Report on dietary diversity survey

Conducted by NESFAS in 2018 within the "No One Shall Be Left Behind Initiative"

Biodiversity for Food, Nutrition and Energy Security for 3000 Households in Meghalaya and Nagaland, North East India

The report developed in 2019 by:

Lukas Pawera

Faculty of Tropical AgriSciences
Czech University of Life Sciences Prague
Consultant at the Indigenous Partnership for Agrobiodiversity and Food Sovereignty

Under continuous discussion with:

Bhogtoram Mawroh

Research associate at NESFAS

Table of Contents

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Executive summary

Nutrition and dietary diversity are one of the critical global issues and challenges. In North-east India, poor nutritional status of the communities should be addressed as soon as possible to achieve human and socio-economic development. The previous research has called for better use of extraordinary agrobiodiversity and for strengthening indigenous food systems to improve diet sustainably in the region. However, without knowing food and dietary gaps of the communities, any progress can be hardly made. The main objective of this survey was to assess the dietary diversity of the communities living in the area where NESFAS implements a project aiming to tap the potential of agrobiodiversity for food, nutrition, and livelihood. The survey employed different methods looking at the socio-demographic characteristics, land use profile, and dietary diversity. The survey ran simultaneously with agrobiodiversity mapping (see the separate report). The key findings from this survey showed that only 36% of the respondents are reaching a diverse diet (consuming 5 or more food groups out of 10). In terms of particular districts, the highest proportion of respondents reaching a balanced diet was found in West Garo Hills, followed by Nagaland, Ri Bhoi, and West Jaintia Hills. On the contrary, the worst situation was identified in West Khasi Hills and East Khasi Hills. Looking at the foods consumed, the most commonly consumed food groups were Starchy staples (100% of the respondents), Other vegetables (87%), and Meat (79%). On the other hand, the most under-consumed food groups were Dairy (0%), Nuts and seeds (8%), Eggs (13%), and Other fruits (25%). From the socio-demographic factors, the most apparent positive relationship with dietary diversity seems to have a higher level of education. This most likely indicates the importance of knowledge and awareness for dietary choices. In addition, economic well-being also showed to play some role. Therefore, it is recommended to improve dietary diversity of the poorest ones and also of adolescent girls who showed to have low dietary diversity. The food groups missing in the diets across the studied areas were identified, and this essential information will guide the project implementation to improve dietary diversity more precisely. Other useful findings, suggestions, and lessons learned are also present in the report.

1. Introduction and background of the project and survey

Without a balanced diet and adequate nutrition, humans cannot achieve their full physical and intellectual potential. Malnutrition is responsible for more illnesses and health problems than any other cause, and the burden of malnutrition across the world remains unacceptably high (Development Initiatives, 2018). Globally, stunting among children has slightly declined, but there is new evidence that after a prolonged declining trend, there is a reversal rise of world hunger (FAO, IFAD, UNICEF, WFP and WHO, 2018)[1]. A balanced and diverse diet is a foundation of human health, and it has been identified as an essential driver of sustainable development. Therefore, improving diets and ending all forms of malnutrition by 2030 is one of the SDG targets. Practically, when people diversify their diets, and their nutritional status improves, it helps break the inter-generational cycle of poverty and leads to a myriad of benefits and socio-economic growth of individuals, families, communities, societies, and countries. In biodiverse regions, inadequate food intake of Indigenous peoples is often a result of limited knowledge on nutrition, health, and food biodiversity.

In North-East India, Indigenous communities have relied on their Indigenous food systems based on the rich biodiversity of the region, which comprises about 50% of the total biodiversity of India. Yet, food insecurity and undernutrition were found unacceptably high among the Khasis despite rich food biodiversity in Meghalaya State (Chyne et al. 2017). The 2016 National Family Health Survey of Meghalaya undertaken by the Ministry of Health and Family Welfare showed that many children in Meghalaya do not receive the required nutrients already in their mother's womb. It also found that amongst young children (6-23 months), only 24,2% have an adequate diet. Among children below 5 years, 15,3% suffer from wasting, and 43,8% are wasted. Anemia is also a significant concern amongst children in the age group of 6-59 months (Ministry of Health and Family Welfare, 2016). In neighboring Nagaland, more efficient utilization of the rich agrobiodiversity by the Chakhesang tribe appears to be a strong reason for their better nutritional and health status when compared to the rest of India (Longvah et al. 2017). The Indigenous food systems of the region should be therefore revitalized, diversified, and promoted for overall food and nutrition security of the communities. NESFAS, stepping forward with the "No One Shall Be Left Behind" project is strengthening indigenous food systems to improve nutrition and increase livelihood of indigenous communities of Meghalaya and Nagaland with special focus on youth, adolescent girls, women's groups and community elders. It do so by improving the production and productivity of local food systems, by embracing innovations for local livelihood opportunities, and by encouraging higher consumption of micronutrient-rich local foods. The nutrition component is one of the key project pillars and strategic interventions. Dietary diversity has been selected as an indicator for guiding evidence-based intervention and for measuring the project impact. The strength of this tool is the simplicity and thus not only its

[1] This has been associated with increasing cases of global conflicts and also with impacts of climate change. (Development Initiatives, 2018).

use within monitoring and evidence generation but also its possible direct use in public campaigns and for participatory-results sharing of the survey results.

2. Objectives of the survey

- To determine dietary diversity and to identify food groups missing in the diet
- To assess the socio-demographic characteristics and land use profile
- To document the diversity of foods consumed

3. Methodology

3.1 Development and testing of the methodology

The methodology was designed during the previous visit in July 2018 by the fellow and the NESFAS research team. At that time, our team tested the proposed methodology in the Khweng village, and suggestions based on the testing were presented, discussed, and fine-tuned together with NESFAS. The finalized questionnaires were shared with NESFAS and later on in 2018, NESFAS hired and trained data enumerators, which in tandems collected all the data related to dietary diversity and participatory species mapping.

3.2 Study area

Both Meghalaya and Nagaland are characterized by hilly terrain but while the former is a plateau belonging to the ancient Gondwana Massif and the latter is a part of the more recent Arakan Yoma mountain range. The hills rise from the Brahmaputra valley in Assam from about 600 masl up to an elevation of 1800 masl in the east (average elevation is around 1000 masl). Latitude and terrain play a critical role in determining the climate and agro-ecological zonation of the districts. The higher elevations enjoy a temperate climate, whereas the lower altitudes have subtropical and tropical conditions. Rainfall is high in all areas because of the orographic influence on the Monsoon winds, which arrives in June and start retreating by September. Both Meghalaya and Nagaland have very high biodiversity with large evergreen to semi-evergreen forest covering more than 60% of the area. It is in term of ethnic composition where the difference between the states becomes very obvious. While Meghalaya is mostly composed of two distinct tribes, Khasi-Jaintia and Garo, Nagaland has 16 major tribes. The literacy levels in the studied districts vary in between 60-80% (NESFAS, 2017).

Although the whole project area covers 130 villages/communities from the eight districts of Meghalaya and three districts of Nagaland, the dietary diversity survey sampled respondents from 32 villages chosen systematically across all the districts covered by the project. In Meghalaya, specifically, eleven villages were chosen from the East Khasi hills, four from West Khasi Hills, four from West Jaintia Hills, five from West Garo Hills, and five from Ri Bhoi. In Nagaland, three villages were selected from Phek district and one from Noklak district. The particular villages included in the survey were selected by NESFAS, and the main criteria for including villages were to have more than 50 households and village proximity to the road.

