ANH Academy

Agriculture, Nutrition and Health Academy

ANH Academy Week 2017

ABSTRACT BOOKLET

Kathmandu, Nepal

9-19 July, 2017

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Welcome to the Agriculture, Nutrition, Health Scientific Symposium and Academy Week

We are delighted to welcome each of you to this year's joint Scientific Symposium and ANH Academy Week in Kathmandu. It is an exciting time for research and practice linking agriculture, nutrition and health as we are seeing unprecedented commitment to strengthen agriculture/food systems to realize the co-benefits of optimal nutrition, health and environmental outcomes. We meet in this forum to learn, share, and foster innovative collaborations that cut across disciplines and sectors in order to tackle these complex linkages and questions.

Both the ANH Academy and the Feed the Future Innovation Lab for Nutrition were established to meet such demands. The ANH Academy, through diverse partnerships, brings together the researcher, policy and practitioner communities working at the nexus of agriculture/food systems, nutrition, health and environment. Similarly, the Feed the Future Innovation Lab for Nutrition was established to build evidence based policy actions that increase agricultural productivity, enhance food value chains, and improved diets to achieve measurable outcomes in nutrition. It is testimony to the spirit of collaboration that we have been so fortunate and able to join forces for this event.

This week offers an opportunity to collectively engage with these issues through a range of activities including training and mentoring; sharing of recent innovative research through oral and poster presentations from around the world; panel sessions and keynote addresses on translating research into practice; and networking opportunities.

We greatly appreciate the support of this event's partners and the International Steering, Scientific, and Logistics committees. As always, we thank our generous Nepali hosts and partners, represented most prominently by the Institute of Medicine, along with the Nepali Technical Assistance Group, Nepal Agricultural Research Council and, the Government of Nepal.

We hope you leave here with new ideas and renewed energy to continue your deep engagement to improve nutrition and health consequences of changing agriculture and food systems, particularly in low and middle-income countries.

We would greatly appreciate your feedback on this event to guide our future activities in a way that best meets your interests and needs.

Thank you all for being part of this exciting event!

With best wishes,

Prof. Patrick Webb, Alexander McFarlane Professor of Nutrition, Tufts University Friedman School of Nutrition Science and Policy; Director, Feed the Future Innovation Lab for Nutrition

Dr. Suneetha Kadiyala, Associate Professor in Nutrition-Sensitive Development, London School of Hygiene & Tropical Medicine (LSHTM); PI for the IMMANA programme

WELCOMING YOU TO NEPAL

I would like to take this opportunity to welcome you to the 5th Annual Nutrition Innovation Lab Scientific Symposium and the 2nd Annual Agriculture, Nutrition & Health (ANH) Academy Week.

Over the years, the symposia have been an excellent platform to bring together the scientific community, particularly young scientists, academia and stakeholders to share and understand evidence and research. It has helped identify and prioritise the gaps and stimulate research in those areas. Most importantly, it has paved the way for integrating evidence and policy on the agriculture-to-nutrition pathways. The presentations showcase a global body of research, while still maintaining a Nepal-specific focus.

I thank you for your participation in this year's conference and for bringing your experiences to help pave our way into the future. I am excited that you will experience not only the enriching scientific deliberations but also have the opportunity to see Nepalese culture and hospitality.

Best wishes for a very enjoyable and successful conference.

Sincerely,

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Dr. Madhu Dixit Devkota

Professor and Head,
Department of Community Medicine and Public Health
Institute of Medicine, Tribhuvan University

ANH Academy

Agriculture, Nutrition & Health Academy

About the ANH Academy

The Agriculture, Nutrition & Health (ANH) Academy is a global research network in agriculture and food systems for improved nutrition and health to serve as a platform for learning and sharing.

The ANH Academy is part of the three workstreams of the Innovative Methods and Metrics for Agriculture Nutrition Action (IMMANA) programme. It is also a broader partnership that aims to bring together researchers and users of research cutting across disciplines and sectors to tackle the complex interactions between agriculture/food systems, nutrition, health and environment. It is particularly focused on facilitating rapid sharing of innovative methods, metrics and emerging research findings and strengthening research capacity in this interdisciplinary area.

The ANH Academy is jointly founded and initial coordination is provided by the Leverhulme Centre for Integrative Research in Agriculture and Health (LCIRAH), IMMANA and CGIAR's Research Program on Agriculture for Nutrition and Health (A4NH). Diverse institutions, scientific societies, research programmes and donors support the Academy activities. We welcome new partnerships to collectively deliver the ambitious agenda.

Objectives

- Share innovative research in agriculture and food systems for improved nutrition and health
- Stimulate the development and harmonisation of new research
- Help strengthen the capacity of the research community to undertake inter-sectoral and interdisciplinary research
- Facilitate the uptake of robust evidence in policies and programming in agriculture and food systems for improved nutrition and health

Activities

- An annual Academy Week with learning sessions and a research conference
- Technical working groups
- Online seminars
- Online and face-to-face training opportunities
- An online collaborative platform

Membership

Membership of the Agriculture, Nutrition & Health Academy is free and open to researchers, policymakers and practitioners. Visit the ANH Academy booth in the Atrium to sign up.

Connect with us:

Visit our website: www.anh-academy.org

Email us: ANH-Academy@lshtm.ac.uk

Find us on Twitter: @IMMANA_Res

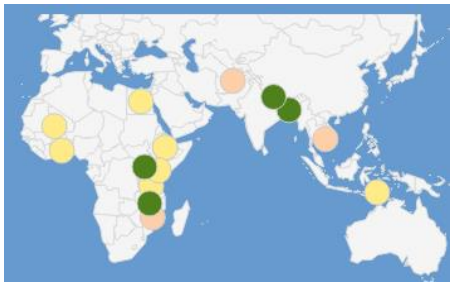
FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

About Feed the Future Innovation Lab for Nutrition

The US government's Feed the Future initiative relies on high caliber US-based research institutions through Innovation Labs, to answer key policy-relevant questions and develop solutions that help increase agricultural productivity, enhance food value chains, and support access to improved diets that achieve measurable outcomes in terms of maternal and child nutrition globally.

The Feed the Future Innovation Lab for Nutrition led by the Tufts University Friedman School of Nutrition Science and Policy is a consortium of institutions including Johns Hopkins Bloomberg School of Public Health, Purdue University, Tuskegee University, and the Harvard T.H. Chan School of Public Health. It is a program of policy relevant research focusing on nutrition and agriculture, which supports national priorities and is directly supportive of Feed the Future priorities. The Innovation Lab works in close collaboration with national stakeholders and host country academic institutions, the USAID Bureau for Food Security and host country USAID Missions.

The Innovation Lab develops partnerships to achieve its research and capacity-building agenda across the US, Europe and its focus countries. These partnerships include government bodies (e.g. Nepal's National Planning Commission, Uganda's National Planning Authority), international non-governmental actors (e.g. Helen Keller International, SPRING and International Food Policy Research Institute), academic partners (e.g. Makerere University in Uganda, Bergen University in Norway, and the London School of Hygiene and Tropical Medicine in the United Kingdom), UN agencies (e.g UNICEF and FAO), and operational programs in the field (e.g. USAID Suaahara in Nepal). The Nutrition Innovation Lab is active in Nepal, Uganda, Malawi, Mozambique and Bangladesh with supported research ongoing in several more.



Country Index

- Priority Countries: Bangladesh, Malawi, Nepal, Uganda
- Countries with Supported Research: Egypt, Ethiopia, Ghana, Kenya, Mali, Tanzania, Timor Leste
- Exploring Research in: Afghanistan, Cambodia, Mozambique

Goals

The overall aim of the Nutrition Innovation Lab is to support innovative research and in-country capacity enhancement that, when implemented as part of USAID-supported country-led plans, will lead to measurable improvements in the diets and nutritional status of vulnerable women and children through agriculture and food based interventions.

Activities

Human and Institutional Capacity Building:

- Long-term training through support of advanced degree pursuits
- Short-term training courses and training workshops

Research

- Nutrition and agriculture linkages
- Program and policy processes
- Biological mechanisms

Connect with us:

Visit our website: http://www.nutritioninnovationlab.org

Agriculture, Nutrition, Health

Scientific Symposium & Academy Week Committees

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Scientific Symposium

Keynote Speakers

Dr Namukolo Covic

Senior Research Coordinator
International Food Policy Research Institute

Dr. Namukolo Covic is a Senior Research Coordinator in the Poverty Health and Nutrition Division at IFPRI based in Addis Ababa, Ethiopia where she works closely with the African Union. With a dual background in agriculture and nutrition, her work straddles the interface between policy, dynamics of nutrition action implementation and the types of capacity considerations needed. She has been one of the facilitators of the African Nutrition Leadership Programme since 2008. Since 2011 she has been involved in different aspects of mainstreaming nutrition in the Comprehensive Africa Agriculture Development Programme (CAADP) and is on the African Union technical team that developed current technical guidelines for the CAADP Biennial Review-2017. She guided the process that developed the Annual Trend and Outlook Report-2015 (ATOR-2015) for the African Union's ReSAKSS Platform led by IFPRI and the ReSAKSS Conference 2016, on a synthesis of evidence towards supporting a nutrition revolution for Africa.

Dr Tahmeed Ahmed

Senior Director
Nutrition & Clinical Services Division icddr,b

Dr Tahmeed Ahmed is Senior Director of the Nutrition and Clinical Services Division of icddr,b. He has recently developed nutritional treatments from locally available food ingredients for preventing and treating acute malnutrition in children. He is the Bangladesh site principal investigator of the Bill & Melinda Gates Foundation supported multi-country Malnutrition-Enteric Diseases (Mal-ED) Project. This study is investigating the association between malnutrition, enteric diseases and cognitive development. His studies of microbiota in acute malnutrition as well as cholera have been published in Nature. He is also working intimately on stunting and environmental enteropathy.

Dr Ahmed was the Chair of the sub-committee formed by the Government of Bangladesh to draft the National Nutrition Policy of Bangladesh. He is a Professor of Public Health Nutrition at the James P. Grant School of Public Health, BRAC University and an Affiliate Professor in the Department of Global Health, University of Washington, Seattle. A prolific author, he has more than 200 papers published in international journals.

Professor Patrick Webb

Director of the Feed the Future Innovation Lab for Nutrition
Friedman School of Nutrition at Tufts University

Patrick Webb is a Professor at the Friedman School of Nutrition at Tufts University. He is the Director of the Feed the Future Innovation Lab for Nutrition, and also Principal Investigator for the Office of Food for Peace's Food Aid Quality Review. The latter builds on his work as Chief of Nutrition for the World Food Program in Rome, the former builds on 9 earlier years at IFPRI.

In his spare time, Patrick serves as Technical Adviser for the London-based Global Panel on Agriculture and Food Systems for Nutrition, he's a member of the CGIAR's Independent Science and Partnership Council, and also a member of the World Economic Forum's Global Futures Council on Food Security and Agriculture.

In addition to the Friedman School, Prof. Webb has academic affiliations with Hohenheim University (Germany), Patan Academy of Health Sciences (Nepal), and the Fletcher School of Law and Diplomacy at Tufts.

SESSION 1: DIETARY TRANSITIONS

Session Chair: Atmaram Pandey, Nepali Technical Assistance Group (NTAG)

Indicators of Affordability of Nutritious Diets in Africa: Food prices that reflect nutritious food

Anna Herforth[1], William Masters[2], Yan Bai[2], Daniel Sarpong[3], Fulgence Mishili[4], Joyce Kinabo[4], Rebecca Heidkamp[5], Jennifer Coates[2]

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Introduction

A primary way that agriculture can influence food security and nutrition is through improving the food environment, by increasing year-round availability and affordability of diverse, nutritious foods. Food prices are tracked by national governments and international agencies but typically encompass basic commodities, or a food basket not closely related to nutritional needs. The IANDA Project (Indicators of Affordability of Nutritious Diets in Africa) develops indicators that reflect nutritious food, using existing food price monitoring systems. Additionally, IANDA partners with agencies that collect data and end users, toward mainstreaming the use of new indicators that reflect the affordability of nutritious diets.

Methods

In two focus countries, Ghana and Tanzania, we worked with stakeholders to identify the most important sources of food price data and to understand their scope in geographic coverage, foods covered, frequency and methods of data collection. The food lists covered by each organization were analyzed for comprehensiveness from a nutritional perspective, in partnership with stakeholders from other national agencies. Foods important to consumption habits and nutrition that were missing were proposed as additions. Using both historical data and new pilot data, three types of indicators were constructed. To construct the Cost of Dietary Diversity (CoDD) indicator, the food items for which prices were collected were grouped into the 10 food groups of the Minimum Dietary Diversity for women indicator (MDD-W), and the lowest cost items for each group were used to establish the cost of achieving minimum dietary diversity. To construct the Cost of Nutrient Adequacy (CoNA) indicator, food price data were used in conjunction with the West African Food Composition table, and linear programming was used to establish the lowest cost way to achieve adequacy of essential nutrients.

Findings and Interpretations

In each country, there were two primary sources of food price data: in Ghana, Ministry of Food and Agriculture (MoFA) and the Ghana Statistical Service, and in Tanzania, the Ministry of Industry and Trade and the National Bureau of Statistics. In Ghana, a total of 21 food items were added to the existing food price monitoring list used by the Ministry of Food and Agriculture; this expanded list was piloted in four geographically distinct districts. Four items were dropped after the pilot due to persistent lack of availability in markets, or a determination that they were not critically important to consumption in Ghana, leaving a total of 17 new food items. The Ministry of Food and Agriculture determined that the expanded list would be useful for monitoring the price of nutritious foods and not overly burdensome, and therefore is now institutionalizing the expanded list nationwide. These data, as well as data from the national statistics organizations in both countries, were adequate to construct indicators of Cost of dietary diversity (CoDD), Cost of nutrient adequacy (CoNA), and Cost of a Recommended Diet (CoRD).

Conclusions

Resulting from partnership between the Ghana MoFA and IANDA, in our knowledge Ghana is the first country to institutionalize monitoring of the price of nutritious diets. The indicators of affordability of nutritious diets developed can be incorporated into food price monitoring systems in other countries as well, to track costs of nutritious food across seasons and geographies. In addition, they can also be used as indicators of nutrition-sensitive agriculture within programmes or national evaluation platforms. The accuracy of the indicators in representing a nutritious diet depends on the comprehensiveness of food lists within existing food price monitoring systems, and strong partnerships with stakeholders.

Factors Influencing Consumption of Animal-Source Foods in Timor-Leste

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Introduction

Timor-Leste, the newest nation in Southeast Asia, is battling with high rates of undernutrition, with 50.2% of children under five years being stunted due to chronic undernutrition. Most households raise livestock; however, despite the nutritional value of animal-source foods (ASF) they are more often used for sale than consumption in resource-poor areas. Ongoing research aims to study the impact of improving animal health on maternal and child diets and nutrition, however the drivers for ASF consumption must be understood at the household level in order to effect change.

Methods

This is a longitudinal, mixed-methods study, with data being collected from three rural villages in Timor-Leste participating in a pilot Newcastle disease vaccination program for village chickens. Participating households were selected on the basis of having one child under the age of two years at enrolment, and mothers and children are followed longitudinally. Quantitative data collection is performed across the three agricultural seasons (dry, heavy rain and light rain), and includes maternal and child dietary diversity data based on a 24-hour recall period, anthropometric measurements collected from infants, young children and their mothers, and haemoglobin measurements of infants and young children.

Qualitative data collection is performed annually through key informant interviews and focus group discussions. Key informants include village and sub-village chiefs, cultural leaders, local and municipal health and agricultural staff. Gender-disaggregated focus group discussions, involving both young and old members of the community. Direct observation of household practices is also included in the suite of research tools.

Findings and Interpretations

Quantitative data from this study shows significant differences in ASF consumption between the three villages across all seasons. Qualitative data was collected to understand these differences, and analysis identified three broad themes that strongly impact the practice of household ASF consumption: the use of animals for sociocultural practices; household socioeconomic status; and women's social status.

The main theme impacting household consumption of ASF is the practice of sociocultural ceremonies. Across the three villages, the number and temporal length of cultural ceremonies observed involving animals varied greatly. Triangulation with qualitative data confirmed that villages citing a higher number and longer length of cultural ceremonies consumed more ASF than villages that observe fewer ceremonies.

A second theme was the influence of socioeconomic standing on the ability to access ASFs. All participants stated that they like to consume ASF and would have consumed more if they had the means to purchase it.

Finally, women's social status emerged as a theme, with more women in villages that consume greater quantities of ASF stating that they are able to decide to slaughter household chickens for consumption on their own, or to sell their chickens to purchase other foods without prior consultation with their husbands.

Conclusions

A great body of evidence exists in support of the promotion of ASF consumption in resource-poor areas, particularly to enhance the physical and cognitive development of growing children. In Timor-Leste, despite high levels of livestock ownership, consumption of ASF in rural regions is low while child undernutrition rates are high. This study found that men and women living in rural villages would like to increase their consumption of ASF, and that sociocultural practices around ASF consumption vary greatly across the three villages. Two avenues through which ASF consumption could be increased is through improvement of household socioeconomic status, and through greater empowerment of women. These findings support agricultural programs that aim to

improve production of small livestock species that are more likely to be under the control of women, including village chickens.

This study also highlights the importance of using longitudinal studies across the seasons and mixed methodologies to identify and interpret patterns, particularly the complex ones encompassing food choice, availability, access and utilisation.

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Nutrition Transition in Zambia: Changing food supply, prices, household consumption, and nutrition outcomes

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Introduction

Diets in many regions are changing from traditional foods comprising coarse grains, pulses and vegetables to a more uniform global diet with increased animal foods, fat, sugar and processed foods (1). This common pattern of dietary change and associated nutrition and health outcomes has been described as a 'nutrition transition' (2). Africa has lagged behind other parts of the world in this change, but Africa is now transforming more rapidly than other regions (3, 4). Zambia is seeing many demographic and food system changes play out within its borders, driving a nutrition transition particularly within urban areas.

Methods

This paper draws on several sources of data to bring together a picture of changes in food and nutrition in Zambia over several decades. First, a broad picture is painted of the factors known to drive the nutrition transition, and whether they are present in Zambia. This background analysis uses publicly-available data and reviews published literature on demographic, epidemiological and food system changes that have taken place. Second, FAO food balance sheet data is used to show changes in food supply since the 1970s at a national level, looking not only at availability of core staples, but also at nutrient-rich foods required for a quality diet. Third, Zambian food price data is examined for change since 1996 in key food groups. Forth, a novel analysis of changes in household food consumption patterns over two decades in rural and urban Zambia, and major drivers of change, is undertaken using four rounds of the Zambian Living Conditions Monitoring Survey (LCMS) 1996-2015 (5). Finally, an assessment of changes in nutrition and health outcomes in Zambia is undertaken, using DHS and other recent survey data, and comment provided on likely drivers of these and implications for Zambian food and nutrition policy going forward.

Findings and Interpretations

Food supply at a national level in Zambia is broadly heading away from diverse and healthy diets in terms of available foods per capita. Nutrient-rich foods have barely kept pace or fallen behind population growth, while starches and fats have leapt ahead. Food prices for most major foods in Zambia have fallen significantly in real terms, increasing purchasing power; many households can access more food, but this can be either nutrient-dense food that contributes to a high-quality diet, or calorie-dense, salty or sugary food that can undermine diet quality. Household food expenditures generally follow patterns predicted by economic and public health theory, with decreases in share of expenditures on staple foods, and increases on fats and oils and on both processed foods and perishable meat and vegetables . Dietary data is sparse in Zambia, so little can be said about changing diets beyond extrapolating from household expenditures, which does not account for intra-household allocation. A clear outcome of these changes is an alarmingly fast rise in overweight and obesity particularly in women, and diseases of affluence associated with diet, notably hypertension from salt use. Patterns in household expenditures and nutrition outcomes vary by income group but tend to converge over time.

