

# Animal Sourced Foods and Child Nutrition Evidence from Bangladesh, Nepal and Uganda

## Webinar Transcript

Hannah J. Koehn

Good morning, good afternoon, good evening. Thank you for joining today's webinar to learn more about Animal Sourced Foods and Child Nutrition: Evidence from Bangladesh, Nepal and Uganda. My name is Hannah Koehn and I am a communication specialist at the Feed the Future Innovation Lab for Nutrition, and I will be your MC today. As more attendees are joining the webinar, I will begin to go over some of the housekeeping. The Director of the Innovation Lab for Nutrition, Dr. Patrick Webb, will give a brief background on the Innovation Lab and our research. And then, he'll begin the webinar by introducing today's moderator, Grace Namirembe. I would like to direct all the attendees to a few functions on the Zoom call. At the bottom of your screen, you should see a chat icon and a Q&A icon. Please use the chat feature to engage in relevant conversation with the other attendees. If you have a question for one of the panelists, please use the Q&A feature. Panelists will respond to questions and the Q&A as they are able to but we have also allotted the final 20 minutes of this webinar for the Q&A as well, at which point the panelists will respond to as many of the remaining questions from the audience. If you're experiencing any technical difficulties, please send a message in the chat to Andy Coburn, so that our technical support staff can work with you to help resolve any technical issue. This webinar is being recorded and will be made available on the Innovation Lab for Nutrition and the USAID Advancing Nutrition websites. You can also register for upcoming webinars and our previous recordings and slide decks on our websites. I will repeat these technical housekeeping items in the chat throughout the webinar as people may be joining in at later times. Thank you again for joining us today. And now, I'd like to introduce the Director of the Innovation Lab for Nutrition, Professor Patrick Webb. Pr. Webb is

the [Alexander Mc Farland Professor] of Nutrition at the Friedman School of Nutrition Science and Policy and the principal investigator at the USAID Food Aid Quality Review Project. In 2005, Professor Webb was the Chief of Nutrition at the United Nations World Food Program. He has served on numerous task forces and global advisory panels, and is currently the Senior Advisor to the High-Level Global Panel on Agriculture and Food Systems for Nutrition. With that, let me ask Dr. Patrick Webb to take over and provide us with a brief description of the Innovation Lab for Nutrition. Dr. Webb, over to you.

### Patrick Webb

Sure, thank you Hannah and welcome everyone. It's so great to have some people, old friends and new, joining us for this latest in our webinar series, which you can see the whole series on our website [nutritioninnovationlab.org](http://nutritioninnovationlab.org). I myself am having technical difficulties. So the tropical storm has knocked out the power since yesterday afternoon. So I'm on phone, and so things may be a little bit fuzzy, and who knows how long my battery will survive. But there we go, these things that challenge us. The Nutrition Innovation Lab. very briefly: an important activity of what was the Bureau of Food Security is now the Bureau of Resilience and Food Security within USAID and part of the Feed the Future Innovation Lab, a suite of institutions and centers around the world. Ours focuses on food, diets, and nutrition and our goal, as you can see the map here, in mainly different countries... **[Sound lost]**.

### Hannah J. Koehn

Dr. Webb, I think we lost your audio right there. Dr. Ghosh, can I actually have you jump in, while we resolve some of the audio issues on Dr. Webb side?

### Shibani Ghosh

Sure, absolutely, do you want...? I don't think he is able to hear us either. Correct. I'm going to...

### Hannah J. Koehn

Yes his audio is still not working. I'll have you jump in this section while we resolve some of these issues.

### Shibani Ghosh

Yes thank you. Thank you Hanna and good morning, afternoon, evening everybody... I think Patrick has just realized we are not able to hear him, and I think he isn't able to hear us either. So I'm speaking Patrick...yes got it. I think he is figuring it out... maybe, there he goes. We'll give him a minute to see if his audio reconnects. Everyone we apologize. Patrick, are you back?

Patrick Webb

Can you hear me now?

Shibani Ghosh

Yes, yes. Go ahead. Yes.

Patrick Webb

Sorry, no idea why that happened but there we go.