3.3 Sampling approach

The sampling of the respondents followed both random and purposive sampling approaches. The random cluster sampling focused on selecting randomly three groups (clusters) of vulnerable populations (1. Women at reproductive age = 14-49 years of age; 2. Elders = 50+ years of age, 3. Youths and adolescents = 10-35 years of age). It was complemented by sampling fourth cluster of Key informants such as custodian farmers (with no age and gender criterion), where knowledgeable informants were found purposively via recommendation and snowball sampling technique (Bernard, 2002). In general, the sampling target of eight women at reproductive age, eight elders, eight youth or adolescents, and eight key informants per village tried to be followed. In total, 997 respondents comprised of 876 and 121 respondents from Meghalaya and Nagaland were interviewed, respectively. **Table 1** shows the sample size in particular districts. In case of proportion of the clusters, 25,6% were women at reproductive age, 23,9% were elders, 24,7% were male youths, and 23,9% were key informants. In terms of gender, the proportion of women and men respondents was 50,4% and 49,6%, respectively. Although the Phek and Noklak districts of Nagaland are shown separately in **Table 1**, further on they were merged together into "Nagaland" for the analysis and throughout the report due to small sample size.

3.4 Ethics, socio-economic information, and land-use patterns

Before the survey, procedure and outcomes of the research were explained to the communities. The Code of Ethics of the Indigenous Partnership for Agrobiodiversity and Food Sovereignty was followed (Indigenous Partnership, 2011), and the free, prior, and informed consent was obtained either in a written or oral form. At the start of the interview, basic socio-demographic information was inquired (i.e. respondent type, climatic season, household location, respondent type, age, ethnicity, gender, marital status, education completed, occupation, household livelihood type, household size, household management, distance to market and forest, participation in other projects). To follow a standard and comparable socio-economic indicator, the questionnaire of Simple Poverty Scorecard for India was followed (Schreiner, 2016). This indicator is being commonly used as a proxy for estimating poverty levels. Considering land-use patterns, the section on accessing, using, and owning land uses was developed. It covered all the main land-use systems, i.e. home garden, shifting cultivation, terrace, rice field, forest, river/lakes, ponds, and others.

3.5 Qualitative 24h-food recalls for measuring dietary diversity

Dietary diversity is an indicator defined as the number of different food groups consumed over the last 24 hours. Dietary diversity score is a validated proxy indicator of dietary adequacy (FAO and FHI, 2016). Different foods and food groups are good sources for various macro- and micronutrients, meaning the more food groups consumed, the better the micronutrient adequacy (Kennedy et al. 2007). A food group is defined as a group of food items that have similar caloric and nutrient content.

The method needed to obtain data on dietary diversity is called qualitative 24hour food recall. A 24-hour food recall is a structured interview conducted to capture detailed information about all foods and beverages consumed by a respondent in the past 24 hours, from the yesterday morning after waking up until night when the person went sleep. Open recall method was used for recalling the foods consumed. The 24hour food recalls were conducted after the ordinary days, i.e. if the previous day was an unusual day, such as celebration, ceremony, or when the person was sick, the food recall was not conducted with that person.

3.6 Data handling and analysis

The primary data collected in the field were transcribed from the filled questionnaires into the Excel working sheets. Subsequently, the data were kept separately in the village-wise datasheets, and the first cleaning and cross-checking process was conducted. Afterward, the analysis started by categorizing all the food items consumed. The less common foods had to be discussed with NESFAS staff, associated field staff, or by phone call with custodian farmers. After the data cleaning and cross-checking, all the foods captured by 24-hour food recalls were finally categorized into the standard food groups. Then the dietary diversity (DD) of individual respondents (number of food groups consumed) was determined. Importantly, also the proportion of respondents reaching the minimum dietary diversity for women (MDD-W) was calculated, where the cut off for a balanced diet was 5 or more food groups out of 10 possible groups (FAO and FHI, 2016). Although the MDD-W cut off 5 is validated for women at reproductive age, we scaled this threshold also for the male respondents to estimate the proportion of the whole community reaching a minimum dietary diversity (MDD). Lastly, the proportions of respondents consuming particular food groups were counted and compared.

Although the food recalls captured the consumption of condiments, the food group of “Condiments” itself was not considered in the total food group count as it does not belong to the 10 standard groups. Condiments are normally excluded as they are eaten in a tiny quantity in less than 15 grams per food. In the present survey, also other food items consumed in an amount less than 15 grams were not counted as any food group (e.g. chutneys, tungtap).

The data were handled and analyzed in Microsoft Excel, foremost via pivot tables, filters, and functions. The descriptive statistics were performed, and the results were interpreted numerically and graphically by tables and different chart types. In case of some missing data for any variable, the respondent was excluded from the analysis of that particular variable, and the results were calculated by means of percentages. For example, while the dietary diversity and land-use data are complete and analyzed for all 997 respondents, the socio-economic data for poverty scorecard are analyzed and showed only for 785 respondents due to some missing data. The poverty scores and poverty likelihoods were calculated using the guidelines (Schreiner, 2016). The scores were converted using new R68 scorecard, with using national Rangarajan line and also the World´s Bank international benchmark for extreme poverty of $1.9/day/person.

4. Results and discussion

4.1 Socio-demographic characteristics and their linkages with dietary diversity

4.1.1 Socio-demographic profile and gendered dietary diversity

Table 1 summarizes the socio-demographic characteristics of the respondents in the studied areas. It also shows the results of dietary diversity from a gender perspective. The analysis showed that the average age of the respondents was 39,7 years. The proportion of genders reached nearly equal ratio, with 50,4% of women respondents. The household size, measured as a number of household members, was 3,4 persons on average. The smallest households were found in Jaintia Hills and Ri Bhoi (2,8 persons), while the largest in Garo Hills (4,8 persons). Looking at the likelihood of living in poverty, the most poverty-stricken region was East Khasi Hills, whereas the lowest poverty likelihood was found in Jaintia Hills. Considering education level reached, Garo Hills showed the highest percentage of respondents who finished high school or higher (57%). On the other side was Ri Bhoi with 30% of respondents completing high school or higher.

Dietary diversity indicators were compared in between women and men, and we can see that women have a slightly more diverse diet than men (4,25 DD score compared to 4,12). Furthermore, 39% of women reached minimum dietary diversity, compared to 34% in the case of men.

Table 1 Socio-demographic characteristics and gendered dietary diversity

Socio-demographic characteristic	East Khasi Hills	West Khasi Hills	West Jaintia Hills	Ri Bhoi	West Garo Hills	Nagaland	Total
Number of respondents	347	128	113	128	160	121	**997**
% of women respondents	52,7	50,8	44,2	47,7	53,8	47,1	**50,4**
Mean age	39,6	37,0	40,5	39,4	38,9	43,2	**39,7**
Mean number of household members	3,1	3,1	2,8	2,8	4,8	3,8	**3,4**
Mean poverty score	35,3	37,4	41,7	44,2	39,4	41,3	**39**
Mean poverty likelihood (%) (National Rangarajan)	29,0	26,8	21,0	21,5	26,2	23,8	**25,8**
Mean poverty likelihood (%) ($ 1.9)	6,8	6,2	4,2	4,9	5,7	5,3	**5,8**
% of respondents who finished high school or higher	32,0	31,5	31,9	30,0	57,2	52,5	**38,3**
Gendered dietary diversity							
Mean dietary diversity score of women	3,90	3,52	4,34	4,66	4,78	4,84	**4,25**
Mean dietary diversity score of men	3,91	3,69	4,16	4,25	4,60	4,35	**4,12**