Conclusions

Notably, this paper cannot link each of these changes - to food environment, to food supply and prices, to household consumption, and to diets and nutrition - into a single model of change; the data simply do not exist at all of these different levels in a form that would allow for standard statistical analysis. In particular, dietary data is needed for Zambia, as elsewhere. What this analysis does instead is provide an overview of changes in key aspects of food and nutrition in Zambia, and shed light on the gaps in information that would greatly improve our understanding of the positive and negative aspects of the nutrition transition, and hence our ability to create relevant policy.

Thankfully, the actions required for averting undernutrition, overnutrition, and chronic diseases are broadly similar, involving enhancing availability, affordability, convenience and desirability of diverse nutritious diets. On the demand side, this involves public health messaging and increasing 'nutrition literacy' among all sections of the population. On the supply side, food

systems action will involve promoting diversity in the production of nutrient-rich foods, and supporting supply chains which make these affordable and accessible. These options are discussed for the Zambian context.

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SESSION 2: FOOD POLICY AND PRICE

Session Chair: Paula Dominguez-Salas, London School of Hygiene & Tropical Medicine (LSHTM)

Responsiveness of rural households to pulse price rise: A qualitative study

Vijay Laxmi Pandey, Ranjeeta Mishra

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Introduction

The accelerating prices of pulses in India over the last few years have posed constraints on its consumption, thus affecting the protein supply especially to the poor. Given widespread and chronic malnutrition and micronutrient deficiencies in India, the coping mechanism of Indian households to rising prices is of particular concern. The objective of this paper is to access the consumption coping strategy adopted by households to mitigate the effect of high price of pulses.

There is a differential impact of food inflation on different categories of households, which subsequently determines the type of coping strategy adopted and its perceived severity.

Methods

This paper uses the focus group discussions (FGD) to focus on household coping strategies in response to recent food price spikes in India and the perceived barriers to adoption of pulses production. This paper focuses on the states of Bihar and Odisha which are amongst the poorest states of India suffering from high levels of hunger and malnutrition. Three districts of Bihar and four districts of Odisha are chosen for the purpose. From each selected district, two villages (one small and one large) were selected on the basis of its total population. As a first step coping strategies were identified and ranked by the people through FGD. In each village, eight focus group discussions (four for men and four for women) were conducted, and a total of 104 FGDs were conducted for the study.

FGDs were conducted by the lead researchers with trained research assistants as the note taker. The discussions were tape-recorded and transcribed verbatim in English by the research assistants. Immediately after the meeting of each focus group, the ideas or information that had arisen were arranged under appropriate headings as the summary notes. Further, the transcripts were analysed and arranged under different themes using NVIVO 11.

Findings and Interpretations

The most severe coping strategy, stop eating pulses, is adopted by only those scheduled caste and scheduled tribes (SC/STs) who are landless in Odisha whereas, in Bihar, it is adopted by both, landless SC/STs and landless general category households. Substitution of pulses by other food-category is almost equally adopted by all the four groups in both the states. Substitution by the same food-category is also adopted by all the groups in both the States, but the adoption is mostly dominated by large farmers. Large farmers are mostly curtailing the quantity of the most preferred pulses (by decreasing the portion size at each serving or frequency of consumption) and substitute it with other less preferred pulses and other vegetables. Marginal farmers are also curtailing the quantity of preferred pulses by decreased frequency and the portion size and also the rationing of adult intake in favour of children intake of pulses.

Rainfall, unavailability of the market and spurious seen quality are among the major perceived barriers to pulses production. Pluses are considered to be a marginal crop. In the absence of quality seeds and timely availability of hired labours, the farmers perceived its cultivation risky.

Conclusions

The analysis concludes that there are little resources for landless groups to hedge them against food inflation, which has serious consequences for nutrition security. Therefore, we recommend that pulses should be covered under the PDS system as a priority.

The government should make provision of certified high-quality seeds of pulses of HYV locally available to the farmers and facilitate them with the provision of crop Insurance to reduce risk. We, also recommend the provision of extension services to the farmers to help them with selecting suitable pulse crop, according to the soil and other related information for better yield.

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Health-motivated taxes on red and processed meat: a modelling study on optimal tax levels and health and climate-change co-benefits

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Introduction

The consumption of red and processed meat has been associated with increased mortality from chronic diseases, including cancer, and its production causes a significant portion of food-related greenhouse-gas (GHG) emissions. One policy response is to regulate red and processed meat consumption similar to other foods of public health concerns. Here we describe a market-based approach of taxing red and processed meat according to its health impacts.

Methods

We built an optimization algorithm to estimate the economically optimal tax levels for 149 world regions that would account for (internalize) the health costs associated with ill-health from red and processed meat consumption, and we used a coupled modelling framework to estimate the impacts of optimal taxation on consumption, non-communicable disease mortality, and food-related GHG emissions. Health impacts were estimated using a global comparative risk assessment framework; economic responses were estimated using international data on health costs, prices, and price elasticities; and changes in greenhouse gas emissions were estimated using data of life-cycle analyses.

Findings and Interpretations

The health-related costs to society attributable to red and processed meat consumption in 2020 amounted to USD 300 billion (95% confidence interval (CI), 94-455), three quarters of which were due to processed meat consumption. Under optimal taxation, prices for processed meat increased by 54% on average, ranging from 2% in low-income countries to 200% in high-income countries, and prices for red meat increased by 7%, ranging from 0.3% to 26%. Consumption of processed meat decreased by 21% on average, ranging from 2% to 34%, whilst red meat consumption remained stable as substitution for processed meat compensated price-related reductions. The number of deaths attributable to red and processed meat consumption decreased by 13% (300,000; CI, 44,000-585,000), attributable health costs decreased by 20% (USD 58 billion; CI, 12-100), and food-related GHG emissions decreased by 1.4% (130 MtCO2-eq; CI, 55-179) globally, in each case with greatest reductions in high and middle-income countries.

Conclusions

Including the social health cost of red and processed meat consumption in the price of red and processed meat could lead to significant health and environmental benefits, in particular in high and middle-income countries. The economically optimal tax levels estimated in this study are context-specific and can complement the simple rules of thumb currently used for setting health-motivated tax levels.

The relative price of healthy and unhealthy foods in 176 countries: Implications for food and nutrition policies

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Introduction

Although economists and nutritionists have long viewed income and knowledge as primary constraints on the diversification of diets, the high prices of nutrient-rich foods may also be important. Since many nutrient-rich foods are highly perishable, their relative price is likely to vary substantially across countries, and likely to be determined by local food production and trade characteristics. In contrast, relatively unhealthy staple foods and processed foods are more likely to obey the so called "law of one price", with prices varying little across countries. This paper investigates if these hypotheses are supported by internationally comparable price data from 176 countries.

Methods

We use data on the prices of various foods for 176 countries from the 2011 round of the International Comparison Program (ICP), a project led by the World Bank for the purposes of constructing internationally comparable estimates of GDP and poverty. For each country we construct a novel measure of relative prices, the ratio of a given food (e.g. "large brown eggs") relative to the price of the cheapest cereal in each country. The selection of cereals as a base product is justified by their universal consumption, high tradability, and the fact that they are one of the cheapest sources of calories. We construct relative prices for 20 widely consumed foods, and compare means and variation across foods and across regions using graphs and maps. All price ratios are measure in quantity or caloric terms to facilitate price comparisons across different foods. We use least squares regressions to assess whether cross-country variation in relative food prices explains the consumption patterns of children aged 6-23 months, after controlling for GDP per capita. Finally, we examine why food prices vary across regions by comparing their association with productivity indicators and agroecological characteristics, as well as characteristics of the ICP survey.

Findings and Interpretations

We have five main findings:

(1) Relative prices for more tradable foods vary little across countries, and are generally as cheap as cereals (in quantity terms). Many such foods are relatively unhealthy, however, being high in fat and carbohydrates and low in essential micronutrients and protein (oils, sugar, salt, soft drinks, and various roots and tubers).

(2) Relative prices of healthy fruits and vegetables vary more across countries, but are typically relatively affordable.

(3) Relative prices of animal sourced foods (ASFs) vary substantially across countries and are often very expensive sources of calories.

ASFs are 5-15 times as expensive in low income countries compared to OECD countries, especially in sub-Saharan Africa.

(4) Children's consumption of vegetal foods is not strongly associated with GDP per capita or prices of vegetal foods; in contrast, GDP and relative ASF prices are strongly associated with ASF consumption.

(5) Prices of ASFs are strongly associated with production characteristics. Livestock diseases appear to be a major cause of high ASF prices in Africa along with various downstream value chain bottlenecks that limit the storability and tradability of these foods.

Conclusions

These findings demonstrate that the relative prices of healthy foods, particularly ASFs, vary much more across countries than the prices for unhealthy foods. This finding contradicts the claims of several studies that certain nutrient-rich foods, such as eggs, are relatively cheap (Iannotti et al. 2013; 2014); eggs are cheap in high income countries, but 5-15 times as expensive in low income countries.

These data have several caveats. First, ICP price data are somewhat urban biased, though we can for this problem and it does not affect our central finding that prices are associated with children's diets. Second, while the ICP strives for product comparability, we cannot rule out the possibility that price differences are partly explained by quality differences.

Our findings have important policy implications. Given the strong association between ASF consumption and linear growth, the expensiveness of ASFs in developing countries may be an important underlying determinant of stunting. This suggests that conventional remedies for monotonous diets - income and behavioral change interventions - may be less effective for poor populations facing extremely high ASF prices. This justifies an important role for food policies targeting productivity, value chain efficiency, infrastructure and trade to drive down the relative prices of nutritious foods.

The Changing Food Expenditure Patterns and Trends in Zambia: Implications on Agricultural Policies

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Introduction

Zambia, like many other African countries is undergoing rapid urbanization and rising per capita income accompanied by rising population . These broad changes are expected to drive the transformation in consumption patterns. However, there is lack of evidence on how food consumption patterns have changed among households in urban and rural Zambia. Failure to recognize these changes may have led to the mismatch between agricultural policies and consumer preferences. Against this background, this study sought to understand the changing consumption patterns in Zambia and the implications of this transformation on food policy, food market and rural development.

Methods

The main source of data for the study was the Living Conditions Monitoring Survey (LCMS) data collected in 1996, 1998 and 2010 and 2015 by the Central Statistical Office (CSO) of Zambia. The LCMS datasets are nationally representative survey data collected over time, and contain among other variables, expenditures on food items. The LCMS serve as the official source for national poverty statistics. The sample size in each of the LCMS datasets used in the study were as follows: 1996 (11,961 households), 1998 (16,443 households), 2010 (19,313 households) and 2015 (12,251 households).

The analysis of expenditure patterns of households was conducted in order to determine changes in consumption patterns . The expenditure share of each food item out of total food expenditure (expressed as a percentage) was used to examined how the share of total households budgets are allocated across the different foods and how this has changed over the years. The food items were categorized into the following sub-groups: food groups, commodity groups and level of processing . Comparison of expenditure shares was also done between rural and urban areas and between different income groups.

Findings and Interpretations

The study finds major declines in the shares of food expenditure on maize among rural and urban households between 1996 and 2015. Corresponding to this drop in maize shares, urban households showed a significant increase in wheat expenditure shares while rural households reduced the share of other coarse grains and tubers. Wealthier households spent larger shares of their food expenditure on wheat, rice and potatoes. While poorer households reduced their share of maize expenditures, they have not sufficiently substituted maize with other staples.

Transformation of food consumption patterns is prominently among high income households, mainly in urban areas. Wealthier households increased their share of expenditure on animal foods much more than poorer households did. At the same time, poorer households doubled the expenditure share on vegetables. There was also an increase in the expenditure shares of perishable and processed food in both rural and urban areas, representing opportunities in agro-processing and fresh produce sub-sectors.

The changing pattern of food consumption is consistent with rising incomes and rapid urbanization. However, the disparities between the different income groups and between rural and urban areas is indicative of the rise in income inequality both in urban and rural parts of Zambia.

Conclusions

The study demonstrates that food expenditure patterns have changed quite dramatically over the years especially among the urban and more affluent households. Thus, the beginnings of dietary transformation in Zambia is evident from the reduction in households' expenditure shares on staple foods and the increase in the share of other foods. However, the variations between urban and rural households as well as across the different income groups, are an indication of growing income inequality as well as the concentration of income growth among urban households.

These patterns could be a result of changing preferences as per capita income grows and in some cases prices. Maize centric policies, however, have not kept pace with these changes. Thus, Zambia's agricultural policies have failed to recognize that consumption patterns have changed over time.

The increased prominence of vegetable expenditures among the poor, especially in rural areas, may be indicative of increases in quantities consumed, but may equally be an indicator of higher prices for this food group. Combined with our findings on the low share of nutritious animal foods in low-income food expenditures, this raises concerns over the nutritional quality of diets in poor households, especially in rural areas.

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SESSION 3: POLICY, FOOD SUPPLY AND FOOD PRODUCTION

Session Chair: Jeff Waage, Leverhulme Centre for Integrative Research in Agriculture and Health (LCIRAH)

What Drives Diversification of National Food Supplies? A Cross-Country Analysis

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Introduction

Little previous research has explored what drives the diversification of national food supplies (DFS) across countries and regions. We construct and analyse a cross-country dataset linking a simple DFS indicator - the share of calories supplied by nonstaple foods - with structural transformation and agroecological indicators. Panel econometric models show that several indicators of structural transformation (economic growth, urbanization and demographic change) are strong predictors of DFS within countries, yet time-invariant agroecological factors are also significantly associated with DFS, which appears to explain why some countries have exceptionally low or high DFS relative to their level of economic development.

Methods

To econometrically explore factors that might influence DFS, we first estimate fixed-effects (FE) models to assess the associations between diversity of food supply (DFS) and four time-varying intermediate determinants (consumption, education, urbanization and population 0-14 years). These regressions are effectively difference-in-difference regressions, though a disadvantage of fixed effects models is that researchers are sometimes directly interested in the impacts of time-invariant factors such as agroecological constraints and transport costs. We therefore also utilize the correlated random effects (CRE) model, also called the Chamberlain-Mundlak model, following Mundlak (1978) and Chamberlain (1984), to account for the panel structure in the data whilst still allowing coefficients of time-invariant independent variables to be identified. In this model fixed effects are effectively replaced with country averages of time-varying indicators as well as a vector of time-invariant indicators of interest (for example, agroecological indicators). This model still therefore still specifies within-country effects of time-varying indicators (such as growth in consumption per capita), but allows us to test associations between time-invariant factors and DFS. The key assumption is that the remaining unobserved heterogeneity is uncorrelated with the independent variables.

Findings and Interpretations

For every doubling of household consumption expenditure, calories supplied from nonstaples will go up by nearly 6 percentage points, strongly significant at the 1 percent level in both FE and CRE regressions. However, other indicators of structural transformation are also highly significant but we do not find any significant association between the years-of-education variable and DFS. In the CRE model, the partial elasticity for road density is 0.04, while the elasticity associated with shipping costs is insignificant. This likely reflects the fact that many nutrient-rich foods are highly perishable and are not shipped large distances. Land suitability for crop production is positively and significantly associated with DFS and rural population density has a relatively large and negative partial elasticity of -0.11. In the FE model the within R-squared is 0.62, suggesting that these four structural transformation indicators explain around two-thirds of the changes in DFS over time. In the CRE model, it is worth noting that the time-invariant factors explain a high share of the total variation in DFS (56 percent). Overall, the results support Bennett's (1941) prediction that economic growth leads to diversification of food supplies, but the models are also highly consistent with broader theories of structural transformation.

Conclusions

We find strong support for Bennett's (1941) law—DFS is strongly associated with economic growth—but also evidence that other forms of economic transformation drive DFS, notably urbanization and the demographic transition from younger to older populations. We hypothesize that the transition to an older population structure may influence disposable income at any given per capita level of income, though it may also shift preferences toward tastier and more nutrient-rich foods.

However, evidence suggests that some countries have unusually undiversified food supplies relative to their development levels. It may be that these countries share agroecological characteristics that give them a comparative advantage in rice production, and a

comparative disadvantage in the production of noncereal foods. Our regression analysis provides some support for this hypothesis. These findings pose many challenges for nutrition strategies and policies because it illustrates the difficulties of diversifying food supplies and diets in the absence of prolonged economic growth and transformation. To date, however, little research has assessed how countries might best pursue a strategy of making nutrient-rich foods both more desirable and more affordable, and what impact nutrition-sensitive food policies might have on diets. This would appear to be an important agenda for future research.

Efficiency of small scale vegetable farms: policy implications for rural poverty reduction and nutrition security in Nepal

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Introduction

Poverty and hunger reduction are intertwined challenges and enduring issues in the developing countries. The United Nations, through its Sustainable Development Goal put high priority on ending poverty and hunger in the world by 2030 (World Bank, 2014). The vegetable sector play a key role in reducing hunger and malnutrition for billions of people (Binswanger and Quizon 1986; Islam 2008; AVRDC 2010). The main objective of our study was to evaluate the economic efficiency of vegetable farms and to suggest high priority areas for policy intervention to improve the efficiency of vegetable production leading to enhance income and improve nutrition.

Methods

This study was conducted in four districts namely Dolakha, Lalitpur, Dhading, and Dhanusa representing all three agro-ecological regions (mountain, hill, and terai) in the central region of Nepal. We randomly selected 502 winter season vegetable farms from 12 randomly selected villages (three villages in each district) to be surveyed during July and August, 2013.

A non-parametric deterministic mathematical programming of Data Envelopment Analysis (DEA) approach, developed by Farrell (1957), was adopted under both constant returns to scale (CRS), as in Charnes et al. (1978), and variable returns to scale (VRS), as in Banker et al. (1984). We adopted a two-limit Tobit model (Maddala 1985) to determine the determinants of vegetable farm efficiencies. In order to test the heteroskedasticity problem we used White's test (Hill et al. 2011).

The vegetable production was modeled as a function of land, labor, traction power, seed, organic matter, chemical fertilizer, and other variable costs. We considered some technology and socio-economic related variables such as seed type (dummy), number of trainings received by farm manager, credit access (dummy), external support index (consisting of seven components: fertilizers, irrigation, seeds, pesticides, production material, extension material and post-harvest material), gender of farm manager, and women participation index.

Findings and Interpretations

The sum of coefficients was found to be 1.049, indicates that there are near constant returns to scale in vegetable production. The output elasticity found to be in decreasing order for labor, organic matter, chemical fertilizer, land, traction power and seed. Results revealed that there is a big gap between observed and frontier efficiency scores under both approaches CRS and VRS. Average economic efficiency (EE), technical efficiency (TE), and allocative efficiency (AE) scores were higher under VRS than CRS assumption. The EE was 0.30 under CRS and 0.39 under VRS assumptions, which is far from the frontier efficiency level, indicating that there is a great deal of inefficiency in vegetable farms and that substantial reductions in cost of variable inputs are possible without reducing production.

Various explanatory factors were regressed on EE, TE, AE, PTE and SE using a two-limit censored Tobit model. The improved seed variety, credit access, market access, gender of farm manager, women participation index, and external support index were statistically significant effect on EE, AE, TE, and SE. Thus, the vegetable farmers would be able to reduce their actual costs by 75 % by operating their vegetable farms at the full technical and allocative efficiency.

