Paper for the Expert Meeting on ‘Nutrition-sensitive food and agriculture systems’ at FAO

Linking nutrition and agrobiodiversity

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1. Background: The “agriculture - nutrition gap”


Agriculture-health interactions are complex, can be direct or indirect and are discussed in this study exemplarily for three different areas, namely direct consequences of present food consumption patterns and agricultural production practices on human health; and indirect effects on health of various issues relating to agricultural development and sustainability.


The “agriculture – nutrition gap” is partly due to agriculture not having nutrient output as an explicit goal on the agenda; and nutrition and health communities having never considered using agriculture as a primary tool in their nutrition programmes.


To maximise the nutrient output of farming systems has unfortunately never been an objective of agriculture but rather to maximise production while minimising costs. Welch further argues that the change in agricultural production from more varied cropping systems to more monoculture cereal systems seems to be contributing to micronutrient deficiencies by limiting food-crop diversity.


The agriculture, health and nutrition sectors are not only separated at university-level training and research but also at development organization and governmental ministry level. It is suggested to integrate health and nutrition goals clearly into the design and implementation of agricultural projects in order to have a larger health and nutritional impact.


As the term 'nutrition-sensitive' lacks a common definition and organisations tend to define it in the context of their own programmes, this paper summarises different approaches and presents the variety of definitions and understandings.
2. Bridging the gap: food based approaches


Already more than one decade ago it was suggested to link agricultural production to improving human health, livelihood and wellbeing and to focus on holistic food-based system approaches.


Food-based approaches which include food production, dietary diversification and food fortification, are sustainable strategies for improving the quality of the diet and for overcoming and preventing malnutrition. Increasing access to and availability and consumption of a wide variety of foods across nutritionally distinct food groups not only have a positive effect on micronutrient status but also contribute to improved nutrition in general. In addition to its importance for nutrition, food has social and economic values. Along the entire food chain critical points should be identified where the nutritional quality is reduced or at risk and measures for safeguarding this quality need to be applied.

Food-based approaches would also benefit not only single household members but the whole household or even community that might be suffering from the triple burden of malnutrition.


A great number of food-based interventions still aim at the alleviation of a single nutrient deficiency. Yet, this paper argues that with the knowledge of synergies in the physiologic functions of nutrients being available, interventions need to focus explicitly on improving overall diet quality and it is suggested to mobilise ‘agricultural biodiversity to ensure dietary diversity’.

2.1. Local agrobiodiversity: how to assess its contribution to local diets?


Agrobiodiversity can provide a rich source of nutrients for adequate dietary diversity and quality, a safety net against hunger, and a basis for strengthening local food systems and environmental sustainability. Still, some important questions are yet to be answered, e.g. how on-farm agrobiodiversity contribute to household food consumption, dietary diversity and quality; how agrobiodiversity can be linked to improved nutrition and health outcomes and benefits; and how agrobiodiversity can be scaled for commercial use while maintaining biodiversity and ecosystems and improving human health.

Agriculture approaches planned with nutrition in mind, thus, nutrition-sensitive agriculture, should start with considering and understanding further the role of agrobiodiversity in improving dietary quality and dietary diversity, i.e. to consume of a wide variety of foods across nutritionally distinct food groups.


To overcome malnutrition an interdisciplinary approach linking agriculture and ecology to human nutrition and health, also described as “econutrition”, is needed as obviously
these disciplines share common concerns such as loss of biodiversity, decline in soil fertility, decrease in food production and increase in malnutrition.


The concept of functional nutritional diversity emphasises on the availability of nutritionally district crops in a cropping system in order to address nutrition security issues.


When the type and amount of nutrients produced in each food system has been identified, an optimisation model can analyse which cropping strategies might improve the nutritional quality of people using existing resources.


When the nutrient contents and prices of foods locally available are known it is also possible to use linear programming to identify a nutritionally adequate diet of the lowest costs, for example, for a child of a specific age. The assumption thereby is that price and nutrient contents are linearly related to food weight.

As the availability of foods providing specific nutrients as well as their prices vary between seasons it is necessary to do the calculations for different months in order to come up with matching recipes. Next to seasonality also the issue of foods collected from the wild or fallow lands, for which costs and nutrient content are difficult to assess, needs to be taken into consideration.