% of women reaching minimum dietary diversity	28,4	15,4	44,0	47,5	60,5	52,6	**38,8**
% of men reaching minimum dietary diversity	28,0	19,4	34,9	35,6	50,0	41,3	**33,9**

4.1.2 Poverty likelihood and its relation to dietary diversity

Economic well-being and poverty are known to be influential variables affecting diet and nutrition status. However, as the measuring of poverty or economic well-being is generally very difficult, proxy indicators such as Simple Poverty Scorecards are used commonly. These indicators estimate the likelihood that a household has consumption below the chosen poverty line through 10 questions. The India-specific scorecard has been validated and published in 2016 (Schreiner, 2016). In the studied communities, the mean poverty score is 39[2] (median=38). That can be translated into the 25,8% (median=22,9%) likelihood that the household has per-capita consumption below the National Rangarajan poverty line, or 5,8% (median=3,5%) likelihood of having consumption under $1.9/day/person, the World´s Bank international benchmark for extreme poverty. As can be seen in **Table 2**, a group of respondents with worst dietary outcomes were linked with the lowest poverty scores (highest likelihood of poverty), and vice versa, the best dietary diversity results were found for the respondents with the highest scores. Nevertheless, the dietary diversity outcomes are not always increasing with the increasing poverty scores. What is clear is that the most impoverished individuals (scores 0-4) are having the least diverse diet, and they should be prioritized with support of nutrition and livelihood program.

Table 2 Dietary diversity outcomes according to the poverty scores

Score	Poverty likelihood (%) (National Rangarajan)	No. of respondents	Mean DD score	% of reaching MDD
0-4	76,4	5	3,2	0,0
5-9	70,9	19	3,84	31,6
10-14	61,8	43	4,07	37,2
15-19	51,7	65	4,22	35,4
20-24	44,6	71	4,23	31,0
25-29	37,5	83	4,36	44,6
30-34	31,5	59	4,56	47,5
35-39	22,9	77	4,25	39,0
40-44	16,9	93	4,23	35,5
45-49	11,2	75	4,24	36,0
50-54	8,0	66	4,12	34,8
55-59	5,1	37	4,49	51,4

[2] The lower the score, the higher the probability of living in poverty

60-64	3,1	41	4,45	31,7
65-69	1,8	17	4,47	35,3
70-74	0,9	13	3,92	30,8
75-79	0,5	12	4,25	41,7
80-100 (merged)	0,1-0,0	27	4,81	59,3

4.1.3 Household livelihood types and dietary diversity

The households were categorized into three main types of livelihood strategies (**Fig. 1**). The dietary diversity situation was compared among them and showed that the least diverse diet have households engaged in labor activities. The best DD and MDD reached households with regular job and income, while the self-employed household engaged in agriculture or other activities have dietary diversity somewhere in between the two above mentioned livelihood types. There seems to be a transition in household livelihood strategies, and this is causing changes in diets. Deriving livelihood from agriculture labor activities might be associated with an increasing lack of land, and this according to results, seems to be a threat to the diets.

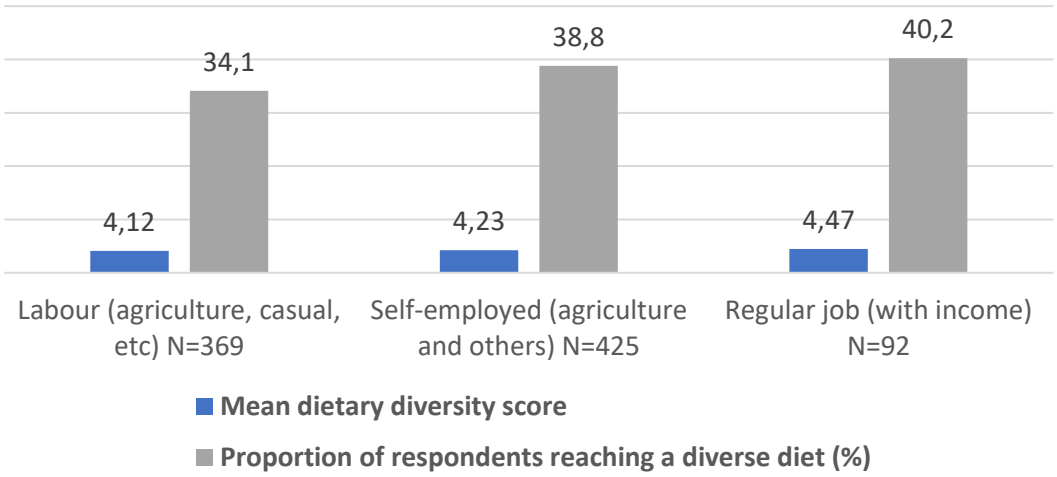

Figure 1 Diversity of diets compared among the main types of household livelihood strategies

4.1.4 Education level and dietary diversity outcomes

Concerning education and its relation to dietary diversity, it can be seen clearly that the respondents with a higher level of education also reached higher dietary diversity (**Fig. 2**). It most likely indicates better general knowledge and awareness of nutrition. However, the higher economic well-being may also play some role (confounding variable).

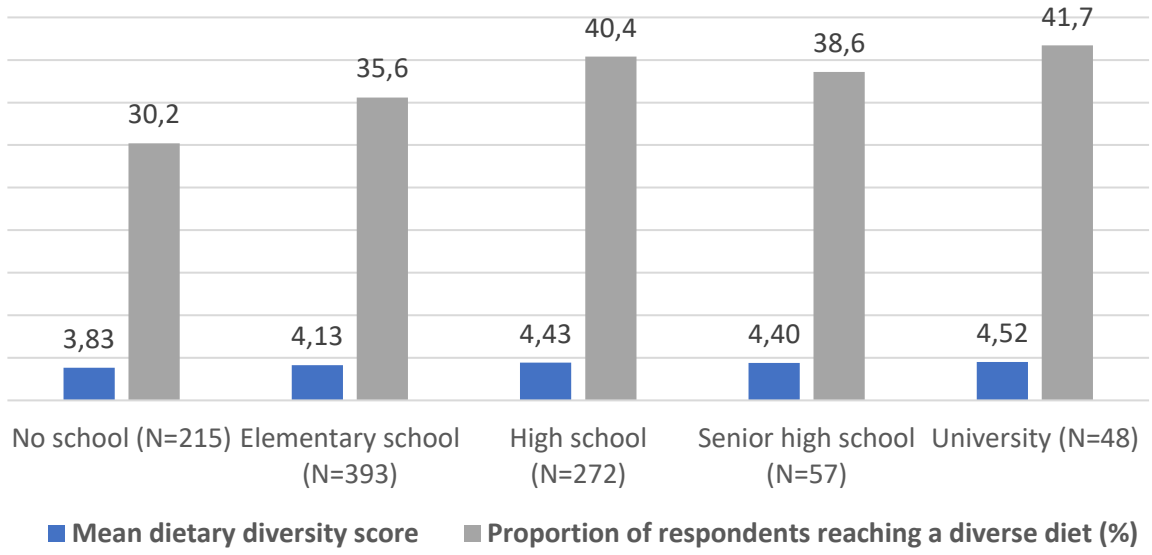

Figure 2 Results of dietary diversity according to the education level achieved

4.1.5 Diet of the different respondent clusters

The description of the clusters is given in the methodology chapter, yet here we showed the data also for the adolescent girls (considered being 10-19 years of age). All adolescent girls interviewed (N=34) were between the age of 14 and 19 years, and therefore they overlap and are covered by the cluster of Women at reproductive age. Despite the small sample of adolescent girls, the results are suggesting that young girls have the least diverse diet, with only 21% of them reaching MDD (**Fig. 3**). On the other hand, it is somewhat surprising that the group of Women at reproductive age reached the best DD and MDD results. In essence it means that with increasing age, adult women are reaching high dietary diversity. The older people and also the key informants such as custodian farmers have rather low dietary diversity. But the youth males have a more diverse diet, with nearly a two times higher proportion of them reaching MDD compared to the adolescent girls.