Conclusions

We fit an input oriented DEA model to estimate alternative measures of farm efficiency using cross-sectional data collected from 502 randomly selected farm households. Our dependent variable, farm output, and seven different inputs in our DEA model to estimate the efficiency of the small-scale vegetable farms. The efficiency scores were then regressed on a set of explanatory variables to identity the policy and programmatic interventions that would do most to boost farm level efficiency. The results showed that a majority of the farms are operating very inefficiently relative to the most efficient farms, and suggesting that there is a potential to increase both technical and allocative efficiency for majority of the farms compared with best practice farms. The average potential for cost reduction is 75% and such cost reduction comes by adopting the best

technology practices of the efficient farms through the optimal resource allocation.

Our results from Tobit model suggest that technical efficiency and allocative efficiency of vegetable farms are affected by a number of explanatory variables related to types of external support index, gender of farm manager, women participation index, access to credit, access to market, and type of seed.

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Improving health and sustainability outcomes in the edible oil sector in India: A qualitative policy analysis

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Introduction

Following trade liberalization in 1994, India's edible oil imports have increased exponentially. Imported palm and soybean oils currently make up 70% of the edible oil available for consumption 1. Imports represent an important source of affordable calories and fats. However, the widespread availability of cheap imported oils can also contribute to a shift towards "westernized" diets, with increased consumption of salt, saturated fats, sugar and highly processed foods, leading to increased prevalence of NCD2. There are also concerns about the impacts on local producers, and environmental effects in supplying countries, where oil crops have contributed to large scale deforestation3.

Methods

Our aim was to analyse opportunities and constraints for policy interventions aimed at improving health and sustainability impacts in the edible oils sector, identifying realistic and politically feasible policy options.

We conducted a qualitative policy analysis of policy documents, interviews with experts and stakeholders in policy, industry and civil society, and a mapping of the main segments of the sector and their interaction..

We combined a nutrition-oriented value chains framework4 with a policy space analysis framework5. In the first stage, we analysed the characteristics within each segment of the value chain, including financial, technological and political/organizational. We then mapped key policy interventions and instruments along the value chain. These include mainly existing policies, but also some interventions proposed by experts and stakeholders. In a second step, we analysed opportunities and constraints given by the value chain segment characteristics and context, which shape the policy space. We identified key leverage points, synergies and trade-offs across nutrition, economic and sustainability objectives and analysed the coherence of interventions along the value chain.

Findings and Interpretations

We found significant opportunities for policy action, related to increasing awareness, political will and potential to align key interests on nutrition and sustainability. Perceptions of sustainability and nutrition as competing goals as well as demand patterns associated with palm oil, which is consumed to a large extent in processed food and meals cooked out of the house, can constrain the policy space.

We identified four key entry points along the value chain.

Firstly, there are opportunities for climate and nutrition sensitive interventions in the domestic oilseed sector, integrated within existing and planned agricultural policies.

Secondly, inclusion of nutrition and sustainability concerns in the tariff-setting agenda, perhaps through the creation of a specific multi-stakeholder platform, can enhance the effectiveness of interventions in other segments.

Thirdly, inclusion of local edible oils in the Public Distribution System can be complementary to recent policies promoting fortification6. This strategy could improve nutrition security, support local producers and create policy space to address issues related to sustainability and NCD.

Finally, there are a number of initiatives targeting food environments focusing on street food, school meals, processing, labelling, packaging and advertisement7,8. These offer a good opportunity for the promotion of quality and sustainability of edible oils.

Conclusions

We identified significant opportunities for policy action, as well as important constraints. We find that sustainability and nutrition (and within nutrition, policies focusing on under- and over-nutrition) tend to operate as separate agendas, and focus on different segments along the value chain. Strategies for NCD prevention in the edible oils

sector tend to focus on labelling and packaging and, increasingly, food environments, but are less prominent in other segments of the value chain. On the other hand, sustainability goals, which are gaining attention in more upstream segments, could be supported by inclusion of sustainability in policies aimed at downstream segments.

Overall, given the sector characteristics and demand patterns, direct targeting of household consumption decisions is likely to have a limited impact. Instead, we identify four key leverage points along the value chain and suggest that coherent action across all four points can improve health and sustainability outcomes.

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Food Policy and Health Outcomes: A Mixed-Methods Investigation of Health-Sensitive Palm Oil Policy in Thailand

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Introduction

Palm oil is a cheap and versatile edible oil in widespread use as a food ingredient that has been linked to negative health and environmental outcomes. The study aimed (i) to understand the prospects for future health-focused policy development to limit food use of palm oil and promote a greater diversity of oils in Thailand's food system, and (ii) to enable a quantitative appreciation of the potential economic, health and environmental implications of policy change.

Methods

The study employed a mixed-methods approach, using qualitative research to uncover the nuances of policymaking in the sector, and using the qualitative information to underpin quantitative simulation modelling and interpret modelling results.

In the qualitative phase, eighteen semi-structured interviews were conducted with a range of stakeholders in Thailand. The interviews probed views on the economic, health and environmental dimensions of the issue, the prospects for health-focused policy development and the policy development process. Transcripts were analysed using a health policy analytical framework.

In the quantitative phase, we developed a simulation model that integrates macroeconomic, environmental, demographic and health models and modules into one framework. The model focuses on regional nutrient intakes from food demand (including palm oil) and their implications for population serum cholesterol levels and clinical health outcomes, and on land use change for oil palm production and their implications for carbon sequestration. Clinical health outcomes including myocardial infarction and stroke are linked to labor market participation and to public/private hospital and care expenditures, allowing a holistic analysis of potential policies.

Findings and Interpretations

The qualitative results show that there are several impediments to the emergence of strong regulation, including the primacy of economic considerations in setting policy, doubt and misperception about health implications, and a complex regulatory environment with little space for health-related considerations. A key and unique feature of Thailand's oil palm production has been that it is predominantly based on smallholder production in abandoned paddy fields and waste lands, in contrast to the large-scale plantations in forested areas as found in Malaysia and Indonesia.

The simulation modelling results show that policies to reduce Thai palm oil consumption by 50% yield positive health and economic impacts saving more than 3000 lives and raising national income by 0.32%/1.8bn USD annually by 2035. However, as foreshadowed by the qualitative insights, the reduction in oil palm farms actually reduces carbon sequestration and increases annual C02-equivalent emissions by more than 0.5Mt by 2035. This is due to the small scale nature of oil palm production in Thailand that does not compete with forests.

Conclusions

The results underscore the importance of retaining the smallholder, low-impact nature of Thai oil palm production, while finding ways to mitigate health impacts from palm oil in widespread food use. Supporting the current trend towards biofuel use of oil palm and diversifying away from palm oil in food use may be a way forward.

Food Self-Sustainability Drive and Malaria Spread in Rural Nigeria: A Need for Policy Coherence?

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Introduction

Nigeria struggles with hunger, malnutrition and health challenges according to the 2016 Global Hunger Index and the 2015 Malaria Report respectively. Policies and Programmes to grow agriculture lack health components despite that irrigation, which drives the programs also enhances malaria spread. Malaria is responsible for 60% outpatient visit to health facilities, 30% childhood death, and 25% of death in children under one year in Nigeria. The study highlighted four pathways through which malaria impact rice output and use of farm inputs for the advocacy for policy coherence to boost the national rice self-sufficiency efforts and food security programs in Nigeria.

Methods

The study used irrigated, upland and lowland rice production technologies located on coordinates 5° 58′ 0″N, 7° 52′ 0″E; 7° 37′ 16″N, 5° 13′ 17″E; and 9° 27′ 0″N, 5° 38′ 0″E in Ebonyi, Ekiti and Niger States respectively. The LGAs are important rice producing areas according to the state ADPs and have high malaria cases. Also, the presence of irrigation project for rice production in Lavun LGA; lowland rice production in Afikpo-South LGA; and upland rice production in Ifelodun/Irepodun LGA made them suitable. The study adopted Multistage sampling technique and data was collected randomly through 16 weeks using well-structured questionnaire. Six hundred rice farming households were involved, but 570 questionnaires were found useful. The survey questionnaires consisted of three parts which are Household socio-economic aspect, Farm-related aspect, and health aspect. Tobit regression model analyzed through maximum likelihood estimate was used for the determinants of malaria spread, Multinomial Logit Model was adopted for the Household choice of malaria treatment options, Cost of illness was for the determination of Economic Burden of Malaria, and Stochastic Frontier Model analysis captured output and productivity measurement. Hypotheses were also tested using paired sample t-test.

Findings and Interpretations

Household size, Years of education, annual income2, treatment cost, Farm distance to homestead and marital status are all significant variables at ($p < 0.05$) that influenced malaria spread. The marginal effect shows that an added naira in treatment cost increases the average rate of malaria spread by 0.001 and an additional kilometre to farm distance lessens the spread of malaria by 0.029. Choice of Malaria care provider analysis shows that household size, education, clinic distance, treatment cost, malaria perception and number down with malaria, influenced the choice of public hospital to self-medication. The Economic cost of malaria was about 8.93% of rice farmers' annual income. Treatment cost ($p < 0.05$) and number down with malaria ($p < 0.01$) reduced the productivity of the malarious households. The non-malarious household mean efficiency score was 29.9 higher and the non-malarious household rice output is 40.7% greater than malarious household output. The paired sample t-test result showed that non-malarious households were more efficient than the rice farmers from malarious households.

Conclusions

The study provided evidence-based research that linked SES and some agricultural and health variables directly to malaria spread. It also established that malaria imposes economic burden on some rice farmers which invariably affected efficiency and rice output in the study area. Malarious households were found to be lower in technical efficiency than the non-malarious households. This study, therefore, has established the need for policy coherence in agriculture and health sectors. Efforts and policies by international, regional institutions and public institutions in Nigeria geared towards translating a food insecure, hunger dominated and malaria-ridden Nigeria to a rice self-sufficient or food self-sustained and healthy nation should be policies that take health and agricultural policies into consideration coherently for speed and effectiveness, hence the need for institutional policy coherence.

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SESSION 4: CLIMATE, SEASONALITY AND ENVIRONMENTAL CHANGE

Session Chair: Stuart Gillespie, International Food Policy Research Institute (IFPRI)

Seasonality of consumption of non-staple micronutrient-rich foods among young children in three geographically diverse Nepali communities

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Introduction

A diverse diet that includes micronutrient-rich foods is important for child nutrition and health. Due to the cross-sectional design of most dietary diversity studies, the potential seasonality of child diets is not well understood across the different ecologies of Nepal. We examined seasonal patterns in child consumption of key micronutrient rich foods across Nepal's three agro-ecological regions, and assessed whether seasonal consumption patterns vary by wealth and caste/ethnicity.

Methods

We analyzed longitudinal data from three PoSHAN Community Studies surveillance sites. Data was collected three times per year during the monsoon (May-July), harvest (September), and winter (January-February) seasons, between May 2013 and February 2015. A seven-day food frequency questionnaire was used to collect dietary data from children 6-72 months in the three sites: mountains (Jumla, N=226), hills (Arghakhanchi, N=168), and plains (Banke, N=225). For each food group (vitamin A-rich fruits and vegetables, dairy, eggs, and flesh foods), we calculated summary statistics and the relative contribution of individual foods to total food group consumption by season and region. We then fitted multivariate negative binomial models to estimate the relationships of season, wealth, and caste/ethnicity with consumption frequency for each region. These models provided coefficient estimates in the form of incident rate ratios (IRR), interpreted as the ratio of times a child in a given category consumed a food in a seven-day period compared to children in the baseline category. Finally, we calculated and plotted the average adjusted predicted consumption frequencies for each food group across seasons, wealth levels, and caste/ethnicity groups.

Findings and Interpretations

Children's diets were very low in micronutrient-dense foods year-round, with seasonal vulnerability to particularly low consumption varying by agro-ecological region and socioeconomic group. In the mountain site (Jumla), consumption of vitamin A-rich fruits and vegetables was lower in the harvest season compared to the monsoon season (IRR: 0.5, $p < 0.001$), and in the winter those with lower income were particularly vulnerable to low consumption (IRR: 0.5, $p < 0.001$). In the plains site (Banke), weekly consumption of vitamin A-rich fruits and vegetables was lower during the harvest season compared to the other two seasons (IRR: 0.2, $p < 0.001$), reaching close to zero. Dairy consumption decreased during the monsoon season in the hills (Arghakhanchi), compared to the other two seasons (IRR: 1.6, IRR: 1.5, $p < 0.001$) and in Jumla dairy consumption decreased during the winter, but the change was only significant among Dalit (very low caste) children (IRR: 0.3, $p < 0.004$). Consumption of meat and fish was slightly higher during September in Banke compared to the other two seasons (IRR: 1.6, $p < 0.001$). Interestingly, this increase was primarily attributable to greater consumption of fish among Muslim children at that time of year (1.7, $p < 0.004$).

Conclusions

Overall, these findings emphasize Nepali children's low consumption frequency of micronutrient-rich foods and the need for program planners to be watchful for and responsive to seasonality. Seasonal variations in young children's consumption of non-staple nutritious foods may result in poorer diet quality at certain times of year and among certain population groups. There are also, however, opportunities to identify by examining the "positive deviant" practices adopted by certain groups who adequately cope with seasonal availability of foods, or are able to substantially increase their consumption at certain times—practices that could be promoted more widely in the same population. Our findings also emphasize the need for more widespread and long-term collection of seasonal dietary intake data to identify groups most vulnerable to poor diets, and for researchers to consider the implications of when data collection occurs and its potential to mask or accentuate deficiencies in diet quality and disparities between groups.

Assessing the rainfall-agriculture and rainfall-health nutrition pathways in Uganda

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Introduction

This paper studies nutrition outcomes of 4,463 children below age 5 in Uganda. In addition to studying traditional indicators at the child, mother, household and district levels, data on rainfall are used. Rainfall is linked to short-term child growth through two pathways, one for agriculture and another for health. When rainfall is sufficient, crop yields are likely to be high, leading directly to more food consumption and indirectly to lower food prices. The link between health and rainfall can be traced through its influence on the household health environment and disease transmission. The analysis aims to measure these connections.

Methods

Child growth is measured using weight-for-height (WHZ) and height-for-age (HAZ) z-scores, obtained from 2006 and 2011 Uganda DHS surveys. Rainfall data come from the Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS), gridded satellite-based precipitation estimates from NASA and NOAA with daily time scales at 0.05 x 0.05 degree spatial resolution. Analysis of links between rainfall and WHZ follow the approach of Rabassa, Skoufias and Jacoby (2012) and Tiwari and Jacoby (2013). For HAZ the approach of Cornwell and Inder (2015) is followed. The analysis assesses the importance of cumulative rainfall received at different periods -- before and after birth, and during the main agricultural season -- and its associations with child nutrition outcomes. Two hypotheses are tested: (1: agriculture pathway) that children observed (conceived, born, or contemporaneously measured) in periods following a high rainfall season have higher WHZ and HAZ; and (2: health pathway) that children observed during or immediately following a high rainfall season have subsequently lower WHZ. Four-level hierarchical regressions are used to account for the structure of the data: nutritional outcomes (first level), nested within households (second level), nested within clusters (third level), nested within districts (fourth level).

Findings and Interpretations

Evidence supports the hypothesis of a negative health pathway. Diarrheal disease has a significant and negative association with WHZ when rainfall is included only as a moderator or as a moderator as well as a covariate. This association remains negative and significant when the production pathway (the main crop yield) is included as a control. Evidence also supports the hypothesis of a positive agricultural pathway. The main crop yield has a significant and positive association with WHZ when rainfall is not accounted for and when rainfall in the previous year is accounted for only as a moderator or as a covariate. The effect is positive and significant below 665 mm of rainfall received in the main rainfall season of the previous year -- when rainfall is accounted for only as a moderator, and is positive and significant above 403 mm of rainfall -- when rainfall is accounted for as a moderator as well as a covariate. The health and agricultural productivity effects of rainfall are somewhat offsetting: at low ends of the rainfall spectrum, crop yield effects dominate, leading to low child nutrition outcomes; at the higher end of the rainfall spectrum, negative health effects offset positive crop yield effects.

Conclusions

This study highlights the importance of rainfall in influencing the nutrition outcomes of children under age 5 in Uganda. The findings for the health pathway show that diarrheal disease has a negative and significant association with child nutrition outcomes, which becomes more negative with increasing rainfall received in the main rainfall season in a given year. This reveals the importance of rainfall in influencing the household's disease environment and its impacts on the child health in the short-term. The findings for the production pathway suggests that at the lower end of the rainfall spectrum crop yields are low leading to lower child nutrition outcomes, but at the higher end of rainfall spectrum the benefits of rainfall on crop yields are offset by the effects of diarrheal disease. The negative disease effect dominates. This further reveals the importance of rainfall in influencing the household's disease environment and its impacts on child health in the short-term.

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Realistic and healthy dietary changes to address freshwater constraints in India: a modelling study

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Introduction

Diets in India have a large blue water footprint (WF) relative to other countries. The blue WF represents the embedded irrigation water in crop and livestock products. Irrigation is widely used in India, and this dependence is likely to increase with population growth and dietary change, yet water resources are already stretched. This challenge may affect the availability of and access to healthy diets, particularly for poorer populations. This study aimed to identify realistic and healthy dietary changes that, if adopted at a wide scale, could enhance the resilience of the Indian food system to future decreases in water availability.

Methods

The blue WFs of typical Indian dietary patterns were quantified based on published dietary and WF data. A target reduction in blue WFs was based on projected declines in per capita freshwater availability to 2025 (18%) and 2050 (30%). The consumption of 36 food groups was optimised to meet blue WF reduction targets and WHO nutritional guidelines while minimising deviation from existing patterns. To ensure that results were equitable, the WF target was applied across all dietary patterns, such that greater reductions in blue WF were required for dietary patterns with higher baseline blue WFs. Resulting changes in life years lost due to coronary heart disease, stroke, diabetes and cancers, were modelled using life tables. Changes to greenhouse gas (GHG) emissions associated with the diets were also quantified.

Findings and Interpretations

The target reductions in blue WFs of diets was achievable with relatively small changes to diets. Optimised diets typically contained less wheat, dairy and poultry, and more legumes. The lower WF diets were also generally healthier. Adopting diets for the 2050 scenario would result in 6800 (95% CI 1600–13100) life-years gained per 100000 population over a 40-year period. Dietary changes were also accompanied by reductions in GHG emissions. The magnitude of the health and environmental impacts varied between dietary patterns. For example, wheat-based diets had larger blue WFs than rice-based diets (wheat is typically grown under irrigation) and wheat-based diets changed more following optimisation.

Conclusions

The projected decline in per capita freshwater supplies poses a challenge to ensuring availability and access to healthy diets in India. Policies to guide dietary choices could reduce blue WFs of diets and deliver environment and health co-benefits; however, current dietary trends run counter to some of the optimisation model outputs. For example, consumption of dairy and poultry products is rapidly rising in India, yet these products have large blue WFs and their consumption decreased in the optimisation process. However, relatively small changes to consumption patterns across food groups achieved significant reductions in dietary blue WFs demonstrating the strong potential for diet-led strategies (alongside production-side innovations) to shape a healthy and sustainable food system in India.

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Pathways of child food insecurity amidst climate change: A Case Study of Indian Sundarbans

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Introduction

Climatic vulnerability affects food security by altering all four dimensions of food security: food availability, accessibility, utilisation and food system stability. It is hence seen as a crucial "hunger risk multiplier". The Indian Sundarbans is an example of a badly affected region due to climate change that is at a high risk of food insecurity. The impacts of climate change manifested as extreme weather conditions, gradual land erosion and increase in land salinity have greatly affected the four dimensions of food security in the region.