2.2. Dietary diversity: Food groups as indicator for an adequate diet


It is already known that a lack of diversity is a crucial issue, particularly in the developing world where diets consist of starchy staples to a great extent with less nutrient-rich foods such as animal source food, fruits and vegetables being available, accessible or known to be important for a balanced diet. On the other hand it is acknowledged that the consumption of a variety of foods across and within food groups almost guarantees adequate intake of essential nutrients and important non-nutrient factors.


These studies have already well documented the links between dietary diversity and diet quality and nutritional status of children.


In addition, these studies found associations between dietary diversity, food security and socioeconomic status.

Now, it is crucial to understand how agricultural systems and the benefits derived from agrobiodiversity affect consumption patterns, nutrition and health status, in particular of people in the developing world.

3. Case study: Vegetable production and consumption in East Africa

3.1. Linking vegetable production and consumption: Does diversity in the field equal diversity on the plate?


While a direct link between production and consumption of cultivated traditional vegetables was found, no association was detected between production and consumption of exotic vegetables, as many of them were bought from markets, and also no relation to consumption was found for vegetables collected from the wild. This highlights the importance of taking the sources of foods into consideration which are next to own production the collection from the wild, buying from markets, receiving foods as gifts, exchange of foods and food aid – and not only focus on on-farm agrobiodiversity.


This ongoing study in Kenya at Bioversity International focuses on demonstrating that local agrobiodiversity has an impact on dietary diversity and quality, and on nutritional health of women and children under two, thus the first 1000 days. One objective of this study is a gap analysis regarding the discrepancy between the foods that infants and mothers eat and their nutritional requirements. At the same time the local agrobiodiversity available and accessible is surveyed with the question in mind whether the gap can be filled with locally available foods to achieve dietary adequacy. This study, which also includes a nutrition intervention, will contribute to the understanding of the role of agrobiodiversity in nutrition and health and how and to what extent on-farm agrobiodiversity contributes to household consumption, dietary diversity and quality.

3.2. Dietary diversity: links to agricultural production and socio-economic values


Dietary diversity scores (DDS) of women were significantly associated with the number of vegetables that women cultivated/collected. In addition, those women who cultivated/collected vegetables more consistently (similar species richness year round),
but also those who sold their products, had higher DDS. Consequently, not only the availability of agricultural diversity is linked to dietary diversity, but also the possibility of marketing agricultural products which would contribute to cash income that in turn can be spend on additional foods.

Vegetables were among those food groups consumed by nearly every participant year round; however, the amount of vegetables consumed decreased with increasing diversity in the diet. Obviously, less healthy and valuable food groups such as beverages and sugar accounted for a high dietary diversity and replaced the amount consumed of more healthy food groups such as vegetables. Consequently, different forms of an increase in dietary diversity must be distinguished. While a high nutritional diversity is usually desirable for a balanced diet it may not necessarily result in better health. Therefore, dietary diversity scores should be either enhanced with a measure of dietary quality or used in combination with further measures of dietary quality and food quantity.


This paper argues likewise that a certain degree of diversity does not mean that the dietary quality will match people's particular needs. Consequently, dietary quality and nutritional adequacy of diets should be of high significance.


This review emphasizes among others on the relationship between household food production and nutrition of household members being not straightforward, yet, rather complex involving selling and purchasing of foods, control of income, social biases as well as decision making processes.

4. Conclusion

Fortunately, a growing number of research and development institutions currently realise the urgent need for multi-sectoral approaches to bridge the gap between agriculture, nutrition and health, to jointly tackle the triple burden of malnutrition and, thus, creating nutrition-sensitive food and agricultural systems. The recent “Synthesis of Guiding Principles on Agriculture Programming for Nutrition” by FAO gives an overview and 20 main recommendations on how to make agriculture work for nutrition.

Agricultural biodiversity should play a key role in this process as it will not only ensure environmental sustainability but can contribute to nutritional adequacy of diets, cultural acceptability and – especially when traditional foods are considered – also to low cost accessibility of food, thus, creating sustainable diets.