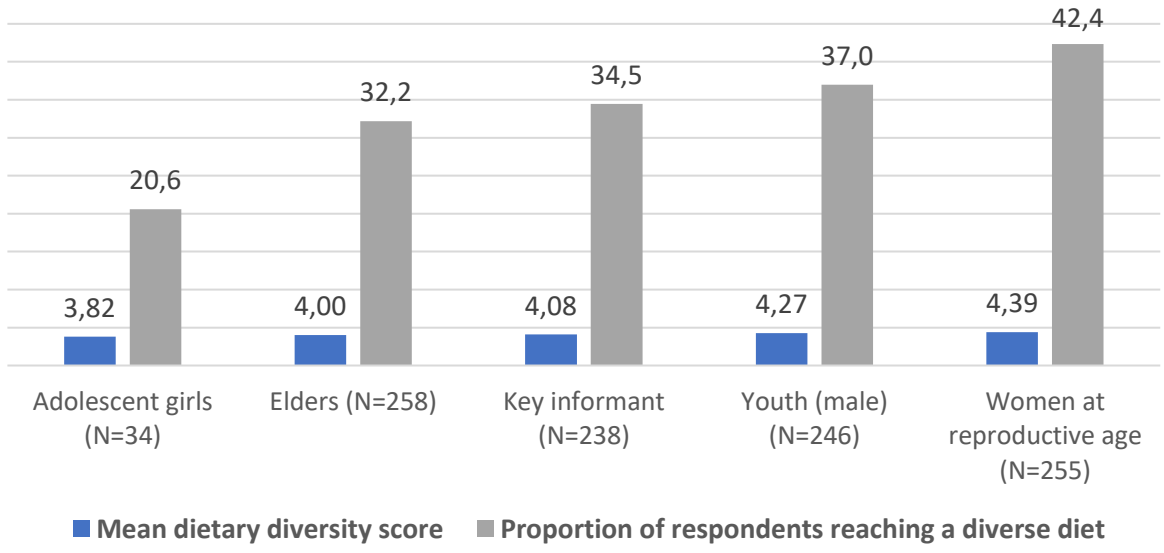

Figure 3 Dietary diversity results of the different sampling clusters and adolescent girls

4.2 Land use patterns and diets

4.2.1 Land use profile of the communities

Life of Indigenous peoples and local farmers is inextricably linked with their lands. **Table 3** is showing the land-use pattern in the studied areas. Considering the total sample, we can say that the most important land use is home garden as it is used by 93% of the respondents. Next is forest (72%), shifting cultivation (58%), and rice field (51%). However, there are differences between the districts. Home gardening is prevalent everywhere but most widely in Garo Hills (99%) and West Khasi Hills (97%). Forests are used most extensively in Nagaland (95%) and Garo Hills (89%). Shifting cultivation persists strongly in Garo Hills (94%) and Nagaland (80%). Rice field is widespread in Ri Bhoi (74%) and Nagaland (71%). Agricultural terracing became relatively common in East Khasi Hills (48%) and Ri Bhoi (34%). Natural water bodies of rivers and lakes are used most in Nagaland (63%) followed by East Khasi Hills (31%), whereas artificial ponds are less significant in general, with Ri Bhoi and Garo communities using them most among the studied areas (17% and 14%, respectively).

Table 3 Proportion of respondents using particular lands

Land use	East Khasi	Garo Hills	Jaintia Hills	Nagaland	Ri Bhoi	West Khasi	Total sample
Home garden	93%	99%	84%	89%	91%	97%	**93%**
Forest	71%	89%	52%	95%	82%	36%	**72%**
Shifting cultivation	47%	94%	20%	80%	47%	63%	**58%**
Rice field	26%	65%	47%	71%	74%	66%	**51%**
Terrace	48%	0%	28%	18%	34%	10%	**28%**
River/lake	31%	11%	22%	63%	26%	13%	**28%**
Pond	10%	14%	12%	10%	17%	4%	**11%**
Mean number of land-uses	3,4	3,7	2,7	4,3	4,0	2,9	**3,5**

4.2.2 Landscape diversity in relation to diets

Is there a relationship between landscape diversity and dietary diversity? In **Figure 4**, the dietary diversity outcomes of the respondents were grouped according to the number of lands used by the respondents. There seems to be an interesting trend of having a diverse diet either with managing 0 or 1 land-use, then there is a decline in dietary diversity, and afterward continuous increase since managing 4 or more land-uses. This trajectory may be showing a transition from agriculture and subsistence economy towards off-farm income. However, for the majority of the respondents who are subsistence farmers, the fact of accessing and using more land-uses seems to have positive outcomes for dietary diversity. Yet, more robust statistical analysis could be performed to quantify the strength of the relationships.

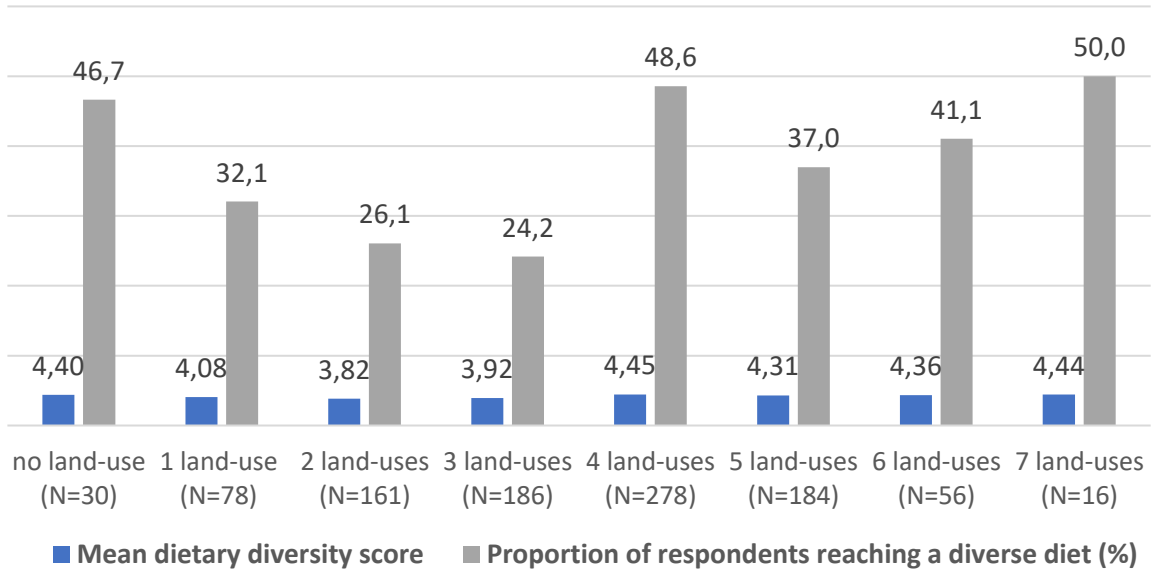

Figure 4 Number of land-use systems in relation to dietary diversity outcomes

4.3 Dietary diversity in the overall project area

When considering the total sample, the average dietary diversity score is 4.18, meaning that a person in the project area consumes on average slightly over 4 food groups per day. Looking further at the recommended minimum dietary diversity, it became clear that nearly three-quarters of the respondents are not reaching it (see **Fig. 5**).