Methods

We used a comparative case study approach using a cross-sectional, mixed method design. For the purpose of comparison we used a criteria based sampling to select three villages based on their proximity to the ocean and a systematic random sampling for selection of households with children below 6 years of age in each village. Villages were segmented based on catchment area of Integrated Child Development Centres. 1041 Households were selected sequentially from the list of mapped households from all segments. Anthropometric measurements like height, weight and mid-upper arm circumference were conducted with all the selected children (0-6 years). The household survey assessed the following aspects- a) Malnutrition and childhood illness in the last 30 days. b) Access to health and nutrition services c) Assessment of food security in households d) Migration and its effects on households e) Experience of climate and climatic extremities and its effect on assets, livelihood and food security. The study team also administered qualitative tools like 1) Comprehensive vulnerability analysis with a mixed group of community members 2) In-depth interviews with the mothers of the selected children 3) Key Informant Interviews with all the public and private health providers in the villages.

Findings and Interpretations

Villages close to the sea are facing the most impact of climate change on the four dimensions of food security. Across the three region 25.4% of the households faced extremely high losses to food resources during climatic emergencies. 66.64% of the households face low to very low food security and 44.53% of the households show low to very low levels of child food security. People are using coping strategies ranging from borrowing money from others (67.62%) to buy food to cut down the number of meals per day (31.67%). As per USAID food security instrument for the last 12 months the region closest to the sea has a higher percentage [32.00%] of food insecure households compared to other regions. Qualitative findings suggest not only the amount of food is decreasing but the choices of food groups are also facing a limitation to rice, pulses and potatoes and consuming less the groups like meat/fish, fruits and dairy products. Further analysis shows prevalence of malnutrition is higher (Underweight 31% and stunting-36.5%) in households facing very low or low food security and average number illnesses is 8 times in a year experienced by children in a year.

Conclusions

The study presents empirical evidence on the pathways of climate change impact on child food security in climatically vulnerable Indian Sundarbans. However, the risk is still not well reflected in the malnutrition status of the children due to range of short term coping strategies taken by the parents. The populace bounces back each time after a climatic shock but worse than the previous. Simultaneously, there is no such adaptive mechanism or mitigation plans for sustainable dealing with the changing situation. Social programmes which exist to ensure food security in the region need to be adapted to cater to this vulnerable population. Even within this special climatic region there are some pockets as identified by the study which will need more support in specific times. Additionally, long term measures to increase the resilience of the population and mitigate the continuous environmental degradation due to climate change need to be urgently identified.

Seasonal variations in household food security and dietary diversity and associations with maternal and child nutritional status in rural Ethiopia

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Introduction

In Ethiopia women and children are severely affected by poor health and under-nutrition. Food availability and dietary diversity influence this status, and are likely to vary seasonally. Different indices have been developed to measure food insecurity (e.g. HFIAS, HDDS, FCS), but there have been few analyses which investigate the relationships between these indicators, their seasonal variation between post-harvest and lean season, and direct measures of women and children's nutritional status. This study measures nutritional status through anthropometric and bio-marker measurement and analyses the relationship with measures of food security status in both seasons.

Methods

The study was conducted in two rural areas of Ethiopia: Eastern Oromia and South-Central Tigray. Data were collected in two seasons: post-harvest and lean season. In total 800 households were surveyed and a wide range of socio-economic and food security-related data were collected. A sub-sample of 183 mothers and their children age 6-23 months were then surveyed in both seasons for nutritional, socio-economic and food security data. The analysis in this paper is based on the sub-sample. Anthropometric measurements of mothers and children were performed using standardised WHO procedures. Blood samples were taken from mothers and children enabling measurement of haemoglobin, anaemia, serum zinc and ferritin. Food security/dietary diversity indices were calculated at household level (HFIAS, HDDS, FCS), and dietary diversity was also measured separately for mothers and children. A range of analyses of statistical association were undertaken, including comparison of mean values, correlations and regression using ordered logit and probit regressions. These analyses investigated the relationships between the different food security/dietary diversity indices by season, and the measures of nutritional status of mothers and children.

Findings and Interpretations

Food security indicators and most anthropometric measurements for mothers and children showed higher levels post-harvest than pre-harvest. But child wasting appeared to improve pre-harvest: this result reflects reduced wasting (and improved infant dietary diversity) in Eastern Oromia, possibly due to the increased market orientation in Oromia, mitigating the shortages of household food crops, in contrast to Tigray.

There are few statistically significant correlations between food security indicators and measures of nutritional status, although household FCS is correlated with maternal BMI and haemoglobin post-harvest, and with weight-for-age and weight-for-height for infants in the lean season.

Regression analyses found (controlling for other factors) maternal haemoglobin and ferritin are significantly associated with household FCS both post-harvest and in lean season, and with HDDS post-harvest only. Child stunting, wasting and underweight are all significantly associated with HDDS post-harvest. No significant relationship was found between food security indicators and bio-markers for children: the latter are partially influenced by low consumption of animal-source foods.

Both HDDS and household FCS were significantly associated with maternal dietary diversity in both seasons: household dietary diversity may be an important indicator for maternal nutrition. Variation in mothers' nutritional status by season shows the need to examine dietary intake by season.

Conclusions

The paper analyses association between food security indicators and nutritional status of mothers and their children aged 6-23 months, across seasons and locations. Significant levels of under-nutrition and food insecurity were found, particularly pre-harvest.

Household FCS is a predictor of maternal BMI and haemoglobin in both seasons, while HDDS is a predictor of maternal haemoglobin and ferritin post-harvest. Children's weight-for-length was associated with household FCS in both seasons, suggesting household FCS is a useful tool to measure acute under-nutrition in both infants and mothers. Weight-for-length and length-for-age are associated with HDDS post-harvest, suggesting

greater dietary diversity at household level contributes to improved nutritional status of infants.

Overall, household FCS is positively associated with nutritional status of mothers and children in both food surplus and shortage seasons, while HDDS is best in predicting maternal and child nutritional status during the food surplus season. These differences highlight the importance of using multiple indicators and measurements. Improved food security at household level appears to lead to nutritional benefits for mothers and children, suggesting intra-household allocations are managed effectively at household level. Agricultural and related interventions need to focus on ensuring access to increased quantity and diversity of food, particularly in the lean season.

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Household Food Production and Maternal and Child Dietary Diversity in Nepal: Variations in association by season and agro-ecological zone

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Introduction

Dietary intake, an immediate determinant of undernutrition, is poor in Nepal. Many agriculture programs are production oriented and not focused on dietary quality and diversity of food produced. Suaahara, a large scale integrated nutrition program, sought to improve the nutritional status of women and children. Enhanced homestead food production (EHFP) activities, including both gardening and poultry rearing, complemented behavior change communication to promote the essential nutrition and essential hygiene actions (ENA/EHA). This study examines associations between EHFP participation and dietary diversity among mothers and children under 2 years and variation in these associations by season and agro-ecological zone.

Methods

Data from Suaahara household seasonal monitoring surveys (n=2,929 mothers; n=1837 children 6-23 months), which included dietary data from a 7-day recall for mothers and children, as well as maternal reports on participation in five EHFP activities: 1-3) received vegetable seeds, chicks, and technical support, 4) participation in EHFP training, and 5) participation in EHFP beneficiary groups. We constructed binary variables for each activity and a scale (0-5) summing participation in these 5 EHFP activities. We used the 10 food-group Women's Dietary Diversity Score (W-DDS) for women's diet diversity and the 7 food-group classification for child diet diversity. Multivariable linear regression analyses were used to assess associations, by season and agro-ecological zone, between participation in each EHFP activity and the overall EHFP scale with both maternal and child dietary diversity. We controlled for the following potential confounders: child sex; women's age in years; women's education; household caste; number of family members in the household; number of children under 5 years of age in the household; labor migration of any adult household member; household access to food markets; size of land owned by the household and clustering at the district-level.

Findings and Interpretations

We found several positive significant associations between participation in EHFP activities and maternal and child dietary diversity in rural Nepal and in the context of a large integrated nutrition program. Suaahara. We also found that these associations varied by EHFP activity, season and agro ecological zone when controlling for various cofounding factors at the household and individual level as well as district level clustering. In adjusted models, we found three EHFP activities to be associated with dietary diversity – chicks, technical support and EHFP groups, but the magnitude of the associations varied by season and context. The degree of participation in five EHFP activities was positively associated with maternal dietary diversity in the terai (β=0.24, P<0.001) and mountains (β=0.12, P=0.01) during the winter but not rainy season and for child dietary diversity only in the terai in the winter (β=0.35, P<0.001). Our findings highlight that the relationships between EHFP and maternal and child dietary diversity are complex and may vary by place and time.

Conclusions

Our findings highlight the potential nutritional benefits of EHFP participation among mothers and children under 2 years. However, we found variation by sub-national context and seasonality in the magnitude and significance of these relationships. Future programs and policies may need to consider these context-specific factors if agricultural programs are to improve nutrition year-round in Nepal. It is important to remember that food alone is not sufficient: food, health care and a clean environment and care are all important for nutritional wellbeing. For this reason, EHFP programs complement homestead garden and backyard poultry interventions with ENA, EHA, and other nutritional related SBC strategies to promote gender and social inclusive health and nutritional advancements. For example, Suaahara's distribution of seeds and chicks and provision of technical support was complemented by Suaahara's EHFP beneficiary groups in which agriculture-health-nutrition linkages were discussed, as well as other non-EHFP Suaahara activities including mass media campaigns and counselling of pregnant and lactating women. Future assessments of

EHFP should be designed to quantify the contribution of each of these programmatic investments to better understand the context in which EHFP is most able to influence maternal and child diets and nutrition.

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EVIDENCE FROM THE FEED THE FUTURE NUTRITION INNOVATION LAB

Session Chair: Patrick Webb, Tufts University

Household food production is associated with dietary diversity for poorer households and older children: Results from a nationally- representative survey in Nepal

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Introduction

Children's dietary diversity, particularly their intake of more nutrient-dense food groups, is an important influence on nutritional status and health in low-income countries where malnutrition is most widespread. Previous studies in regions with low intake of nutritious foods have found diet quality to be positively associated with their household's own agricultural production, especially in remote settings far from markets. We add to this literature by identifying modifying effect of household wealth and child age to capture any systematic differences in dietary intake associated with heterogeneity in market access and child nutritional needs.

Methods

We use differences within villages to identify links between household food production and food consumption among children between the ages of 6-59 months by pooling all observations (n= 5,978 children) from the two waves of nationally-representative panel data obtained from the Policy and Science of Health, Agriculture, and Nutrition (PoSHAN) survey in 2013 and 2014. Household food production is captured using novel ways of measuring agricultural production diversity in terms of both food groups and food species grown. Child food consumption is measured using dietary diversity score, whether child meets minimum dietary diversity score (≥4), and consumption of individual food group. Interaction between household wealth quintile and household food production is used to capture modifying effect of wealth. And the sample is split into the following five child-age groups to capture modifying effect of child age: 6-11, 12-17, 18-23, 6-23, and 24-59 months.

Findings and Interpretations

We find strong associations between child dietary diversity and food production diversity in terms of both diversity of food groups and of species grown among poorer households, especially for older children in poorer households, and particularly for nutrient-dense fruits and vegetables, dairy and eggs. With each additional food group produced, log-odds of meeting minimum dietary diversity score (≥4) increase by 0.25 (p=0.01) for children aged 24-59 months. For younger children aged 18-23 months there is a similar effect size but only in the poorest two quintiles of household wealth, and for infants 6-18 months we find no correlation between production and intake in most models. Raising livestock for meat is positively associated with child dietary diversity at all wealth levels, and children consume starchy staples and legumes regardless of their household production.

Conclusions

Household food production is associated with child food consumption and consumption of most nutrient-dense foods, but only among poorer households and older children (≥ 18 months). Findings from the study suggest that farm-diversifying programs intended to improve child dietary diversity are likely to see maximum benefits by targeting the poorest rural farming households and the most nutrient-dense foods, and be accompanied by other policies to reach younger children (<18 months). These findings corroborate and add to previous research on mechanisms and mediating factors linking agriculture to nutrition, with methods and nationally-representative results for Nepal that could potentially generalize to other low-income settings.

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Nutritional resilience following the 2015 earthquake in Nepal

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Introduction

The earthquake that hit Nepal in April, 2015, caused considerable structural damage and loss of life but little is known about the longer-term impacts of the earthquake on nutritional status of preschool children, agricultural loss, household food security, or other risk factors for malnutrition. This analysis provides the first systematic national estimate of the nutritional situation in Nepal following the earthquake, summarizing findings related to damages incurred by rural households one year after the earthquake. At the time of submission, preliminary data were available from this survey more extensive analysis will be presented at the time of the conference.

Methods

The Policy and Science for Health, Agriculture, and Nutrition (PoSHAN) study under the Nutrition Innovation Lab has established a national agriculture-to-nutrition system in Nepal that collects observational panel data annually from a representative sample of ~5500 households in 63 wards across 21 districts, 7 in each of the 3 agro-ecological zones of the country. Within each ward, all households with a child under 5 years of age or a newly married woman were eligible for inclusion. We present data from three annual rounds of data collection conducted at the same sites in the same season each year (2013, 2014, and 2016- post earthquake), including data on agriculture, SES, diet, anthropometry, program participation, and markets. Seven of our VDCs in the hills and mountains were classified as 'earthquake affected' by the Government of Nepal. We will present a descriptive analysis and comparison of key characteristics for households and children living in earthquake affected (N=1056 HH, 998 children) and less affected VDC's (N=1025 HH, 1059 children) in the mountain and hills regions of our sample only, before and one year after the earthquake including child nutritional status, food security, livestock ownership, breastfeeding practices, and trends in the price of key commodities.

Findings and Interpretations

In earthquake affected regions, 6.3% of households had a family member die in the year prior to 2016, and 34.3% of those households reported that the death was due to the earthquake. Injuries among a family member were reported by 16% of those in earthquake affected areas vs. 11.6% of those in not affected areas. Of those living in earthquake affected areas, 20.5% lost crops and 36.1% of those attributed the loss to the earthquake. Nearly a third of households in earthquake unaffected households and 21.1% of those in earthquake affected areas lost livestock or poultry in the year following the earthquake. Preliminary analysis suggests that stunting in earthquake affected areas was lower prior to the earthquake compared with areas classified as not affected (23.1% vs. 48.3%). A year after the earthquake, stunting had decreased in earthquake affected areas (22.0%) but increased in non- affected areas (46.9%). Wasting also declined over the same period in earthquake affected areas (4.5% to 2.1%) and in non affected areas, from 11.5% to 8.5%. Following the earthquake, 87.6% of households in affected areas reported being food secure vs. 65.2% in non affected areas, representing improvements from 82.4% and 57.0% reported prior to the earthquake.

Conclusions

Available data from one year after the earthquake suggests that despite substantial agricultural and other damages incurred by households, the nutrition and food security status of households living in areas defined as 'earthquake affected' in our sample appeared to have improved a year after the earthquake than a year before the earthquake. The reasons for this resilience remain unclear but it is possible that it could be due the influx of food and other relief items could be responsible

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Engagement in agriculture protects against food insecurity and adverse child nutritional outcomes in a peri-urban population in Nepal

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Introduction

Urbanization is occurring rapidly in many low and middle income countries and livelihoods of food insecure households are shifting accordingly. More than a quarter of all urban dwellers are involved in the agro-food sector. Few studies have explored the associations between peri-urban household participation in agriculture and their food insecurity, dietary diversity and child or maternal nutritional status.

Methods

A cross-sectional survey of 344 mother-child pairs was conducted in Bhaktapur district Nepal. A structured survey collected data on households' agricultural practices, livestock ownership, food security, dietary diversity and expenditures was administered, and anthropometric status of mothers and children aged 5-6 years old. The Household Food Insecurity Access Scale and FAO household dietary diversity indicators were used and logistic regression was used to calculate multivariable adjusted and unadjusted odds ratios (AOR and OR respectively).

Findings and Interpretations

Our findings suggest that cultivation of land was associated with a lower risk of child stunting (AOR 0.44, 95% CI 0.25,0.79) and household food insecurity (AOR 0.36, 95% CI 0.20, 0.65), but not low maternal body mass index or anemia. Livestock ownership (mostly chickens) was not associated with child or maternal nutrition outcomes, but livestock-owning households had lower risk of food insecurity (OR 0.46, 95% CI 0.24, 0.88). Households that cultivated land had similar dietary diversity scores than households that did not, but were more likely to consume fruits, vegetables, eggs and milk products, and less likely to consume tubers, legumes, meat and sugar. Households that grew vegetables were more likely to eat vegetables, and children living in households that grew vegetables had a lower risk of stunting (AOR 0.48, 95% CI 0.26, 0.87).

Conclusions

Our study suggests that households involved in cultivation of land in peri-urban Bhaktapur had a lower risk of children's stunting and of food insecurity, than non-cultivating households -- and that vegetable consumption appears to be enhanced among these households (especially those that grew vegetables). Given Nepal's rapid urbanization rate, more attention is needed to the potential role of peri-urban agriculture in shaping diets and nutrition.

Diet and seasonality as determinants of aflatoxin exposure in pregnant women and birth weights in Banke, Nepal; preliminary results from a birth cohort study

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Introduction

Aflatoxins are highly carcinogenic fungal metabolites produced by the Aspergillus flavus and Aspergillus parasiticus fungi. Research in Africa and Asia has linked these toxins with child stunting, but no study has examined the socio-demographic and economic determinants of aflatoxin exposure among pregnant women in Nepal. The Terai region's hot and humid climate is conducive to aflatoxin proliferation. This could lead to chronic exposure to aflatoxins among vulnerable groups, such as women and their unborn children.

Methods

The USAID-supported AflaCohort Study enrolled 1,675 mother/infant dyads from July 2015 through August 2016. Pregnant women aged 16-49 were recruited from 17 Village Development Committees in Banke district. One venous blood sample was collected from each pregnant woman at recruitment to test for aflatoxin presence (through serum aflatoxin B1 (AFB1) lysine albumin adducts). AFB1 levels were assessed by high-performance liquid chromatography (HPLC) with fluorescence detection, a validated method (US Centers for Disease Control and Prevention) that measures exposure during the past 2-3 months. At recruitment, a questionnaire was administered to all participants to assess socio-demographic and health characteristics, food consumption practices, agricultural and food purchasing, storage and processing practices. Ordinary least squared (OLS), quantile regression (QR) and logistic regression models were used to examine factors associated with serum AFB1 levels in these pregnant women and the association between AFB1 and low birth weight (LBW). Statistical analyses were conducted with Stata® SE version 14.

