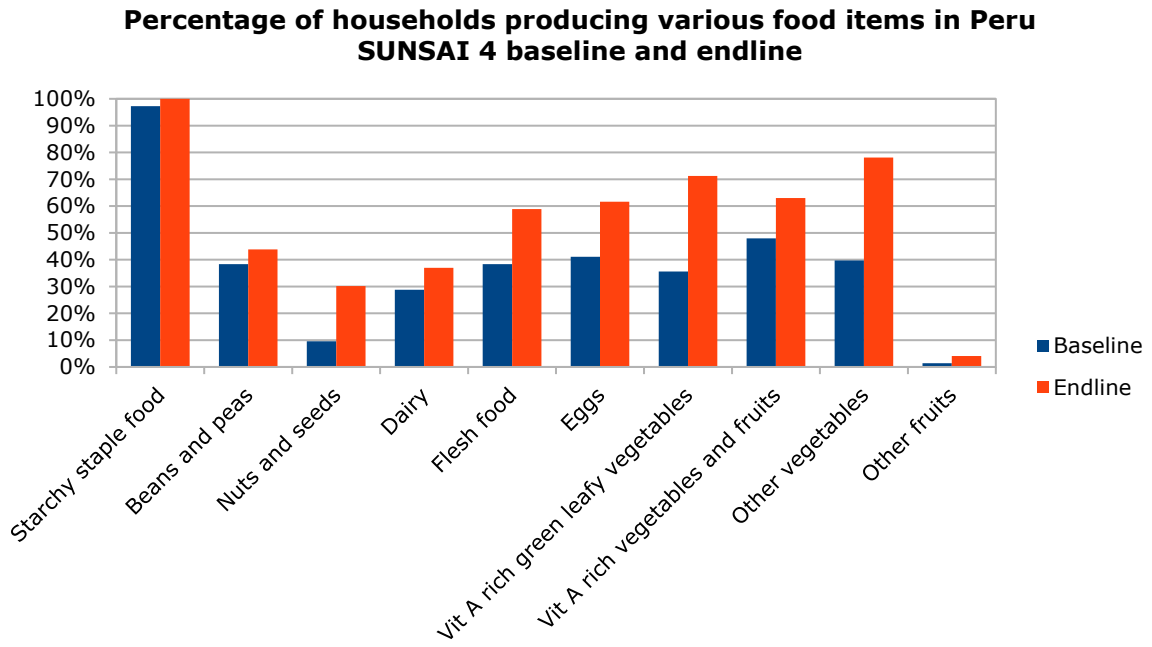

Figure 85 *Percentage households producing each food group Peru SUNSAI 4 interventions during baseline and endline*

Figure 85 presents comparison between the average number of food groups produced during baseline and endline under SUNSAI 4 in Peru for 73 respondents. There is an overall increase in the average number food groups produced, except for other fruits. Like the consumption pattern, the increase in food production is highest for green leafy vegetables and other vegetables which can be associated to the perception as very important food support from their own garden for family members based on FGDs. The SUNSAI 4 intervention concentrated on nutrition improvement both the supply side and demand side. Focus on one aspect can limit the response to dietary diversity and nutrition outcomes. Consumers are crucial for the optimal development of nutrition-sensitive systems.

Studies in other countries supports the finding. In the study conducted in Bangladesh, India and Pakistan, it was evident that nutrition education approach could transcend value chain actors. The success of interventions including both the supply and demand side rely heavily on distribution system, well-functioning markets and consumer awareness of the nutrition value (Maestre et al., 2017). Therefore, interventions like SUNSAI 4 are important be make consumers aware of the nutritional benefits diverse diet that can support improve in nutrients enriched food production.

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Report WCDI-21-177

Wageningen Centre for Development Innovation supports value creation by strengthening capacities for sustainable development. As the international expertise and capacity building institute of Wageningen University & Research we bring knowledge into action, with the aim to explore the potential of nature to improve the quality of life. With approximately 30 locations, 6,800 members (6,000 fte) of staff and 12,900 students, Wageningen University & Research is a world leader in its domain. An integral way of working, and cooperation between the exact sciences and the technological and social disciplines are key to its approach.

To explore the potential of nature to improve the quality of life

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