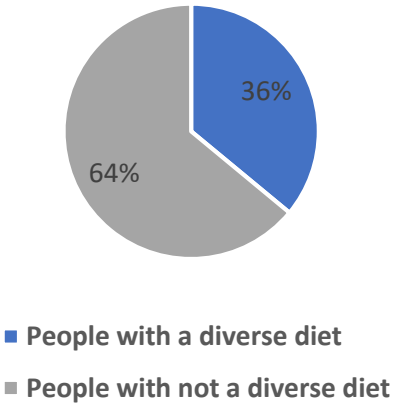

Figure 5 Proportion of respondents reaching minimum dietary diversity in the project area

What are the local communities eating? **Figure 6** demonstrates that the most consumed food groups are Starchy staples (100% of the respondents), Other vegetables (87%), and Meat (79%). On the contrary, the most under-consumed food groups are Dairy (0%), Nuts and seeds (8%), Eggs (13%), and Other fruits (25%). Also Pulses and Vitamin A-rich plants are consumed only by around one-third of the respondents. Green leafy vegetables are consumed slightly more by 43% of the sample. Considering a rural setting, the results are somewhat surprising in terms of frequent consumption of meat on the one hand, and the rare consumption of fruits on the other. According to NESFAS, fruits are often sold instead of own consumption.

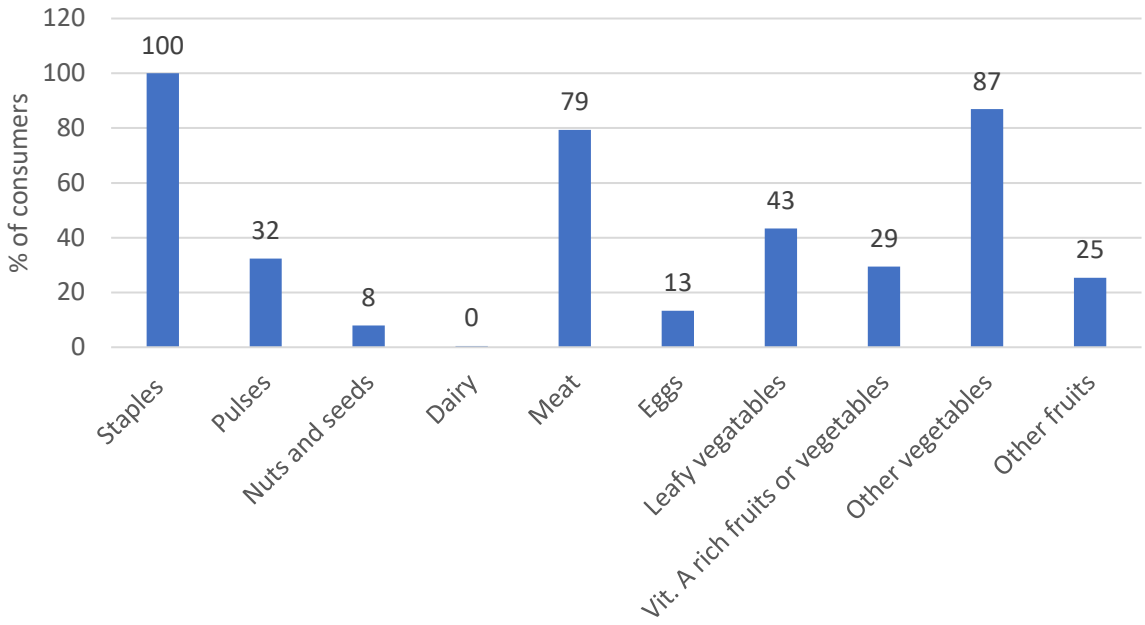

Figure 6 Proportion of food group consumers in the project area

4.4 How diverse is the diet in particular districts?

Analyzing data district-wise revealed that some regions have more diverse diet and higher proportion of people reaching MDD than the other regions (**Fig. 7**). The most diverse diet along with the highest proportion of respondents reaching MDD was found in West Garo Hills, followed by Nagaland, and then Ri Bhoi. On the contrary, the worst situation was identified in West Khasi Hills and East Khasi Hills, where only 17% and 28% of the respondents reached MDD, respectively. Garo Hills and Nagaland were both found to have a higher share of respondents reaching higher education degrees than the other regions. Higher education may be one of the substantial factors for better dietary diversity outcomes.

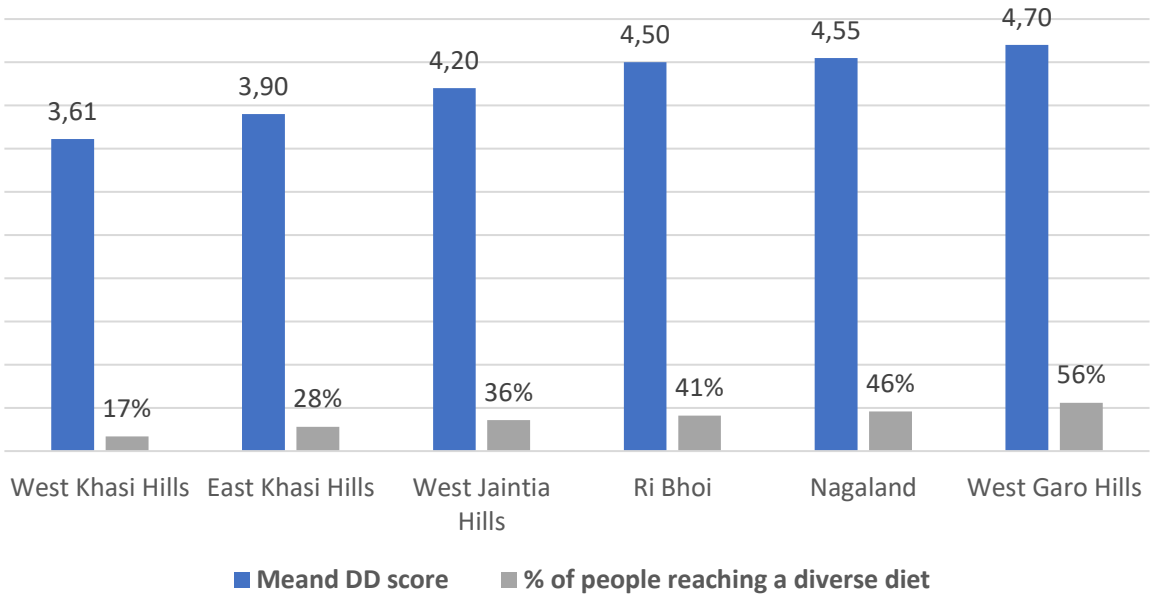

Figure 7 Mean dietary diversity score and proportion of people reaching a diverse diet

However, looking only at the mean values do not show the overall distribution of results. Histograms are useful for showing distributions of the quantitative results. Therefore, histograms were used to plot the frequencies of DD scores in all districts (**Fig. 8**). On the example of Garo Hills where the best DD outcomes were identified, we can detect that the distribution is skewed to the right, showing that majority of respondents obtained equally DD score of 4, 5 and many also 6. In the case of Jaintia Hills, we can observe a few outliers, respondents who reached a very high DD score of 8 with no one consuming 7 food groups.