Findings and Interpretations

Detectable levels (albumin adducts >0.2 pg/mg) were found in 94% (1555/1650) of the pregnant women. The mean serum AFB1 concentration was 3.2 (±8.3) pg/mg albumin (undetectable to 147), with a geometric mean concentration of 1.37 (CI: 1.3-1.4) pg/mg albumin. Factors significantly associated with AFB1 albumin-adduct levels in bivariate analysis, included maternal age, first pregnancy, maternal hemoglobin, maternal mean upper arm circumference (MUAC), seasonality, and maize and groundnut consumption in the preceding week. Groundnut consumption was reported by 32% of the women, maize by 3 % and both groundnuts and maize by 2%. Adduct levels varied remarkably across peanut and maize consumers and non-consumers, mean levels being the highest in those reporting eating both maize and groundnuts in the previous week (7.9 pg/mg albumin adducts) and lowest in those who reported not eating either of these foods (2.4 pg/mg albumin adducts). Mean adduct levels were highest during the pre-winter (Hemanta) and winter (Shishir) seasons, reflecting seasonality in aflatoxin contamination of key staple foods. Adjusting for other socio-economic factors in the OLS model, age (p=0.04), groundnut and/or maize consumption in the past week (p=0.0000), and seasonality (p=0.0000) were significant predictors of high AFB1. The QR results revealed heterogeneity in the size of the effects of groundnut consumption and seasonality on maternal aflatoxin levels. Women who reported one more occasion of groundnut consumption in the past week experienced an increase of 1.03 pg/mg AFB1 albumin adducts for those in the highest quantile (90%). This significant positive effect was higher than the mean effect observed in the OLS point estimate. The effect of pre-winter and winter seasons increased for women across all quintiles. The effect of these seasons on maternal aflatoxin exposure in the highest quintile was greater than the mean effects obtained in the OLS regression. Approximately 20% of the infants were born with a LBW. After adjusting for socio-demographic variables and potential confounding factors, findings showed the odds

of a LBW infant increased with increase in maternal AFB1 albumin adduct levels (OR=1.14; 95% CI: 1.01-1.28 p=0.031).

Conclusions

Exposure to AFB1 was almost ubiquitous among the pregnant women enrolled in the birth cohort. Levels of exposure were lower than those found in previous studies in Africa and other parts of Asia. Significantly higher levels were found during the pre-winter and winter seasons and in women who had consumed foods susceptible to aflatoxins such as groundnuts and/or maize during the preceding week. Use of QR over OLS allowed closer understanding of the heterogeneity in effect size. High prevalence of LBW was found among the study population with a significant association with aflatoxin levels indicating the need to examine if aflatoxin mitigation strategies would lower low birth weight prevalence in this population. Analysis is being conducted to understand the relationship between dietary patterns, seasonality in relation to crop management and storage practices, food processing techniques, and aflatoxin exposure and other adverse birth outcomes.

SESSION 5: HOUSEHOLD FOOD PRODUCTION AND NUTRITION LINKAGES

Session Chair: Y.N. Ghimire, Nepal Agricultural Research Council (NARC)

Agriculture to Nutrition-ATONU: Market availability modifies home production diversity's effects on dietary diversity among women in Ethiopia

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Introduction

In Ethiopia, women's dietary diversity (DD) is low, primarily due to poor food availability and access – both at home and at the market level. Recent studies have found that farm diversity is positively associated with women's DD, but these effects are small, and plateau at a certain threshold, suggesting that a multitude of other factors affect dietary diversity. These factors include market access, technology, livestock ownership, and women's role in decision making.

Methods

The aim of this study is to estimate the impact of market, on farm crop and livestock diversity on: (1) dietary diversity, and (2) consumption of individual food groups (flesh meat, eggs, vitamin A rich foods) among 2103 women 18-49 years of age enrolled in the Agriculture to Nutrition (ATONU) study in Ethiopia. Women's dietary diversity (DD) was calculated using the 24-hour recall where consumed food was categorized into ten food groups, where minimum dietary diversity (MDD-W) was defined as consumption of 5+ food groups. Market diversity, collected at the village level was categorized into ten food groups similar to the women's DD. Low market diversity was defined as less than four food groups. Household livestock diversity was defined in three ways: (1) tropical livestock units, (2) unweighted sum of livestock owned, and (3) ownership of cattle, poultry and goat/sheep. Household crop diversity was calculated by seasons, main/rainy (Meher) and minoy/dry (Belg), and were grouped into seven food groups (without animal source foods). Multivariate models adjusted for size of land owned, agro-ecological zone, region, asset quintiles, household size, head of household's age, woman's age, head of household status, type of: drinking water, toilet, wall, roof, electricity access, and running water.

Findings and Interpretations

Overall, only five percent of women met the minimum dietary diversity, and the most commonly consumed food groups were staples and legumes. Mean crop diversity during the main season was 1.41, and during the minor season lower with 0.41 crop food groups. Median livestock ownership was four types of animals, where chickens and cows were most commonly owned animals. Median one-year market diversity of food groups was 5 (IQR: 3,7). Adjusted models indicate that low market diversity was associated with 0.15 increase in DD ($p<0.000$) in the minor season, while in the major season, there was 0.21 increase of DD ($p<.05$), particularly at lower crop diversity. Cattle and poultry ownership increased DD significantly by 0.21 and 0.39, respectively, while goat/sheep ownership did not have an effect. In parallel models, other definitions of livestock diversity were also positively and significantly associated with woman's DD. Older women had lower DD (0.008, p-value of 0.076), along with women who lived in households made with traditional walls (0.18, p-value of 0.097), and plastic sheeting (0.58, p-value of 0.002). Size of land owned (0.012, p-value of 0.025) and belonging to a higher asset quintile group were positively associated with DD (0.28, p-value of 0.000).

Conclusions

This study is one of first to estimate the direction and the magnitude of the impact of market diversity on the relationship between home production diversity and dietary diversity. These results show that low market diversity increases DD, especially when the home crop diversity is also low. This may be due to increased home consumption as a result of lower market access or the lack of substantial income from selling crops at a market with lower diversity or income from selling crops is not invested in food due to lack of choices at the market. Further sensitivity analysis of diversity definitions at the

market and home production will characterize the robustness of these findings. We also aim to examine factors associated with consumption of individual food groups, and in particular, assess the specificity of food crops grown with foods consumed. The results of this analysis will add an important paradigm shift to the nutrition-sensitive agriculture frameworks that target vulnerable rural populations.

Homestead Food Production and Child Anemia in Burkina Faso: The Mediating Roles of Mother's Complementary Feeding Knowledge and Production Diversity

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Introduction

There is sparse evidence on how agriculture-nutrition interventions can improve child nutrition. In complex programs rarely are hypothesized pathways to improved nutrition investigated. Applying recent innovations in causal mediation, we seek to understand the pathways through which an EHFP program reduced child stunting in Burkina Faso. Specifically, we investigate the contributions of: 1) mother's knowledge of complementary feeding and household agricultural production diversity to child minimum acceptable diet (MAD), and 2) of knowledge, production, and MAD to stunting. Further, we test for heterogeneity by market access, hypothesizing that production diversity is important for diets and growth in villages without markets.

Methods

Longitudinal analyses of a panel of 848 children aged 3-12 months at baseline (24-39 months at endline) in 40 villages whose households participated in a cRCT from 2010-2012. A parametric approach to causal mediation is applied – an extension of Robins' g-computation to more than one mediator, implemented using Monte Carlo simulation – to estimate novel measures of (in)direct effects known as "interventional" effects; these are identified under fewer assumptions than required in traditional mediation methods. The approach accounts for intermediate confounders, and accommodates nonlinearities in the models, thereby overcoming some limitations of traditional approaches. We adjusted the analyses for the following intermediate confounders: Mother's empowerment, assets, and underweight status at endline.

Findings and Interpretations

Among children aged 6-12 months at baseline, there was an indirect effect of EHFP on MAD via knowledge [3.3 percentage points (pp) (95% CI:0.6,5.9)] and a marginally significant indirect effect via production diversity [3.5 pp (CI:-0.4,7.4)], mediating 37% and 39%, respectively, of the total effect on MAD, adjusting for baseline (Child age and sex, mother's age and height) and intermediate confounders. In villages with a market the impact on MAD was greater, and the proportion mediated via production was not attenuated. In villages without a market MAD did not increase, nor were there indirect effects via knowledge or production. The latter can be explained in part by the fact that there was only a small, marginally significant, increase in production diversity in villages without a market.

Among children aged 3-12 months at baseline, a marginally significant impact on stunting [-9.0 pp (CI:-18.2,0.2)] was found in villages without a market. There was no indirect effect via knowledge, and an indirect effect via production [-5.7 pp (CI:-11.4,0.0)], mediating 63% of the impact on stunting. Unlike the sub-sample, in this full sample production diversity increased significantly in villages without a market, confirming our hypothesis regarding the importance of production in these villages.

Conclusions

Both mother's knowledge of complementary feeding and production diversity were pathways to achieving child MAD in the context of this EHFP program in rural Burkina Faso. Production diversity is important for stunting prevention when markets are absent. Additional possible mediators not related to the production-consumption pathway may have contributed to reduced stunting prevalence, such as hygiene practices, healthcare seeking behaviors and any ensuing improvements in health, but were not measured. Future evaluations should continue to examine hypothesized pathways to impact using rigorous causal mediation methods, in order to understand how programs work, inform program design, and scale up impact on nutrition.

Exploring linkages of production diversity with household nutrition and management of crop biodiversity in the rural remote mountains of Nepal

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Bioversity International

Introduction

The smallholder farmers in high mountain regions of Nepal depend on traditional food crops (buckwheat, beans and amaranths) for their local food and nutrition security where production, access and availability of major cereals (rice, wheat, maize) and conventional vegetables (leafy green and others) are limited due to remoteness, marginal risk-prone environments and poverty. However, presently the information is scant about production of traditional crops and factors driving their consumption for food and green vegetables including biodiversity of these crops. This study aims to assess relationship between production diversity with consumption and maintenance of crop biodiversity in mountain farms in Nepal.

Methods

This study is based on the statistically representative survey of 328 farm households from four representative districts of high altitude regions (1500-3000 msl) of remote mountains. The survey was carried out using proportionate random sampling of 72-90 households from one selected representative VDC of Humla, Jumla, Lamjung and Dolakha districts representing western, central and eastern mountains. The survey was carried out using specifically designed questionnaire on household socioeconomic features, land use, tenancy, market factors, crop varieties grown, seed sources, food sufficiency, production diversity and household consumption of vegetables. The information was supplemented from participatory rural appraisals, field monitoring visits, stakeholder consultation and literature review on mountain production systems. Nutrition security is assessed from own production and household sufficiency and consumption of green leafy and other vegetables and pulse production. Tobit regression model is used to assess factors driving household area allocation for production, while Probit model is used to analyse farm household's decision to consume green leafy vegetables of these traditional crops (amaranths, buckwheat, beans) and Poison (Count) regression model is used to analyse household's decision to maintain cultivar diversity of these crops. The findings of the regression results and descriptive statistics are tabulated and presented in tables and figures.

Findings and Interpretations

Farmers in high mountains of Humla, Jumla, Lamjung and Dolakha are maintaining fairly good intraspecific diversity of amaranth, beans and buckwheat and consuming them at the household level both as staple foods and green vegetables. The average food staple, pulse and vegetable availability and sufficiency period from their own production from these crops is less than 4 months in Humla and Jumla and 5-6 months in Lamjung and Dolakha. A positive relationship was found between production of traditional crops for both green vegetables and food grains with household self-consumption and farm household maintenance of crop diversity. Factors influencing traditional crop production, consumption and cultivar diversity of these traditional crops are related with farmers' age, farm size, agroecology, women members in the households, vegetable and pulse sufficiency level and market distance. However the extent of influence of these factors to production, consumption and crop diversity management at the household varied with crop types and agroecology. Households in high mountains of Jumla and Humla (Karnali region) are more likely to allocate larger proportion of farm area, cultivate and consume amaranth, buckwheat and beans for both food and vegetables as compared to those farm households in relatively lower mountains of Lamjung and Dolakha.

Conclusions

A positive relationship between production diversity with household self-consumption and farm household maintenance of traditional crop diversity was obtained. Key factors driving production, consumption and maintenance of crop biodiversity are related with farm size, family size, agroecology and market distance. Households located farther away from market in higher mountains of Karnali region (Jumla and Humla) and those with larger cultivated farms and family size and women members in the households cultivate, consume and maintain more diversity of crop cultivars. Therefore, increased production diversification of traditional crops with improved technologies and practices to remote agricultural dependent households having more family labor availability with working women in agriculture can enhance household consumption of green leafy portion of

the crops and maintain traditional crop diversity. This will require an increase need of developing and promoting diverse set and choices of varieties of traditional crops (amaranth, buckwheat and beans) with different maturity and planting seasons to increase diversity-rich production of these crops for green vegetables and promote year-round consumption of these crops for enhanced nutrition of rural remote households. Such strategy will also support in maintaining greater local crop biodiversity and improve resilience of smallholder farming systems to unpredictable environmental changes in Nepal Himalayas.

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Is household production of food for own-consumption purposes a predictor of food security and dietary diversity? Household survey results from rural Myanmar

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Introduction

This paper uses newly collected household survey data from Myanmar to investigate whether household food own-production diversity and household livelihood diversity are associated with superior dietary diversity and food security. The investigation is informed by research that suggests positive associations between dietary diversity and own-production diversity (Arimond and Ruel, 2004; Malapit et al., 2015; Jones, 2017), and tentative indications that this is also true for livelihood diversity (Ng'endo et al., 2015), hence raising questions about the relative influences of direct production and market-based pathways for dietary diversity (Fanzo, 2017), and how this connects to householders' perceptions of food security.

Methods

The authors undertook a household survey of 3,320 households in rural Myanmar in February-April 2016. Six townships (rural regions) were identified as representative of three distinct agro-economic zones (dry zone, hilly region and delta) and 20 villages per township were selected in each using a proportion-to-population sampling design. Thirty households per village were randomly sampled using the female responsible for food preparation as the respondent. An expansive definition of food own-production incorporated plant cultivation and livestock husbandry in fields and home gardens, and wild foods acquired in forests, vacant lands, or captured/caught. Dietary diversity was used as a proxy for diet quality (Carletto et al., 2015) and measured using the categories of the Minimum Dietary Diversity for Women (MDD-W) methodology (Arimond et al., 2010). Food security measurements assessed perceived anxiety over food access, using an adapted, 11 question version of the Household Food Insecurity Access Scale (HFIAS) method (Coates et al., 2007; Na et al., 2015). Data was analysed using multivariate regression analysis. The key dependent variable was the number of food groups (defined by the MDD-W method) produced for own-consumption. The independent variables included measures of food security, household dietary diversity and controls for households' socio-economic and demographic characteristics.

Findings and Interpretations

Data underline the complex pathways linking dietary diversity, food production, livelihoods and food security. Preliminary findings indicate: (1) Production of food for own-consumption was found to be statistically significant for dietary diversity. Average MDD-W scores in all townships were higher for households that produced/sourced food for own-consumption, compared to those that did not. (2) For households producing/sourcing foods for own consumption, positive associations exist between the diversity of production/sourcing, and the diversity of consumption, indicating the character of food own-production, not just its presence/absence, matters for dietary diversity. (3) Households with farm-based livelihood arrangements were not found to have more diverse diets or greater food security than others, which emphasizes the power of the non-farm economy as an agent of change in rural Myanmar. (4) In five of the six townships, whether or not a household produces/sources food for own-consumption seems to exert no influence on food security. This suggests that livelihood factors, not the capacity to produce/source one's own food, shape respondents' anxiety over access to food. Further analysis will assess the sensitivity of all these preliminary findings to other socio-economic variables captured by the survey.

Conclusions

Survey data paint a picture where food production for own-consumption exerts some positive influence for dietary diversity, but not for food security. These insights are contextualized by international research asserting a decoupling of the food and livelihood circumstances of rural households from the requirement to produce/source foods from land to which they have access via ownership, rental or communal rights. For Myanmar, the findings suggest tentative comparability with processes of agriculture-nutrition disconnection, documented in India. They imply a need for policy-making to be appreciative of the complex pathways linking agriculture, nutrition and livelihoods, in this crucial period of Myanmar's history.

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Farm Diversification and Food and Nutrition Security in Bangladesh: Empirical Evidence from a Nationally Representative Household Panel Data

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Introduction

Research shows that links between agricultural and nutritional outcomes are less clear. The evidence is often anecdotal and based on country case studies, making it impossible to compare results within countries (Carletto et al, 2016; Yosef et al. 2015) driving the need for more research in country specific settings. Most of the related studies have used cross-sectional data (e.g. Sibhatu et al, 2015; Koppmair et al, 2017). This research has used two wave panel data from Bangladesh to examine the link between farm diversification and nutrition outcomes.

Methods

To investigate the relationships between food and nutrition (FN) and farm diversification, we define food and nutrition security indicators for households, women and children (FNit) as a function of household farm diversification (HFDit), individual variables (Iit), household demographic characteristics (Hit), and community variables (Cit).

$$FNit = b0 + b1HFDit + b2\ Iit + b3\ Hit + b4Cit + ci + \varepsilon it \quad (1)$$

We expect that farm diversity is positively correlated with household, maternal and child dietary diversity. The equation (1) is estimated by applying different forms of Fixed Effects model (e.g. poisson fixed effect for dietary diversity score) depending on the nature of dependent variables. We suspect that more progressive and efficient households are more likely to diversify their farm. In that case, the estimated farm diversity effect would suffer from systematic selection bias. To overcome the selection bias problem we have used a fixed-effects (FE) estimator including year dummies which leads to a two-way FE model. FE models have recently been used to control for selection bias in different contexts (e.g., Crost et al., 2007; Jorgenson and Birkholz, 2010; Kouser and Qaim, 2011; Kathage and Qaim, 2012).

Findings and Interpretations

For measuring the key independent variable i.e. farm diversification, we use the number of crop and livestock species produced on a farm and in a robustness check we also use number of food crop species produced and Margalef species richness index. On the other hand for measuring the key outcome variable i.e. dietary diversity, we have used the food variety score (no. of food items consumed) and the dietary diversity score (no. of food groups consumed). The Poisson fixed effect regression result by using the International Food Policy Research Institute (IFPRI) Bangladesh Integrated Household Survey (BIHS) two round nationally representative panel data shows that farm production diversification is positively associated with dietary diversity of household, women and child. Furthermore the role of other factors that may influence dietary diversity, such as market access measured by distance from market and households selling and buying status, off farm income, agricultural technology adoption and other socio-economic variables, is also analysed. The estimation coefficient for farm production diversification remains more or less the same.

Conclusions

Like many other developing countries, Bangladeshi farmers have diversified into higher-value crops and the agricultural sector has experienced a structural transformation. Diversification towards non-farm activities are seen as an important future strategy for farmers to reduce dependence on agricultural production as a source of income. Despite the growing importance of these activities, very little attention is paid to this topic and very little is known about the role that they play in the income of food and nutrition security of rural households in Bangladesh. We use two waves of panel data from the Bangladesh Integrated Household Survey (BIHS), a unique and nationally representative sample of farming households in Bangladesh, implemented by the International Food Policy Research Institute (IFPRI) to investigate relationships between production diversity on food and nutrition security measured by household, maternal and child dietary diversity. The result shows that farm production diversification is positively associated with household, maternal and child dietary diversity. Thus increasing farm production diversity may be the most effective strategy to improve diets in smallholder farm households along with improving access to markets, technology adoption and diversity income towards off farm sources.

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SESSION 6: NOVEL METRICS TO STUDY THE AGRICULTURE-NUTRITION PATHWAY: EVIDENCE FROM OBSERVATIONAL STUDIES

Session Chair: Joyce Kinabo, Sokoine University of Agriculture

A methodological cluster-randomized controlled trial in Burkina Faso to assess bias in estimates of key agriculture-nutrition associations using household survey data

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Introduction

Analyses of agriculture and nutrition relationships often rely on data collected using different survey design methods. Assessing the magnitude of bias of estimates of agricultural production characteristics resulting from the design of such surveys could inform the development of surveys that make efficient use of limited resources for collecting data on those agricultural characteristics most relevant for predicting nutrition outcomes. This study aims to assess the effect of agricultural survey design on estimates of agricultural production characteristics, and on the association of these characteristics with dietary quality and diversity as well as anthropometric outcomes among preschool-aged children in Burkina Faso.