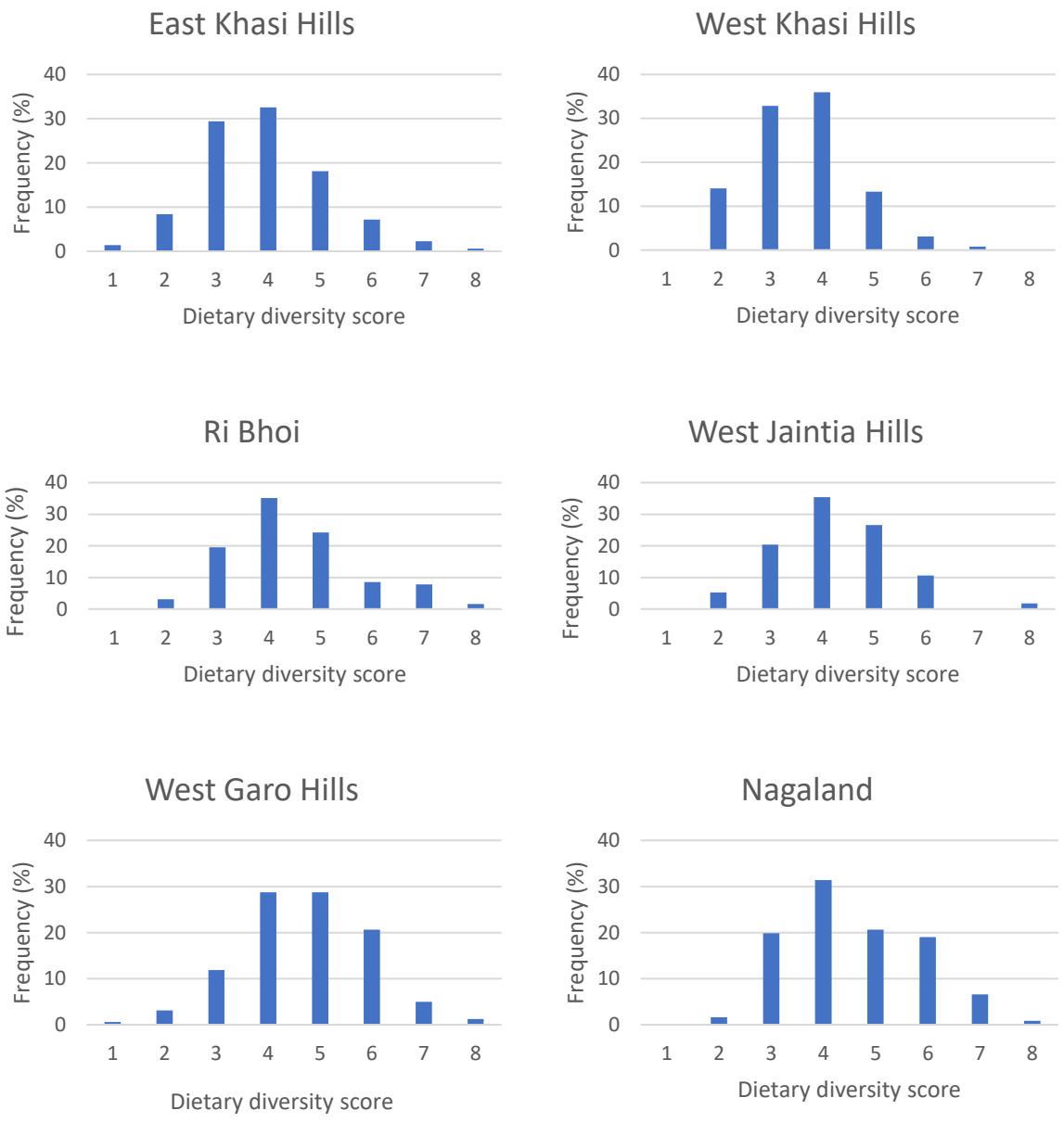

Figure 8 Histograms of dietary diversity scores in the studied areas

When looking into food groups consumed within the districts, it is evident that Starchy staples (mostly represented by rice, but also potatoes or taro) are consumed by every single respondent (**Table 4**). Pulses are most commonly consumed in Nagaland (63% of the respondents), while in West Khasi Hills only 15% of the respondents consumed them. Nuts

and seeds is one of the least consumed food groups. It is consumed most in Ri Bhoi (19%), whereas in West Khasi Hills and Garo Hills it is not consumed at all. Dairy is beside some rare individual cases not consumed at all as milk and its products are not part of the local food culture. Contrarily, Meat, poultry and fish are consumed very commonly, with Garo Hills having 87% of consumers, and on the other side Nagaland with the 63% of consumers. Eggs are surprisingly consumed by a minority, with the highest proportion of consumers in Jaintia Hills (21%) and the lowest proportion in Nagaland (6%). In the case of very diverse food group of Leafy vegetables, it is consumed the most in Jaintia Hills by 54% of the respondents, while Nagaland is having only 22% of consumers. Vitamin A-rich vegetables or fruits are consumed by over half of the Garo sample (56%) but only by 15% of the respondents in Nagaland. Other vegetables are eaten by the majority of the whole sample. However, Other fruits are consumed unfortunately to a much lesser extent with a maximum of 44% of consumers in Garo Hills and minimum of only 7% of consumers in West Khasi Hills.

Table 4 Proportion of food group consumers in the individual districts (%)

FOOD GROUPS	West Khasi Hills	East Khasi Hills	West Jaintia Hills	Ri Bhoi	Nagaland	West Garo Hills
1. Starchy staples	100%	100%	100%	100%	100%	100%
2. Pulses	15%	26%	37%	20%	**63%**	38%
3. Nuts and seeds	0%	7%	16%	**19%**	5%	0%
4. Dairy	2%	0%	1%	1%	0%	0%
5. Meat, poultry, fish	77%	76%	80%	86%	69%	**87%**
6. Eggs	9%	15%	**21%**	11%	6%	13%
7. Leafy vegetables	36%	46%	**54%**	46%	22%	40%
8. Vitamin A-rich plants	36%	20%	16%	45%	15%	**56%**
9. Other vegetables	80%	86%	74%	95%	**96%**	91%
10. Other fruits	7%	14%	21%	28%	35%	**44%**

4.5 Dietary diversity in individual blocks and villages

Considering individual villages, only one village reached mean DD score above 5, and that is remote Pathso village of Noklak district in Nagaland (mean DD = 5,62; 84% of the respondents reaching MDD). The diet there is very balanced and rich in pulses, fruits, and vegetables. Also local nuts and different meat sources, including wild animals, are consumed there. **Table 5** shows the mean DD score and proportion of people reaching minimum dietary diversity across all the villages and other administrative units.

Table 5 Dietary diversity results for all the villages, blocks, districts and states

Location	Sample size	Mean DDS	% of respondents reaching minimum dietary diversity (5 or higher)

MEGHALAYA STATE	**877**	**4,18**	**35%**
DISTRICT: EAST KHASI HILLS	**348**	**3,90**	**28%**
Block: Khatarshnong Laitkroh	64	4,20	39%
Village: Laitsohpliah	32	3,81	34%
Village: Mawkma	32	4,65	44%
Block: Mawkynrew	128	3,96	29%
Village: Khapmaw	32	3,90	25%
Village: Nohron	32	4,00	34%
Village: Rasong	32	4,34	41%
Village: Umsawar	32	3,59	16%
Block: Mawryngkneng	32	3,03	6%
Village: Mawpyrshong	32	3,03	6%
Block: Mawsynram	62	3,78	16%
Village: Mawhiang	32	3,69	16%
Village: Nongwah	30	3,87	33%
Block: Shella bholaganj	62	4,00	31%
Village: Mustoh	32	4,03	31%
Village: Nongpriang	30	3,97	28%
DISTRICT: WEST KHASI HILLS	**128**	**3,61**	**17%**
Block: Mawshynrut	96	3,79	22%
Village: Langshongthiang	32	4,22	34%
Village: Nongriangka	32	3,41	3%
Village: Pyndeng Mawlieh	32	3,75	28%
Block: mawthadrashian	32	3,06	3%
Village: Umdum	32	3,06	3%
DISTRICT: RI BHOI	**128**	**4,50**	**41%**
Block: Umling	64	4,35	25%
Village: Marmain	32	4,06	25%
Village: Mawiong	32	4,63	47%
Block: Umsning	64	4,66	34%
Village: Khliehumstem	32	4,43	34%
Village: Khweng	32	4,88	59%
DISTRICT: WEST JAINTIA HILLS	**113**	**4,20**	**36%**
Block: Amlarem	57	3,87	38%
Village: Nongtalang	32	4,34	38%
Village: Samenong	25	3,40	13%
Block: Laskein	32	4,69	53%
Village: Mynso B	32	4,69	53%
Block: Thadlaskein	24	4,38	38%
Village: Mookjat	24	4,38	38%
DISTRICT: WEST GARO HILLS	**160**	**4,70**	**56%**
Block: Rongram	160	4,70	56%
Village: Ganol Sangma	32	4,94	63%
Village: Chandigre	32	4,06	34%
Village: Samigre	32	4,78	56%

Village: Sasatgre	32	4,97	69%
Village: Tosekgre	32	4,75	56%
NAGALAND STATE	**124**	**4,55**	**46%**
DISTRICT: NOKLAK	**36**	**5,62**	**84%**
Block: Noklak	36	5,62	84%
Village: Pathso	36	5,62	84%
DISTRICT: PHEK	**88**	**4,19**	**33%**
Block: Chizami	32	4,41	38%
Village: Chizami	32	4,41	38%
Block: Meluri	24	3,88	24%
Village: Phor	24	3,88	24%
Block: Phek	32	4,28	38%
Village: Phek	32	4,28	38%
WHOLE PROJECT AREA	**1001**	**4,18**	**36%**

4.5 Positive deviants and what do they consume?

Only in a few villages, the proportion of respondents reaching minimum dietary diversity went over 50% of the sample (**Table 6**). These villages can be considered as positive deviants which could be looked upon for inspiration and for developing a culturally-suitable intervention for other villages.

Table 6 Villages with the best dietary diversity results (≥50% of respondents reaching MDD)

Village	Location	% of respondents reaching minimum dietary diversity	Mean dietary diversity score
Pathso	Noklak, Nagaland	84%	5,62
Sasatgre	Rongram, Garo Hills	69%	4,97
Ganol Sangma	Rongram, Garo Hills	63%	4,94
Khweng	Umsning, Ri Bhoi	59%	4,88
Samigre	Rongram, Garo Hills	56%	4,78
Tosekgre	Rongram, Garo Hills	56%	4,75
Mynso B	Laskein, Jantia Hills	53%	4,69

To further shed light on the differences in foods consumed by people reaching a diverse diet and those who not, all the respondents were divided into two groups (a group reaching and a group not reaching minimum dietary diversity) and the food groups consumed were compared in between the groups (see **Fig. 9**). We can see that among respondents who reached MDD, it is more common to consume all food groups beside Starchy staples, which are consumed by both groups to the maximum (100% of the respondents). The most striking gap is observed in the consumption of Other fruits, Pulses, Green leafy vegetables, and

Vitamin A-rich plants. Moreover, consumption of Nuts and seeds; Meat, poultry and fish; Eggs; and Other vegetables is also lower among those who did not reach MDD.

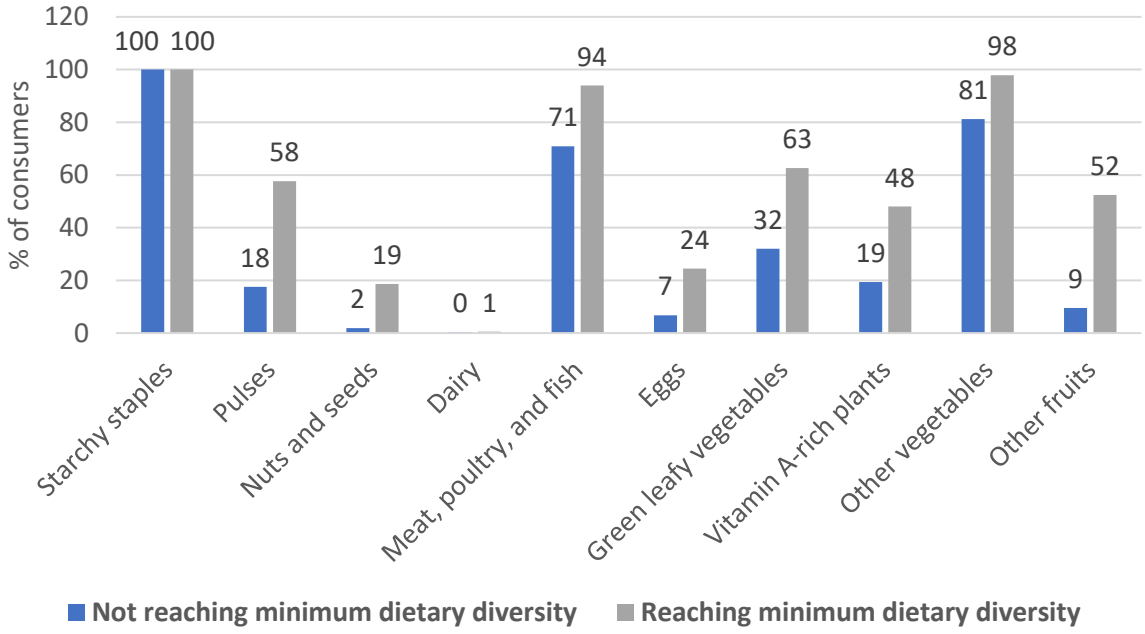

Figure 9 Comparison of food groups consumed when above or below the threshold of 5 groups (MDD)

5. Challenges and lessons learned

5.1 Challenges during data collection

- Food recall method went relatively well, but enumerators often forget to write down the food details such name and types of plant varieties (e.g., beans type, names of pumpkin, etc.). Also the food sources were not traced entirely and precisely.
- According to enumerators, respondents sometimes felt a bit shy when mentioning what they had eaten yesterday. The interview approach needs good flow, trust, and privacy when possible.
- Data enumerators often made spelling mistakes in writing local plant and food names. This led to confusion during data analysis, and it required longer cross-checking with the field staff.
- Some parts of the questionnaire were probably more challenging as they have frequent missing data, i.e., Poverty Scorecard. Often just one out ten answers is missing, yet it already means that the score cannot be calculated for that respondent (interviewer should either complete the missing answer or stop asking further poverty questions).

5.2 Data loss during the research process and analysis

- Direct categorization of foods into the standard food groups by data enumerators brought a very high error.