Methods

A methodological cluster-randomized controlled trial was carried out between January and February 2017 in seven provinces of Burkina Faso testing three different approaches to collecting data on agricultural production characteristics by varying respondents and agricultural units of analysis. Provinces were randomly selected within each of the country's three agroecological zones. Five communities per province, and 30 households per community were randomly selected, with 10 households per community randomly assigned to one of three treatment arms (n=1,050 households). Respondents in the control arm received a comprehensive questionnaire that collected plot-level data on land area, crops raised and harvested, earnings from agriculture and non-agricultural activities, and control of management decisions and agricultural income. These data were collected from each plot manager separately. Households assigned to treatment arm one of the trial were administered a diagnostic version of the control arm survey that collected aggregate data from the household head only. Households in treatment arm two were administered the same survey version as treatment arm one, but a randomly selected household member, excluding the household head, was chosen as the respondent. We use multi-level regression analysis adjusting for intra-village clustering to estimate the average treatment effect of the three alternative survey designs.

Findings and Interpretations

We will examine the extent to which sociodemographic characteristics of surveyed households are well balanced across the three treatment arms of the trial. Mean child height-for-age Z-score (HAZ) (SD) for children aged 24-59 months among the entire sample was -1.2 (1.2). Mean child weight-for-age Z-score (WAZ) and weight-for-height Z-score (WHZ), respectively, were -0.98 (-0.96) and -0.41 (0.96). The area of cultivated land, overall crop yields (by weight), and the species diversity of crop production were all significantly lower among treatment arms 1 and 2 as compared to the control arm of the trial ($P<0.05$). The associations of land area, crop yield, and crop species diversity with the mean micronutrient density adequacy and diversity of preschool-aged children's diets, as well as with the three anthropometric outcomes described above will be presented. We will further present findings from separate analyses for each of these outcomes, adjusting for potentially confounding covariates that are determinants of each outcome, from regression models interacting agricultural production characteristics with dummy variables representing the randomized treatment assignment.

Conclusions

Survey design choices have a clear influence on estimates of agricultural production characteristics based on data collected from household surveys in Burkina Faso. By estimating the interaction effect between survey design and agricultural production characteristics on diet and anthropometric outcomes, estimates of the extent to which survey design may bias the assessment of key agriculture-nutrition relationships will be provided. This analysis will allow for the estimation of confidence intervals for interpreting results across studies that apply different survey designs to examine similar relationships.

Can locally available foods fulfil the requirements of major essential nutrients of a typical household in Rohtas, Bihar? A Cost of Diet Assessment

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Introduction

Bihar, known for being amongst the most backward States in India, has a relatively high prevalence of poverty and undernutrition. Around 64% of the children (6-59months) suffer from anaemia while 60 percent of the women (15-49yrs) are undernourished (BMI <18.5 kg/m2)1. Inadequate intake and poor quality diet are the majors factors associated with undernutrition. Promotion of adequate nutrient intake through increased consumption of locally available diverse foods is one of the most sustainable means to improve nutrient adequacy. However, a prior understanding of the food prices, existing dietary practices, nutritional adequacy of the locally available foods, in addition to the existing economic conditions of the target population is needed for development of successful nutrition interventions.

Methods

The present study used linear programming approach (Cost of the Diet (CoD) software (developed by Save the Children, UK)) to calculate the minimum amount of money a family is required to spend in order to fulfill their energy, macro- and micronutrient requirements, using locally available foods. The present CoD assessment is based on the data collected from randomly selected households in four villages (Kaithi, Birudih, Amra, Harka) in Rohtas, Bihar, India. Information was collected using standardized questionnaire on all the locally available foods and their sources, prices of these foods and the actual diet consumed by a typical household in the villages (using 24-hr diet recall method). The CoD software was used to calculate the minimum cost of a nutritionally adequate diet for the whole family and identify the nutrients that could not be met using the locally available foods.

Findings and Interpretations

The 'energy only diet', aimed to fulfill only the energy requirement of the households, also met >65% of protein, fat, magnesium, zinc, Vit B1 and niacin, while meeting ~30% requirements of Vit C and Vit B2, ~ 45% of folic acid, ~ 50% of Pantothenic acid, 10% of Calcium. A 'nutritious diet', that met the adequate requirements of all the major nutrients (including energy, protein, fat, Vit A, Vit C, Vit B1, Vit B2, Niacin, Pantothenic acid, Vit B6, Folic acid, Vit B12, Calcium, Iron, Magnesium and Zinc) was also possible using the locally available foods. However, the 'nutritious diet' was 4 times more expensive than the 'energy only diet', thus limiting its affordability. In a nutritious diet, wheat flour, egg, spinach, dried coconut, coriander leaves, buttermilk and tomato were the contributors of majority of the essential micronutrients. However, based on the typical dietary habits of the people of Rohtas, a nutritionally adequate diet based solely on the locally available foods may not be possible.

Conclusions

It is possible to design nutritious diets using locally available foods (such as flour, egg, spinach, dried coconut, coriander leaves, buttermilk and tomato) that are likely to meet the requirement of majority of the essential nutrients. However, due to high cost of a nutritious diet (Rs 170 per day for a typical family of 4 members), it may not be accessible to a large section of population. Along with nutrition education, policy interventions to increase the affordability of such diets through multi-pronged strategies is necessary to improve nutritional status in these areas.

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Piloting the use of accelerometry devices to capture energy expenditure in agricultural and rural livelihoods: Protocols and findings from Ghana and India

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Introduction

The limited uptake of agricultural innovations with proven productivity-enhancing potential and the translation of productivity increases into improvements in nutrition are two major challenges facing low-income Countries [1-4]. Human energy expenditure patterns associated with agricultural and livelihood activities can be expected to have an important influence on the uptake of agricultural innovations and their nutrition impacts on the rural population [5]. Incorporating the human energy expenditure dimension in analyses of the uptake of agricultural innovations and their nutrition impacts has been constrained by a lack of reliable robust empirical measurement of energy expenditure associated with agricultural activities in free-living populations.

Methods

The Doubly-Labelled-Water (DLW) method has been the standard method used to capture energy expenditure levels of free-living humans. However, this method requires respondents to be brought into an experimental facility and does not allow study of a large and representative samples. Advances in accelerometry technology offer the opportunity to scale-up empirical measurement of energy expenditure profiles in developing countries, and the pilot study described in this paper takes advantage of this to generate rigorous energy expenditure profiles associated with agricultural and livelihood activities. In this paper we develop a methodological framework in which energy expenditure data from accelerometry devices is integrated with information from activity and time-use questionnaires administered to respondents to build energy expenditure profiles associated with agricultural and livelihood activities. We report our experience with pilot studies in rural Ghana and India and provide preliminary results.

Findings and Interpretations

Our findings confirm some of the stylised facts of agricultural and rural livelihoods, but the study also provides several new insights. While the overall daily energy expenditure for men is greater than for women, we find that women consistently maintain higher physical activity levels than men through the course of the day. Men and women spend a similar proportion of their time on economic activities – the greater proportion of time that women spend on domestic activities appears to involve a trade-off against opportunities for social interactions. Agricultural and rural livelihoods are dominated by “light” and “moderate” activities rather than by “vigorous” activities. Daily energy expenditure for both men and women is substantially lower than the norm (2900 kcal per day) used for computation of the poverty line in Ghana. We compare these results with data from India (data collected in Jan-Feb. 2017 and analysis currently in progress).

Conclusions

Comparing experiences and results from Ghana and India, we explore the potential applications of the protocols and methods for a better understanding of agriculture-nutrition linkages in developing countries.

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SESSION 7: GENDER AND EQUITY

Session Chair: Binjwala Shrestha, Institute of Medicine (IOM)

The relationship between crop-related agricultural workload and maternal and infant nutritional status in rural Pakistan: the LANSA project.

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Introduction

The nutritional status of women of reproductive age and infants is poor in rural Pakistan. The agricultural workforce is also becoming increasingly feminised, with 75% of women employed in agricultural labour. Agricultural work, for women, often involves working long hours performing manual labour in the field. The impact of women's agricultural work conducted during pregnancy on maternal and early infancy nutritional status is not known in this setting. Thus, this study aimed to examine the relationship between crop-related agricultural activities during pregnancy, maternal body mass index (BMI) and infant growth.

Methods

A cross-sectional survey of a representative sample of rural mother-infant dyads was conducted in Sindh province from January to February 2016. Infants were 2-12 weeks of age. Interviewer-administered questionnaires and maternal and infant anthropometric measurements (weight and height/length) were collected. The primary outcomes were maternal body mass index measured post-pregnancy (BMI; n=1146) and infant length-for-age zscore (HAZ; n=1143). Crop-related agricultural activities measured included sowing, transplanting, digging, weeding, applying fertilizer, grain and vegetable harvesting, and cotton picking. A binary variable was created for any crop-related agricultural activities done during pregnancy. Cotton picking was also independently examined given the long hours and high intensity of the work.

Hypothesized modelled pathways from crop-related agriculture activities to maternal BMI and infant growth were created based on the literature and drawn as directed acyclic graphs (DAGs). Associations between crop-related agricultural activities (i.e. any crop-related activities or cotton picking) and maternal BMI and infant HAZ were examined using multivariate linear regression analysis; adjusting for variables identified as confounders in the DAGs. Structural-equation based modelling was also used to test whether maternal BMI mediated the association between crop-related agricultural activities and infant growth.

Findings and Interpretations

The median [IQR] BMI of women and HAZ of infants were 20.5 [18.7, 22. 6] and -1.82 [-2.7; -0.9], respectively. Overall, 21.6% of women were underweight and 45.3% of the infants were stunted. Among the women, 43% reported doing crop-related agricultural activities during pregnancy of which 29% were involved in cotton-picking. Crop-related agricultural workload and cotton-picking were both negatively associated with maternal BMI after adjusting for potential confounders (β=-0.97 [-1.51; -0.48] for any crop-related agricultural work and β=-0.87 [-1.33; -0.45] for cotton-picking). Among infants, both crop-related agricultural work and cotton-picking were negatively associated with HAZ, but this negative association remained significant for only cotton-picking in the multivariable analysis (β=-0.34 [-0.54; -0.13]). Given evidence that cotton picking was negatively associated with both maternal BMI and infant HAZ, structural-equation based modelling was used to test whether the relationship between cotton-picking and infant growth was mediated via maternal BMI. These results showed that cotton picking had a direct effect of -0.29 [-0.47; -0.10] on infant HAZ and an indirect effect of -0.05 [-0.09; -0.02] via maternal BMI with a total effect of -0.35 [-0.53; -0.16]. This suggests that 14% (-0.05/-0.35) of the relationship between cotton-picking and HAZ is mediated via maternal BMI.

Conclusions

This study has generated new and critical evidence on the linkages between maternal agricultural workload and maternal and infant nutrition in a sample of mother-infant dyads living in rural Sindh. The high prevalence of low maternal BMI and stunting in early infancy is a public health concern. Crop-related agricultural work during

pregnancy, especially cotton-picking, was associated with poor maternal and early infancy nutritional status, even after controlling for confounders such as household wealth and education. The results of this study underscore the need to reduce agricultural workload demands during pregnancy to improve maternal and infant nutritional status. Our findings highlight the difficult trade-off faced by poor rural women whose work in agriculture is driven by the need to support household consumption in the first place. Pakistan's economy relies on the agriculture sector. Given that both commercialisation of agriculture and women's involvement in agriculture are increasing, results from this study suggest the government should invest in women and their working conditions to improve the long-term health and nutritional status of its rural population. Policies and programmes in agriculture, nutrition and social protection in Pakistan are yet to be attentive to the needs of vulnerable groups such as female agricultural workers.

Qualitative findings on the Women's Empowerment in Nutrition Index

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Introduction

To better understand the role of women in mediating agriculture to nutrition linkages, we develop the concept of nutritional empowerment. We use the lens of nutritional empowerment to assess how women make nutritional decisions and how their ability to make decisions differs across nutritional drivers such as health, food purchases, home production, water and sanitation, and care practices. In this study, we collect and analyze qualitative interviews from three sites in rural South Asia to identify the drivers of women's nutritional empowerment across multiple domains of nutrition. We also identify socio-cultural conditions that do or do not support nutrition.

Methods

To better understand the constraints that rural South Asian women themselves identify as important for their nutrition, we collaborated with rural civil society members, training them to become community researchers. In each rural agrarian site (northern Bangladesh, and Bihar and Orissa in India), we trained about twelve civil society members, 80% of which were women. Over the course of several days, our researchers described the role of gender in mediating agriculture to nutrition linkages, how nutritional decisions are made in their families, and which aspects mattered most to them. Through this dialogue, we identified a variety of pathways through which nutrition is influenced, which then shaped the research questions the community researchers asked.

After the training, which also included ethics in research, community researchers returned to their communities. Using audio-recorders, each researcher had one-on-one discussions with poor and marginalized (e.g., landless) community-members of the same gender about decision-making, power, and nutritional practices in their households. One unique aspect that community researchers bring to the research of complex causal pathways, such as agriculture to nutrition linkages, is that they can break through some of the contextual and political barriers that can occur when relatively unknown outsiders interview marginalized individuals.

Findings and Interpretations

Findings from our participatory, community-based qualitative research help us (1) to identify what nutritional empowerment means to women living in rural South Asia and (2) which factors are most relevant for measuring nutritional empowerment.

We find that focusing on a single empowerment domain (e.g., agriculture) will not adequately capture the more complex reality that women face. Many women in our sample report having decision-making authority in some aspects of their lives but not in others. For example, women explain that they are actively involved in agriculture and education decision-making with their partners but have little input into food budgets or food choices. A key implication is that focusing on only one domain of empowerment or on only a handful of indicators may overstate (or understate) a woman's degree of empowerment. Second, due to socio-cultural norms, poverty, and lack of empowerment, we find that children's nutritional status may be an imperfect proxy for their mother's nutritional status. For example, women detail how they forgo food to support their children's education. Other women explain how the order of eating limits their intake of the tastiest foods. Thus, we should not assume nutritional improvements for children will translate to their mothers.

Conclusions

In this paper, we identify conditions influencing what we call "nutritional empowerment". Nutritional empowerment is the capacity for a woman, and not just her children, to be well fed and healthy; to have a meaningful say in household nutritional practices; and to receive support in implementing them. We find that women in agrarian communities face competing priorities for their time and resources. By tracking how they make nutritional decisions in a complex environment, we identify policies and practices that may best improve agricultural-nutrition linkages. Thus, understanding the factors that contribute to women's empowerment to make nutritionally advantageous decisions is crucial to broader goals of nutrition and health in development.

Effect of male out-migration on household food security: Evidence from a mixed methods study in Far West Nepal

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Introduction

The study is set in Maulali, a Village Development Committee (VDC) in Far West Nepal. The study site was selected for its history of food insecurity, vulnerability to various environmental shocks, isolation, and high rate of migration. Nearly all households in the VDC are engaged in agriculture and male labor out-migration is a major livelihood strategy given low agricultural productivity and little availability of local wage work. The vast majority of migrants are male (81.9%) who leave behind their families to migrate for unskilled wage labor and education, particularly across the border in Indian cities.

Methods

This study employs both quantitative and qualitative methods to assess the effect of male out-migration on household food security.

Quantitatively, we are conducting monthly and quarterly census-level (510 households) surveys using a mobile-phone platform. Monthly household food security surveys measure coping strategies linked to food consumption (Coping Strategies Index) and dietary diversity (Food Consumption Score) over the previous month. Quarterly household capital flows surveys focus on the exchanges of capital through updates on the baseline household capital stocks data on human, physical, and financial capital, including information about migrants and remittances.

In conjunction with the quantitative efforts, we have conducted 24 focus group discussions and 46 iterative in-depth interviews in Maulali to garner perceptions about the effect of male out-migration on household food security. Focus groups were stratified by caste and gender. Interviews were stratified by the same criteria in addition to the household's migration status.

Findings and Interpretations

The FCS suggests that 97.2% of all households have an acceptable level of food consumption. Similarly, nearly 80% of households report zero or very low levels of coping behavior. While quantitative measures indicate general food security in Maulali, there are pronounced asset poverty, and vulnerable agricultural systems, and qualitative accounts of deprivation.

Remittances are central to livelihood and food security strategies in Maulali, with nearly a quarter of the population currently away and sending remittances. However, labor out-migration is described as an economic compulsion, never a choice. There is a heavy reliance on remittances to meet households' daily consumption needs but the amounts – infrequent and modest - do not allow them to build capital stocks. It is easier for households to get loans and credit if they are receiving remittance as promise of future remittances act as insurance for lenders of households' ability to pay back.

When migrants do not send back remittances, those left behind are forced to take up casual labor opportunities but earnings are inadequate to make ends meet. Male out-migration also place additional burden on women and children to take up traditionally male responsibilities or if social norms do not allow, find willing male laborers.

Conclusions

Migration appears to be the central economic fact in Maulali. Male out-migration is critical given low agricultural productivity (hampered by lack of rainfall, limited irrigated land, and limited market access) and little availability of local wage work. At present, elements of the qualitative and quantitative data contradict each other. The monthly survey data show that few households are resorting to those coping strategies normally seen in times of food deficits (and tested in Maulali). Food consumption scores are high. In contrast, the qualitative narrative implies hardship, food shortages, and chronic indebtedness—an overall struggle to make ends meet. Areas for further investigation in this regard include allocation of food (as well as expenditures on medical care, clothing, education, etc.) within households, gendered-perceptions of food security/insecurity, and decision-making around expenditures and consumption at the household level.

Food security does not lead to equity: a study on intra-household food allocation in rural Nepal.

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Introduction

Agricultural interventions aiming to improve nutrition often adopt strategies to improve household-level food production, for example by promoting gardens, nutrient-rich crops, livestock farming, and providing seeds [1]. These interventions typically improve agricultural outcomes, but their effects on nutritional status are weaker, suggesting that the pathways from household food availability to individual consumption could be strengthened [2]. In the patriarchal South Asian context, gains in the availability of household food may not be equitably shared among individuals, and could selectively benefit traditionally favoured men [3]. Yet, evidence on the associations between household food security and intra-household food allocation is limited [4].

Methods

Interviewers measured diets of pregnant women, their mothers-in-law, and male household heads to assess food allocation patterns among households enrolled in the Low Birth Weight South Asia Trial – a cluster-randomised controlled trial in Dhanusha and Mahottari districts of Nepal. Between June and September 2015, we conducted 24-hour dietary recalls, three times per person, with a food list, an atlas of portion sizes, and smartphones to enter data. Nutrient intakes were calculated using a food composition table and local recipes.

We used 'Relative Dietary Energy Adequacy Ratios' (RDEARs) to approximate intra-household food allocation, calculated as the ratio between pregnant women's 'calorie adequacy ratios' (CARs = intakes / requirements) and household heads' CARs, and the equivalent ratio between pregnant women and mothers-in-law. We used two measures of food security: a binary variable using the Household Food Insecurity Access Scale (HFIAS) to indicate any or no food insecurity, and a continuous variable of calorie intakes averaged across all three household members. With control arm data, we fitted multivariable linear regressions using log-transformed RDEARs and controlling for clustering, strata, and confounders (wealth, caste, maternal education); using the dataset from all arms we also adjusted for trial arm. Significance level was set at 0.05.

Findings and Interpretations

We interviewed 805 households (6,765 individual dietary recalls), including 150 households in the control arm. Pregnant women were comparatively disadvantaged in the allocation of calories. In the control arm, which is more comparable to other areas, the median (25th – 75th centiles) RDEARs between pregnant women and male household heads were 0.83 (0.68 – 1.03), and RDEARs between pregnant women and mothers-in-law were 0.88 (0.72 – 1.03). These disparities in adequacy ratios were statistically significant; pregnant women's CARs were significantly lower than their mothers-in-law (coeff -0.14 (95% CI -0.21, -0.07, p<0.001) and male household heads (coeff -0.18 (95% CI -0.24, -0.13, p<0.001).

There was no effect of food security on food allocation. Analyses with the control arm and the full dataset showed no significant association between being food insecure (vs. no insecurity) and log-RDEARs between pregnant women and male household heads. The same result was found for pregnant women and their mothers-in-law. Using average household CAR, there were no significant associations with log-RDEARs, except when using the control arm data and log-RDEARs between pregnant women and household heads (coeff 0.00 (95% CI 0.00, 0.00; p=0.045). This effect was similar but not significant after adjusting for confounders.

Conclusions

Calories are not allocated equitably within households, and equity does not appear improve when households are more food secure.

Our study focuses on joint households; different results may arise from nuclear or female-headed households. More work is needed to examine the effects of food security on the allocation of micronutrients, often found in high status foods like meat and dairy, and alternative analyses are required to infer causality.

From our findings, we hypothesise that the gains from agricultural interventions aiming to improve food security will, by default, disproportionately benefit men. Agricultural programs might improve their effects on maternal nutrition by factoring gender into their design. Current approaches to do this include: consulting women and men at the design phase; delivering nutrition education and counselling (and including decision-making household members such as men and mothers-in-law); and providing women with employment, resources, grants or credit that they may have more control over. Although intuitive, there is no evidence to support the idea that these approaches will change food distribution patterns or make agricultural interventions more equitable. More work is needed to identify determinants of food allocation that are amenable to change, to design programs that can equitably benefit men and women.

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SESSION 8: PROGRAM EVALUATIONS I

Session Chair: Heather Danton, SPRING

Cooking Contests for Healthier Recipes: Impacts on Nutrition Knowledge and Behaviours in Bangladesh

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Introduction

Globally, a staggering two billion people suffer from micronutrient malnutrition (IFPRI 2016). Improving nutrition is one of the Sustainable Development Goals (SDGs). One step to meet this goal is to improve incomes and the affordability of healthy foods (Smith and Haddad 2002), but income growth does not map one-to-one into better nutrition (Headey 2012). Many poverty alleviation programs aiming to enhance nutrition therefore include behavior change communication (BCC). This study uses a field experiment in Bangladesh to assess the impacts of BCC, focusing on nutrition training (providing information) and cooking contests (providing experience).

Methods

First, in 900 households, we tested the nutrition knowledge of two household members and invited one of them to participate in a nutrition training that covered dietary diversity, important micronutrients and WASH. We evaluate the effect of this nutrition training quasi-experimentally, by comparing differences in pretraining and posttraining nutrition knowledge among trained and nontrained household members.

Second, in randomly selected neighborhoods, the nutrition training was followed by a cooking contest designed to reinforce nutrition training messages and learn by doing. In the cooking contest, teams of participants had to apply what they had learnt from the training by preparing a recipe; judges scored all recipes in terms of nutritious value, WASH and taste. We will estimate the effects of these cooking contests using our experimental design.

Findings and Interpretations

Comparing differences in pretraining and posttraining knowledge among trained and nontrained household members, we find that training has a positive effect on nutrition knowledge. In a newly developed test asking participants to identify foods that contain specified nutrients (e.g. foods that contain 'iron'), or serve specified purposes (e.g. foods that 'prevent anemia'), the nutrition trainings significantly improve test scores. However, the improved knowledge does not translate into healthier diets.

We find no additional effects of cooking contests on either knowledge on diets. Although cooking contests did result in increased knowledge sharing among participants, and although an increase in knowledge sharing is associated with improvements in household diets, we find no impacts of cooking contests on household diets for the average participant. This suggests the existence of barriers to healthier diets beyond nutrition knowledge.

Conclusions

Our findings relate to the literature on nutrition education and behavioral change communication (BCC), which in developing countries mainly focuses on programs targeting maternal and child nutrition. Stand-alone messaging around complementary feeding has small effects on dietary outcomes compared to interventions that involve food fortification (Dewey and Adu-Afarwuah 2008, de Brauw, et al. 2015), but more expensive BCC campaigns with for instance periodic home visits, livestock transfers or support to start homestead gardening have been more effective (Olney, et al. 2015, Kim, et al. 2016). Successful programs provide information as well as experience, using a mixture of methods to reinforce messages (Sarassat, et al. 2015, Murray, et al. 2015). We find that a relatively low-cost BCC strategy helped improve knowledge, but that alternative interventions – or more intensive BCC campaigns - are needed to strengthen links between knowledge and behavior.

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Home Garden Approach for Enhancing Nutritional Security of Smallholder Farming Families in Nepal

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Introduction

Nepal has made a satisfactory level of progress on the health indicators over the past decade while achieving the MDGs. However, undernutrition remains a big challenge across the country particularly in the case of women and children. Earlier studies have elucidated that undernutrition problem is widespread from highly productive areas (plains) to the mountainous areas of Nepal. Rather than geographical locations, the problem of undernutrition is more severe in the strata of farmers having low on-farm and off-farm incomes along with low education level, which consequently places them in the situation of food and nutrition insecurity.

Methods

Twenty districts of Nepal covering plain/terai (six), mid-hills (thirteen) and high (one) were selected in order to implement the project. The district stakeholders team identified the most food and nutrition insecure 10 Village Development Committees in each district. A total of 1250 households (having at least 75% small holders and disadvantaged households) were selected using either underlying cause of poverty analysis data or wellbeing ranking. A baseline survey was carried out using simple random sampling method in all 20 districts. A semi-structured questionnaire was administered to 6320 households primarily to assess the maintenance of home harden component, existing diversity on animal, fruits and vegetable, dietary diversity and involvement in local institutions. The collected information was analyzed using SPSS software. The same respondents were supported through group mobilization and services were provided on basic nutrition orientation training, low cost home garden management, crop diversity and food fair and distribution of vegetable diversity seed kits. An output monitoring survey was carried out in July 2016 considering 1000 HHs (50 HHs selected randomly from each district), after one year of intervention.

Findings and Interpretations

Only 38% of the respondents maintained five and more home garden components (vegetables, fruits, cattle, goat, pig, poultry, rabbit, and fish) in baseline. Out of seven food types (starchy, leafy greens, Vitamin A rich fruits and vegetables, other fruits and vegetables, legumes, meat and dairy products, and oil and fat), only 6.6% households consumed six and above types of food category. It indicates that the food eaten by the majority of respondents is not diverse enough to solve the nutritional purpose. Likewise, only five species of vegetables were consumed by the majority (92%) of the respondent. Moreover vegetable was least available during March to May. Beneficiary households managing five or more components were increased by 4%. Respondents consuming more than six types of food also increased by more than double (14.3%). With the support of vegetable diversity kits, species richness has been increased to double as compared to the baseline. 25.1% of respondents are consuming fresh vegetable all-the-year-round, which include vitamin A rich vegetables. Representation of the respondents in the local institutions was 27.3% at the baseline survey but the representation of disadvantage group members increased to 82% in executive positions in the local institution like farmers group.

Conclusions

The approach of uniting small holders and disadvantaged households and serving them through groups seems to be effective to reach into the marginal households for nutritional enhancement. Though it is too early to conclude, initial data suggests that the home garden approach would be instrumental in raising nutritional status of poor and marginalized farming families in Nepal.

Participatory Learning and Action for Nutrition Sensitive Farming System among Tribal families.

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Introduction

Many studies have shown that lack of nutrition awareness and lack of dietary diversity are the causes for high prevalence of underweight, stunting, wasting, and anemia mainly among children and women in many countries including India. Indigenous communities in tribal regions used to have enormous food diversities but many traditional food-items have reached to verge of extinction and getting eroded. Present generations do not cultivate them because information gaps on practices and health benefits. VAAGDHARA undertook study for revival of nutrition sensitive farming systems using knowledge from elders of indigenous communities in India.

Methods

The study was undertaken in two phases: Knowledge and communication mechanisms around food system were gauged in the first phase through food sovereignty march by group of motivators and community leaders reaching 5000 families in 100 villages spread over 300 kilometers. Key methods were focus group discussions, key informant and youth interviews, interactions with lead farmers and the elderly.

The knowledge thus built through formative phase was consolidated in the form of an eight stages Participatory Learning and Action (PLA) cycle. A catalogue of food diversity heritage of the area was developed prepared. This also brought out barriers and enablers for agriculture led nutrition security among tribal farm families. The PLA cycle was administered with 30 groups of 20 farmers each, covering 600 families. It included: identifying gap between production and consumption; capture health status of group, family members and villages; exploring health benefits of traditional food habits and nutritional value tests; deciding upon component of nutrition sensitive farming system (NSFS); search for methods of revival, take responsibility and practice cultivation observe, reflect and document; collect seeds of to bring back nutritional food diversity within present scenario.

Findings and Interpretations

The food sovereignty march proved to be a curtain raiser for the study and brought together young farmers around forgotten food plants and crops. Thirty five varieties of local food items which were earlier used commonly as food items but are now on the verge of extinction, were identified. This was a whistle blower for reviving traditional food items and their importance in the livelihood of rural communities and more so for resource poor families.

The study also provided insights on the effectiveness of different PLA tools which ar consolidated in the study for sharing with wider community. Study brought out 50 varieties of cultivated and non-cultivated food items which were part of traditional menu, which are documented and tested for their nutritional values, which are much higher than their cultivated relatives.

The most effective of the different tools evolved during the eight session PLA cycle were: “do you eat what you produce?” has helped to widen “production basket of not only of participating families only but their kin also”. All the processes were documented for the benefit of wider community in the form of the PLA_NSFS (Kuposhan to Suposhan)Malnutrition to Balanced nutrition .

Conclusions

The eighteen month study has helped identify that through enhanced diversity within local food system in the immediate environment and knowledge building can be the solution to address malnutrition. Participatory Learning and Action (PLA) approach is an appropriate way towards searching long lasting solutions to address issues of malnutrition be it under-nutrition or over nutrition. Six to eight to stage PLA can cover complete learning cycle starting from assessment of health situation; establishing linkage between food and health; and comparing traditional and existing agriculture system;

The study brought out that health and nutrition is a live theme that cuts across lives and livelihoods. Addressing it calls for a communication strategy which is regular, interactive and integral part of day to day life so as to build on knowledge and pass it on to future generations. Stories, sayings, idioms, festivals, rituals, folk songs, folklore were found to be the forms traditionally used to transfer this knowledge from one generation to other. The PLA approach helped revive and build on these traditional communication mechanisms. This approach can be customized in different settings for the immediate environment and a strategy evolved for carry forward from one generation to the next.

Greater improvements in child growth and diet quality after a holistic community development intervention than after nutrition training alone

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Introduction

Linkages between investments in agriculture and direct improvements in child nutritional status have been difficult to demonstrate. Moreover, it has not yet been convincingly demonstrated that nutrition-sensitive agricultural interventions favorably impact child growth. Household-level nutrition training programs have had variable results. Notably, few organizations provide such training in the context of multi-sectoral community-based activities emphasizing livestock management practices and social capital development. The importance of this holistic approach to child outcomes has not been systematically studied. Therefore, we investigated the impact of a comprehensive community development intervention on child growth and diet, compared to the impact of training alone.

Methods

The intervention and training were provided by Heifer Nepal, an NGO whose activities focus on the distribution of livestock and training via rural women's groups, with an emphasis on income generation and promotion of social capital. 974 households in three communities in Banke district (Nepal) were matched for specific characteristics. The communities were randomly assigned to receive either (a) a full package of community development activities (social capital development, livestock training, nutrition training) [Intervention], (b) Livestock and nutrition training alone [Partial Intervention], or (c) no interventions [Control]. Child growth monitoring (n=1333, 1-60 months of age) and household surveys to assess change in family demographics, socioeconomic status (SES), income, land and animal ownership, women's empowerment, food security, and child health and diet quality (dietary diversity and consumption of animal source foods [ASFs]) were collected by an independent research organization at 5 household visits over 33 months. Data were analyzed at community, household, and individual levels, using t-tests, ANOVA with Bonferroni post hoc tests, Chi Square tests, and correlations to assess collinearity. Spearman's rho was used to test non-parametric correlations. Mixed-effect linear regression models (using Stata command 'xtmixed') were utilized to predict the outcomes of interest, adjusted for household- and child-specific characteristics.

Findings and Interpretations

From baseline to 33 months, several household characteristics improved more in the Intervention [I] group than the Partial [P] or Control [C] groups, specifically household wealth (+0.09 [I] vs. -0.07 [P] and -0.04 [C], $p<0.0001$), hygiene practices (soap use) (+0.33 [I] vs. +0.15 [C] and +0.14 [P], $p<0.001$), dietary diversity (+1.33 [I] vs. +0.71 [C] and +0.73 [P], $p<0.0001$), and food security (+92% [I] vs. +42% [C] and +63% [P], $p<0.0001$). In addition, significant improvements were found in the Intervention group in child diet diversity (+1.7 [I] vs. +1.1[P] and +1.2 [C], $p<0.0001$) as well as z scores for child weight (+0.22 [I] vs. +0.08 [C] and +0.10 [P], $p=0.006$), weight-for-height (+0.99 [I] vs. +0.40 [C] and +0.47 [P], $p=0.0002$), head circumference (+0.40 [I] vs. +0.15 [C] and +0.01 [P], $p<0.0001$), and mid-upper arm circumference (MUAC, +0.78[I] vs. +0.23 [C] and +0.38 [P], $p<0.0001$). In regression analysis, group assignment predicted child anthropometry (height, weight, and weight-for-height z scores) and diet quality (diversity and consumption of animal source foods), after adjusting for child age and gender as well as multiple household factors (caste, animals, wealth, women's empowerment & education).

Conclusions

In this longitudinal study, a comprehensive multi-sectoral intervention encompassing social and economic capital development and active nutrition messages was more successful in improving key nutrition indicators (weight, weight-for-height, head circumference, MUAC) and diet quality (diversity) in young children. Provision of livestock and nutrition training activities alone had little effect on child growth and diet outcomes. Household SES also improved more in the "full package" communities, as did hygiene practices, even though this was not directly addressed by the intervention. Hypothetically, improved

social capital may enhance responses to training via multiple pathways. Improvements in psychological well-being, gender empowerment, coping ability, and economic circumstances may contribute to better living conditions, including better access to and utilization of food resources, knowledge networks, and health services. These pathways may improve food security, reduce childhood illness, and increase ability to care for the child. Thus, although more time-consuming and costly to administer, livestock-based programs incorporating nutrition training with community social capital development are associated with better child growth and nutrition outcomes than isolated training programs alone. Organizations seeking measureable and sustainable improvements in these important child outcomes over time must consider the benefits of this more intensive strategy.

SESSION 8 *CONTD.*: PROGRAM EVALUATIONS II

Session Chair: Bikash Lamichhane, Child Health Division, Department of Health Services

Mainstreaming participation: Maternal and Child Nutrition Stakeholders in Southwest Ethiopia

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Introduction

Participation is a crucial factor in the achievement of development policy objectives like the improvement of maternal and child nutrition. The vital first step to start a participatory process is to make sure to include the specific people whose input is most needed for meaningful participatory outcomes. The purpose of this study is to identify and characterize maternal and child nutrition (MCN) stakeholders in Jimma zone, southwestern Ethiopia and to decide on the level of their involvement for a MCN project focused on developing food products that meet the needs of mothers and children in the region.

Methods

Stakeholder analysis followed three phases 1) initial selection of stakeholder categories based on the researcher's prior knowledge of the area and in consultation with agricultural and health extension staff, 2) purposive selection of representatives from these categories, including snow ball sampling, for participatory stakeholder analysis activities in each district included in the study area, 3) analysis by the researcher to synthesize the stakeholder input for action within the project. Methods included the creation of a stakeholder matrix, stakeholder analysis wheel and rainbow diagram to characterize the commitment, levels of involvement (close, supportive or peripheral) of the various sectors and to which level stakeholders are affected by and/or are affecting MCN, respectively. Finally, these identified stakeholders were prioritized for different levels of participation.

Findings and Interpretations

Mothers, government officials, health extension workers and staff from the Women and Child Affairs office were characterized as high influence high interest stakeholders. Agricultural experts, health experts, religious institutions, kebele (lowest level administrative unit) and cooperatives fall under the high influence low interest quadrant. On the other hand, research institutions, NGOs, farmers and home economics departments were of high interest but low influence. Groups such as youth and women's associations, the media, food processors, and traders have low influence and low interest. The community grassroots (mothers and farmers) and the health related public sector (health extension workers and health centers) are closely involved in MCN. The non-health related public sector, the private sector and civil society have a supportive role. Furthermore, government and kebele are involved in the peripherals (monitoring and evaluation). Among the different stakeholders listed, those with the most influence on MCN are: mothers, government, farmers, health centers, and agriculture office and health extension workers. On the other hand, the media, health office, health experts, women and children affairs office, research institutions, traders and suppliers are only moderately affecting MCN. Agriculture experts, home economics departments, kebele, formal/informal institutions, cooperatives and food processors are least affecting MCN.

Conclusions

Mothers, farmers, health extension workers and health centers are key players of MCN. Therefore, involving them in decision-making, engaging and consulting them regularly is needed. Consulting research institutions, ministry of trade and industry, NGOs, health experts, agriculture experts and the women and children affairs office; deciding together with the staff from the health office and kebele representatives; and supporting local initiatives by farmers, agriculture office, health office and health centers is concluded. Taking into consideration the spatial and temporal dynamism of the "stakeholder landscape" was crucial in this project to reduce potential exclusions and biases to develop an upgraded food

product that is nutritious, acceptable, affordable, and convenient.

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The Contribution of AFSP Farmers Groups Toward Improved Agricultural Income and Nutrition: Midline results from the DIME Impact Evaluation of AFSP

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Introduction

The Agriculture and Food Security Program (AFPSP) impact evaluation (IE) focuses on the components of AFSP that relate to investment in technology adoption and nutrition enhancement. Examining the difference in outcomes in villages that benefit from AFSP to villages who have not benefited allow the study to measure the causal impact of both supply-side (improved seeds, kitchen gardens, backyard poultry) and demand-side (behavioral change communication) interventions on the nutritional outcomes of pregnant women and young children. A primary question for the study is whether there are complementarities between productivity and behavioral change components through which these interventions reinforce each other.

Methods

The methodology is a multi-arm randomized controlled trial of project components at the level of the village development committee (VDC). One of the weaknesses of the experimental set up is that while timing of the intervention and its related components was random, the choice of whether or not a village received the program at all was not. Identification of program effects therefore relies on a matched controls design that accounts for farmers propensity to join farmers groups and for baseline characteristics that might be different between communities where AFSP forms farmers groups and communities where it has not.

ANCOVA analysis was used to estimate the impact of the treatment on the income from agriculture and livestock production on households that benefited from the AFSP program. The results are stable to controlling for different definitions of crop prices (for example, adjusting for inflation), and for a number of baseline characteristics that could affect both the outcome as well as the selection into the program. In addition, the results change very marginally when a propensity score for treatment-assignment was introduced into the ANCOVA specification.

Findings and Interpretations

On average, income of households in the AFSP villages was 11 percentage points higher than the income of households in the non-AFSP VDCs. While the experimental setup is not a pure randomized control trial, there is reason to believe the results highlighted are a reasonably valid causal interpretation of the effects of the program on farmers' income gained from agriculture and livestock production. The propensity score exercise presents strong evidence that the ANCOVA model's estimates are unbiased.