- There was quite high data loss during transferring data from questionnaires to Microsoft Excel, for example, not entering food and plant details, or translating local names in native languages to English (it is a helpful intention, but the details get lost).
- The created templates for data were laborious for everyone and with a high possibility for overlooking errors

5.3 Foods problematic for categorization

- Beans/ri/french beans (while green bean pods belong to Other vegetables, ripe beans belong to Pulses).
- Chutneys and tungtap were not considered due to generally small amounts consumed.
- Dal and chana are overlooked or miscategorized as Grains, but they are Pulses.
- Pumpkins (some have white and some orange flesh and this needs to be better distinguished from now on).
- Onion was skipped, or categorized as a tuber or condiment (it is Other vegetable).
- Bamboo shoot, Soh phlang, and radish were also categorized as a tuber but belongs to Other vegetables.
- Tomato was categorized as orange-fleshed and thus vitamin A-rich plant.
- Some plants are variable in their colors, and besides pumpkin, for example, also passion fruits, sweet potatoes, bananas, peaches should be controlled for the color of their flesh with regards to their possibility of being categorized as Vitamin A-rich.
- Nei iong and Nei lieh were considered condiments instead of Nuts and Seeds.
- Condiments such as basil, mint, chives or coriander are grouped as leafy vegetables (they should be rather condiments, but it also depends on amount eaten).
- Cultivated lettuce or common cabbage are not Dark green leafy vegetables, but Other vegetables.
- Lemon for flavor is considered condiment but consumed whole slices of lemon are Other fruits.

6. Comments and recommendations to improve the future research process

- In the future, data enumerators need to have food checklist for correct food categorization, or perhaps the most accurate option would be to conduct categorization later by a specialist. Alternatively, the food list method can be tried instead of open food recall (but it has pros and cons).
- The food sources, although unnecessary for calculating dietary diversity, would be very informative and the data could be collected thoroughly in the next survey.

- For efficient data management and analysis, the pivot table data format could be tried out next time.
- It is good to keep data format as simple as possible (one data information = 1 column in excel) with no double rows or double columns, and no merging and unmerging.
- Once a particular data template is created, it must be followed and kept unchanged (consistency). Also, the order of respondents should remain the same even across the different datasheets.
- Once the baseline has not collected a certain indicator/detail, the progress of it cannot be tracked.
- There should be enough time for proper training of data enumerators, and then a reliable communication and supervision of the field team should be ensured (at least during the first days of the fieldwork).

7. Key suggestions for the project implementation

- The project intervention is now supported and guided by DD results – the project should intervene on the overall dietary diversity, but special reference to the missing food groups could increase dietary diversity the most.
- Also, smart selection and prioritization of a few plant horses could be an effective option for project success. E.g. Nuts and seeds (sesame, perilla, sohliang, etc.). Vitamin A-rich plants (orange-fleshed pumpkins, papaya, mangoes, bastard oleaster, carrot, orange-fleshed sweet potatoes, etc.). Pulses (lentils, chickpeas, and many different local species and varieties, with most of them being grown in jhum). Leafy vegetables (chameleon plant, leafy mustard, water celery, and many others). The results of preference ranking exercises can be used along with community feedback and action plans.
- In total, dietary diversity is low, but no so remarkably, the average DD score in the project area is 4.18 (36% reach of MDD). The poor nutrition and health status in the region, as shown by other studies are probably influenced also by WASH and limited access to health care.
- Some leguminous crops and trees (Fabaceae, bean family) offer three food groups (leaves, green pods, and pulses). Moreover, they also fix nitrogen from the air and make the soil more fertile – suitable for crop rotation, intercropping, and particularly good for improving production in shifting cultivation.
- If DD is a key performance indicator, then millets have 0% opportunity to improve DD (100% of people already consume Starchy staples). However, undoubtedly, millets should be still promoted as they are nutritious and they can improve human health.

- There is a high ingredient diversity in chutneys, but the small amount of food is regrettable and does not contribute to the nutrient intake. Shifting this diversity instead to new recipes and salads would be beneficial for nutrition.
- Considering animal-based foods, meat is already consumed by the majority, but eggs are extremely under-consumed and should be consumed more. Dairy is not consumed but that is a cultural issue.
- Another important message is to improve dietary diversity of adolescent girls and the poorest ones.
- The community seasonal food calendars could be developed so that the communities can see in which season what nutritious crops are available for consumption.
- For evaluation or monitoring project progress, the data should be collected in the same period of the year/same season because of considerable differences in food seasonality.
- The dietary diversity is a useful indicator, but it possesses numerous limitations (foremost, it recalls only 24 hours, it does not measure quantities of foods and nutrients). It is also hard to increase it. For example, if people already consume one species in a particular category, the DD will not increase even if they start to eat five additional species in that category.
- Future research could also look at the diet of pregnant women, breastfeeding woman, and kids. In addition, the results suggest that the importance of land access and landscape diversity for diets should be studied more thoroughly in the future.
- The report presented all the primary data but mostly based on the descriptive statistics. A more robust statistical analysis in the future could reveal if the findings are statistically significant. Also, the strength of the relationships between independent variables and dietary diversity could be assessed more thoroughly by correlations or regressions.
- Besides dietary diversity, the data can be used for calculating additional indicators when needed. For example, a number of food servings (e.g. of fruits or vegetables), food variety score, dietary species richness, food consumption frequencies. In addition, further data are also available on taste ranks, plant sources, other plant uses, and seed sources.

8. References

Bernard HR (2002) Research methods in anthropology: qualitative and quantitative approaches. Oxford, UK: Altamira Press.

Chyne DAL, Meshram II, Rajendran A, Kodali V, Getti N, Roy P, Kuhnlein HV, & Longvah T (2017) Nutritional status, food insecurity, and biodiversity among the Khasi in Meghalaya, North-East India. Maternal & child nutrition, 13, e12557.

Development Initiatives (2018) 2018 Global Nutrition Report: Shining a light to spur action on nutrition. Bristol, UK: Development Initiatives.

FAO & FIE (2016) Minimum dietary diversity for women Minimum. A guide for measurement. Rome, Italy: Food and Agriculture Organization of the United Nations.

FAO, IFAD, UNICEF, WFP & WHO (2018) The State of Food Security and Nutrition in the World 2018. Building climate resilience for food security and nutrition. Rome, FAO. Licence: CC BY-NC-SA 3.0 IGO.

Indigenous Partnership (2011) The Code of Ethics of the Indigenous Partnership for Agrobiodiversity and Food Sovereignty was followed. Retrieved from: http://agrobiodiversityplatform.org/files/2011/09/Code-of-Ethics-Final-28-February-2011.pdf

Kennedy GL, Pedro MR, Seghieri C, Nantel G, & Brouwer, I (2007) Dietary diversity score is a useful indicator of micronutrient intake in non-breast-feeding Filipino children. The Journal of nutrition, 137(2), 472-477.

Longvah T, Khutsoh B, Meshram II, Krishna S, Kodali V, Roy P & Kuhnlein HV (2017) Mother and child nutrition among the Chakhesang tribe in the state of Nagaland, North-East India. Maternal & child nutrition, 13, e12558.

Ministry of Health and Family Welfare (2016) National Family Health Survey-4 (2015-2016): State Fact Sheet, Meghalaya, International Institute for Population Sciences, Mumbai.

NESFAS (2017) No one shall be left behind initiative. Biodiversity for Food, Nutrition, and Energy Security for 3000 Households in Meghalaya and Nagaland, North East India. Baseline Approach Concept Note. Shillong, NESFAS.

Schreiner, M (2016) Simple Poverty Scorecard Poverty-Assessment Tool: India. SimplePovertyScorecard. com/IND_2005_ENG. pdf, retrieved 20. July 2018

List of tables

List of figures