Research on other income categories as well as indicators of nutritional status and knowledge is ongoing, and the final draft will include a disaggregation of the impacts by sector impacts of the project as a whole, the delivery mechanisms and challenges that remain, and an analysis of the complementarities between nutrition focused behavioral change communication and productivity enhancement.

Conclusions

This study will provide important insights relevant for Nepal about the value of combining interventions that support agricultural productivity with nutrition messaging, two strategies often employed by agriculture and nutrition programs.

By demonstrating the causal effect of the program, the results also provide evidence for the government of Nepal on which parts of the program work best and which are most important to continue, support, and extend.

Health and nutritional status of schoolchildren one year after complementary school garden, nutrition and WASH interventions: a cluster randomised controlled trial in Nepal

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University of Basel, Switzerland

Introduction

This study was a cluster randomised controlled trial designed to evaluate whether a school garden program and complementary nutrition, water, sanitation and hygiene (WASH) interventions had an effect on schoolchildren's nutritional and health status in two regions of Nepal within one year.

Methods

The trial included 682 children from 12 schools randomised into three arms: arm 1 implementing a school garden (SG, n=172 children), arm 2 with additional complementary interventions (SG+, n=197) and arm 3 without any interventions (control, n=313). Questionnaires were administered to evaluate WASH conditions at the level of schools and households. Dietary intake was assessed using a food frequency questionnaire and 24-hour recall. Haemoglobin levels were measured using haemoCue digital photometer. Stool samples were subjected to wet-mount, Kato-Katz and formalin-ether concentration methods for the diagnosis of intestinal parasitic infections. Water quality was assessed using the Delagua testing kit. The changes in key indicators between baseline and follow-up were analysed by mixed logistic and linear regression models.

Findings and Interpretations

Awareness regarding requirement of ≥5 portions of vegetables per day increased in all arms (SG+: 7.1% to 24.9%; SG: 12.2% to 28.5%; control: 10.9% to 26.5%). Stunting was slightly reduced in SG+ (19.9% to 18.3%; p=0.92, compared to control) contrary to a slight increase in the SG arm (17.7% to 19.5%; p=0.54, compared to control). Anaemia markedly increased in the control arm (22.7% to 41.3%) and the SG-arm (20.7% to 43.9%; p=0.56, compared to control) but slightly decreased in SG+ (33.0% to 32.0%; p<0.01, compared to control). Hand-washing after defecation increased significantly in SG (68.0% to 97.7%; p=0.01 compared to control); and hand-washing before eating increased in SG+ arm (74.1% to 96.9%; p=0.01 compared to control). While the prevalence of parasitic infections was stable in control (43.9% to 42.4%), there was a strong decline in SG+ arm (37.1% to 9.4%; p<0.01, compared to control) and a minor decline in SG (33.5% to 27.4%; p=0.42, compared to control).

Conclusions

Complementary interventions implemented in schools and households improved children's awareness on fruits and vegetables intake, reduced anaemia, stunting and intestinal parasitic infections among schoolchildren within one year.

Farmers' health and agriculture in low income economies: investigating farm households and wider health interactions in rural Malawi

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Introduction

There is now quite a large literature investigating the bi-directional linkages between health and agriculture, including the impact of health shocks on agricultural livelihoods and nutrition.

Methods

In this study we use a set of non-linear farm household programming models, which allow us to simulate both the impact of health shocks on agricultural livelihoods and nutrition and the pathways through which these impacts are transmitted. These models explicitly analyse the seasonality of household production and consumption, labour supply, wages and prices.

Using data from the 2010-2011 Living Standards Measurement Study – Third Integrated Household Survey (LSMS-IHS3), we investigate the welfare impacts of ill health on agricultural livelihoods using a typology of rural households in the Kasungu-Lilongwe Livelihood Zone of Malawi. The typology is developed through the technique of cluster analysis and encompasses a diversity of livelihood strategies and outcomes, but the majority of households are very poor with few assets to fall back on in case of shocks. They also suffer regular bouts of ill health.

Findings and Interpretations

Overall, our findings reveal an abundance of family labour, with very small farm sizes and limited demand for off-farm employment, and hence households are severely cash constrained. In this context, health shocks do impact on the food consumption of poor households, but the impact is not via reduced labour for own farm production. Rather, poor households trade off food consumption during the main production season so as to maintain limited use of purchased farm inputs that will sustain consumption levels in the medium term.

Conclusions

These findings are consistent with earlier work (e.g. Beegle 2003, Jayne et al 2006) that emphasize that, in a context of labour abundance, alternative household labour can substitute for the effort of a particular member who falls sick. Moreover, as the population of Malawi (and many other African countries) has grown by one third in the past decade, we should expect these findings to become more common. The findings also emphasize the importance of free public health care in protecting the livelihoods and nutrition of poor households in low income countries.

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Lessons from implementation and process monitoring of the Food and Agricultural Approaches to Reducing Malnutrition (FAARM) trial in Bangladesh

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Introduction

The 'theory of change' in nutrition-sensitive agriculture programs is often articulated at the outset of the program but the inter-related and underlying assumptions within this theory are then under- or un-measured, especially prior to the conclusion of the program (1-3). The Food and Agricultural Approaches to Reducing Malnutrition (FAARM) project is a cluster-randomized field trial evaluating the impact of Helen Keller International's (HKI) Homestead Food Production (HFP) program. While its primary endpoint is stunting in children under three years, FAARM also aims to understand the multiple pathways through which the intervention achieves or does not achieve impact.

Methods

The FAARM trial runs from 2015 to 2019 and includes 2,700 women (30 years and younger) in 96 villages in rural Sylhet. Women in the 48 intervention villages benefit from skill-building in nutrient-dense fruit and vegetable production, poultry rearing, and marketing, accompanied by transfer of productive assets, and nutrition and health education. Through a program monitoring system (in the intervention households), and a bimonthly surveillance system (in all households) with smartphones and tablets, the team collects real-time data on program activities (e.g. attendance), outputs (e.g. garden diversity) and early outcomes (e.g. dietary diversity) in the pathways of change.

We use surveillance data collected every two months between September 2015 and February 2017 to analyze differences between intervention and control households as early signs of program impact. The main indicators studied are home garden crop diversity (number of species) and women and children's dietary diversity scores (WDDS/CDDS). Further questions on women's knowledge about different food groups and on ideal food plates were added to the surveillance to illuminate gaps in the pathways.

Findings and Interpretations

Home garden crop diversity (including fruits, vegetables and spices) was approximately double in intervention households compared to control households in all seasons: winter season 6.4 vs 2.8, hot season 6.5 vs. 3.1, rainy season 7.7 vs. 4.3 ($p<0.001$). Dietary diversity in women (WDDS) varied little across seasons and was only slightly higher in the intervention than in the control arm: 4.3 food groups vs. 4.1 ($p = 0.11$). Child dietary diversity also showed only little difference between intervention and control groups: 3.0 vs. 2.8 food groups ($p=0.16$).

Food group knowledge was somewhat better among women in the intervention group compared to the control group, but low in both: 1.7 correct answers out of 5 questions vs. 1.3 ($p<0.001$). Nearly all women correctly identified the most diverse food plate as the optimal one for themselves (99%) and for their children (93%), but reported a most commonly eaten food plate that was less diverse, with fruits and vegetables lacking more than animal-source foods (mainly fish), with only a small difference between intervention and control. Reported reasons were mainly lack of money, insufficient household production and for children dislike of taste.

Conclusions

The theory of change mapping and implementation of the process monitoring system in FAARM allowed us to articulate the necessary linkages between program delivery, uptake and outputs necessary for nutrition and health impacts in women and children. The analysis of early output data revealed that some of these linkages are not working as hypothesized. This led to deeper analysis into missing links in key program areas and this information can be used to address gaps and adapt the project to the particular challenges in Sylhet prior to the end of the project. The creation of the monitoring system is in itself a result that can be built upon for future research on process monitoring, especially in homestead food production programs.

References

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POSTER PRESENTATIONS

GROUP 1 MINI POSTER PRESENTATION SESSION: 11-12 July 2017

POSTER TITLE – GROUP 1	PRESENTER
Livestock ownership is associated with increased odds of anemia among preschool-aged children, but not women of reproductive age in Ghana	Andrew D. Jones University of Michigan, USA
Animal source food consumption during early childhood is associated with reduced risk of poorer child development outcomes in rural Nepal	Andrew Thorne-Lyman Johns Hopkins Bloomberg School of Public Health, Harvard T.H. Chan School of Public Health, USA
Rural Women Workload in Agricultural Food Production, Nutritional Status of Mothers and Their Under-Five Children in Ibadan, Nigeria	ARIYO Oluwaseun University of Ibadan, Nigeria
Reported food restrictions in pregnancy and lactation are associated with ethnicity, education and wealth among pregnant women in Banke district	Ashish Lamicchane Helen Keller International, Feed the Future Innovation Lab for Nutrition, Nepal
Using household-level perceptions of their local food environment to inform nutrition-sensitive agriculture program design in Odisha, India	Ashley Aakesson SPRING Project/The Manoff Group, USA
Formative research to design a pilot intervention that assesses feasibility of an integrated agriculture and nutrition intervention to improve maternal and child nutrition in rural Bangladesh	Ashraful Alam Sydney School of Public Health, University of Sydney, Australia
Differences in Coping Strategy and Child Wasting among PSNP Beneficiary and Non-beneficiary Households of Eastern Ethiopia: Cross Sectional Study	Asnake Ararsa Irenso Haramaya University, Ethiopia
Liquid Milk: Cash Constraints and Day-to-Day Intertemporal Choice in Financial Diaries	Berber Kramer International Food Policy Research Institute (IFPRI), USA
Improving maternal and child dietary diversity in Bihar, India: changing household practices using Self-help group platform	Biraj Laxmi Sarangi Project Concern International, India
Monitoring women and children's nutrition via mobile phone surveys: findings from a large scale mode experiment in rural Kenya	Christine Lamanna World Agroforestry Centre (ICRAF), Kenya
Assessing the value of eating patterns as markers of diet quality in a resource-constrained setting	Corey M. O'Hara Tufts Friedman School of Nutrition Science and Policy, USA
Agricultural development interventions on household nutrition in Kenya and Uganda	Cory Whitney Center for Development Research, University of Bonn, Germany
What effect did Kerala's (India) horticultural programme have on access and availability of fruits and vegetables?	Darlena David London School of Hygiene and Tropical Medicine, UK
Food Safety Metrics relevant to Low and Middle Income Countries	Delia Grace International Livestock Research Institute (ILRI), Kenya
Is Dietary Diversity Associated with Anemia during Pregnancy in Nepal?	Dipak Prasad Upadhyaya Institute of Medicine, Tribhuvan University, Nepal

POSTER TITLE – GROUP 1	PRESENTER
Ten2Twenty: Nutritional, social and economic pathways of optimizing adolescent nutrition for better health in low and middle income countries: a systematic literature review	Donya Madjdian Wageningen University and Research, The Netherlands
Deciphering indicators of grain biofortification in rice systems; implications and choice for upscaling	Dr Hafeez ur Rehman University of Agriculture, Faisalabad-Pakistan
Enhancing practice of good nutrition behavior through value chain based agricultural intervention; a myth or reality?	Faria Ahmed CARE, Bangladesh
Production diversity, nutrition diversity and health of children in India	Ganita Bhupal Rajdhani College, University of Delhi, India
Participatory assessment of food environments in rural Ethiopia: Implications and strategies for selecting measures to improve food and nutrition environments	Heidi Busse University of Wisconsin, USA; International Potato Center, Ethiopia
Changes in Minimum Dietary Diversity for Women and Children in Uplands of Vietnam Through Nutrition Education and Agrobiodiversity in Home Gardening	Hoang KT HealthBridge Canada, Vietnam
Adaptation of mental development tool to access child development after a nutrition intervention in rural Ghana	Husein Mohammed School of Dietetics and Human Nutrition, McGill University, Canada
Agriculture to Nutrition (ATONU): Women's empowerment is associated with dietary diversity in Ethiopia	Isabel Madzorera Harvard T.H. Chan School of Public Health, USA
Effect of traditional smallholder agricultural production systems on nutrition and well being of households in Yobe State of Nigeria	Jamila Aliyu Institute for Agricultural Research, Ahmadu Bello University, Nigeria
Examining the Relationships Among Maternal Exposure to Aflatoxins, Birth Outcomes and Stunting in Nepalese Infants: Protocol for the AflaCohort Birth Cohort Study	Johanna Y Andrews Trevino Tufts Friedman School of Nutrition Science and Policy, USA
Effect of Amaranth Sorghum Grains Porridge on Malnutrition among Children in Kiandutu Slums, Kenya and its Acceptability	Judith K. A. Okoth Kenyatta University, Kenya
Agricultural Policies and Child Undernutrition in Low- and Middle-Income Countries	Kafui Adjaye-Gbewonyo Harvard T.H. Chan School of Public Health, USA; Regional Institute for Population Studies, Ghana
Factors associated with child wasting in South Asia: An in-depth analysis of household survey data in six countries	Kassandra Harding Tufts Friedman School of Nutrition Science and Policy, USA
Greater improvements in child growth and diet quality after a holistic community development intervention than after nutrition training alone	Laurie C. Miller Tufts School of Medicine, Tufts Friedman School of Nutrition Science and Policy, USA
Can food scares shift health and nutrition outcomes in low and middle income countries (LMICs)	Paula Dominguez-Salas London School of Hygiene and Tropical Medicine, UK

POSTER TITLE – GROUP 1	PRESENTER
Agricultural food production and selling and the associated household factors in Nepal: Findings from a national survey	Sumanta Neupane Feed the Future Innovation Lab for Nutrition, Nepal Johns Hopkins Bloomberg School of Public Health, USA
Both Individual and Community Level Factors are Essential for Household Food Insecurity in East Gojjam Zone, Ethiopia: A Multilevel Analysis.	Zewdie Aderaw Alemu Debre Markos University, Ethiopia

GROUP 2 MINI POSTER PRESENTATION SESSION: 12-13 July 2017

POSTER TITLE – GROUP 2	PRESENTER
Biofortification: The Evidence	Caitlin Herrington HarvestPlus, International Food Policy Research Institute (IFPRI), USA
Pig farmers, pig eaters? Characterizing household and child feeding practices among smallholder pig farmers in Uganda	Delia Grace International Livestock Research Institute (ILRI), Kenya
Assessment of Nutrition-Sensitive Agriculture Competency of Mid-Level Agriculture Graduating Students in Ethiopia	Mebit Kebede Jhpiego, Ethiopia
Upscaling Participatory Action and Videos for Agriculture (UPAVAN): Development of a participatory, video-based nutrition-sensitive agriculture intervention to improve maternal and child nutrition	Meghan O'Hearn Digital Green, India
Factors associated with consumption of micronutrients rich food among pregnant women of Bajrabarahi Municipality, Lalitpur	Milan Maharjan Institute of Medicine, Tribhuvan University, Nepal
Food security, dietary diversity, home gardens and agricultural factors are associated with child stunting: results from surveys in three rural sites across Myanmar	Min Kyaw Htet Independent Researcher, Myanmar
A qualitative assessment of income generation activities among beneficiaries of a homestead food production program in the Far-Western region of Nepal.	Miti Patel Helen Keller International, USA
Improving Maternal Diet Diversity: Leading Towards Improving Maternal Nutrition in Bangladesh	Monirul Islam BRAC, Bangladesh
Low Prevalence of Breastfeeding Counselling during ANC Visits in the Hospitals of Kathmandu Valley	Nisha Sharma Helen Keller International, Nepal
Seasonal variation in energy Intake from different foods in two different agro climatic locations in rural India	Nithya DJ Leveraging Agriculture for Nutrition in South Asia, M. S. Swaminathan Research Foundation, India
Measuring nutrition governance in Nepal: A multiyear assessment of institutional and individual collaboration, capability and commitment at sub-national levels in Nepal	Patrick Webb Tufts Friedman School of Nutrition Science and Policy, USA
Effects of diet supplementation with livestock products on nutritional outcomes in children: a systematic review	Paula Dominguez-Salas London School of Hygiene and Tropical Medicine, UK
Climatic conditions and child height: Sex-specific vulnerability and the protective effects of sanitation and food markets in Nepal	Prajula Mulmi Independent Researcher, Nepal
Situational analysis of pulse production and consumption in India	Priya Rampal M. S. Swaminathan Research Foundation, India
Assessing the impact of aquaculture on fish consumption, dietary diversity, and household food security in Bangladesh	Rachel Gilbert Tufts Friedman School of Nutrition Science and Policy, USA
Consumption patterns of millets compared to rice and wheat in Karnataka state, India	Raju S Leveraging Agriculture for Nutrition in South Asia, M. S. Swaminathan Research Foundation, India

POSTER TITLE – GROUP 2	PRESENTER
Exploring infant and young child feeding practices and the consumption of poultry products in rural Tanzanian villages: A mixed methods approach.	Robyn Alders School of Life and Environmental Sciences, University of Sydney, Australia
Child Underweight, Land Productivity and Public Services: A District-level Analysis for India	Rohit Parasar M. S. Swaminathan Research Foundation, India
Can Business Led Pro-Nutritional Value Chains Enhance Nutrients Intake?	Rohit Parasar M. S. Swaminathan Research Foundation, India
Developing a framework for pathways from commercially viable agriculture to stimulate consumption of nutritious foods	Ruerd Ruben Wageningen Centre for Development Innovation, The Netherlands
Anemia in women of reproductive age, household food insecurity, food consumption and household food production practices in southwestern Bangladesh	Sabi Gurung Tufts Friedman School of Nutrition Science and Policy, USA
Effects of iron-biofortified crops on cognitive function: findings from randomized controlled efficacy trials involving pearl millet in Indian adolescents and beans in Rwandan university students	Samuel P. Scott International Food Policy Research Institute (IFPRI), India
Multisector Intervention to Improve Food Security, Nutrition, Household Environment and Health in Nepal: Stakeholder Perspectives	Santosh Gaihre University of Aberdeen, UK
Soil Nutrients, Dietary Intake and Nutritional Status of Children and Women in Sodo Zuria District, Ethiopia	Semira M. Beyan School of Plant and Horticultural Sciences, Hawassa University, Ethiopia
Clinical Nutrition care in HIV infection; integral in ensuring better health of HIV infected people	Shashank Shaker Kalouni Nava Kiran Plus, Dhangadhi, Nepal
Ugandan women with higher dietary diversity scores are more likely to belong to higher than lower BMI quantiles: Findings from rural north and south west Uganda	Shibani Ghosh Tufts Friedman School of Nutrition Science and Policy, USA
If we train them, they will garden? : Factors associated with intervention component uptake in a nutrition-sensitive agriculture intervention	Stella Nordhagen Helen Keller International, Senegal
Pesticide exposure during pregnancy and the pregnancy outcome in Chitwan district of Nepal	Sudip Ale Magar Independent Researcher, Nepal
Dairy, fruits and dark green leafy vegetables' consumption during pregancy is associated with lower risk of adverse pregnancy outcomes; a prospective cohort study in rural Ethiopia	Taddese Alemu Zerfu Dilla University, Ethiopia
Food access and dietary indicators related to depression in women of reproductive age in Sylhet, Bangladesh	Thalia Sparling Institute of Public Health, Heidelberg University, Germany
How economic preferences form food and nutrition security	Till Ludwig Center for Development Research, University of Bonn, Germany
Agriculture to Nutrition (ATONU): Guidelines and steps on selecting agricultural development projects and nutrition-sensitive interventions.	Tshilidzi Madzivhandila Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN), South Africa