So, next slide please

I was simply saying that this range of research activities around the world could not be done with a huge number of global, and national, and local partners, hopefully most of whom are here, core partners with whom we've worked from the very beginning of the Innovation Lab, 10 years ago. Purdue, Harvard, John Hopkins, Tuskegee, as well as Columbia and UCDAVIS, but a range of important institutions in the countries in which we work. And for this particular presentation, Makerere University in Uganda, the Bangladesh Agriculture University, in Bangladesh obviously, and Patan Academy of Health Sciences in Nepal have all been extremely influential partners. I have also to point out NGOs, like Heifer International, who've played an important role. So we are using this series of webinars to share recently published or soon to be published findings, so that we can get policy and program-relevant information out to the community as quickly as possible, and get feedback on the discussion of implications. So with that, I'm going to hand to the moderator for this particular webinar, Grace Namirembe, who will carry on with the order of play for this webinar. Thank you so much.

Grace Namirembe

Thank you Patrick. Right, in this webinar, we will examine the role of animal source foods in improving the nutritional status of vulnerable populations and present findings from the Innovation Lab for

Nutrition studies in Nepal, Uganda, and Bangladesh. Let me first introduce the other two speakers today, and then provide a brief summary of the sequence of presentations. So, Dr. Shibani is a research associate professor at Friedman School of Nutrition Science and Policy. She's also the Associate Director of the Innovation Lab for Nutrition, with experience working in the Middle-East, sub-Saharan Africa, and South Asia. Her research interests are in understanding the role of agriculture in improving nutrition, while ensuring health, assessing the diet, and other determinants of nutritional status of infants and young children, and testing interventions aimed at improving maternal and infant nutrition and growth. Dr. Sonia Zaharia is a post-doctoral fellow at the Nutrition Innovation Lab, with a background in economics. Her interest lies at the intersection of economics, agriculture, and nutrition, with the aim of finding sustainable solutions to global food security. She has a Master of Science in sustainable food systems from Wageningen University, and a PhD in finance, from Goethe University in Frankfurt. And now for the sequence of presentations. Dr. Ghosh will start the webinar sharing evidence of the role of ASFs in improving nutritional status of young children, including prior work by the Nutrition Innovation Lab. She will be followed by Dr. Zaharia who will present new analyses, which examine the link between anthropometric outcomes in children and their previous and current consumption of ASFs. Finally, Pr. Webb will complete the panel presentations by responding to a major question as to whether agriculture or multi-sector interventions improve the intake of ASFs in setting where diets are already lacking diversity. And then, we will all come back together, and answer any remaining questions. As Hannah mentioned earlier, please use the Q&A feature to ask questions to the panelists. We will be monitoring this feature throughout the webinar and answering any questions that may come up. Any remaining questions will be answered during the last 15 minutes of the webinar. And without further ado, let me hand over to Dr. Ghosh. Dr. Ghosh, over to you.

### Shibani Ghosh

Thank you Grace. Thank you for a very gracious introduction, and welcome everybody from many, many different time zones. We really appreciate you coming on, especially if it's very early in the morning on your end or very late in the evening as well. So let me jump in into the overall topic of animal source foods, and I think all of us on here are very... probably very familiar with these three bullet points that are on my first slide here, that is: Animal source foods are a source of highly bioavailable protein, iron, vitamin A, zinc and iodine. So that's well proven and that also if you're eating... if it's eaten in small quantities, they do provide these vital nutrients, particularly for infants and young children. Of course, there is a question of whether all the nutrients would be provided, but at least they provide bioavailable forms of those nutrients. And that provision of these ASFs in small

quantities in an important food-based intervention, and this is not just to ensure the growth as in physical growth of children, but also their cognitive development. And I want to place particular emphasis on cognitive development because I think that is the place that we really need to be looking at in terms of improving cognitive development of young children.

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Thank you Hannah. What I want to begin with first is what I like to look at as nutritionist stroke quasi-dietician is what is the composition of animal source foods, and what you have here is the value of these different nutrients per 100 grams and I've just chosen a few examples of raw foods. And these are from the USA Food and Nutrient Database.

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And what you see here I've highlighted is that you do find differences in the nutrient value, whether it's the energy, and in this case I've highlighted protein, fat, calcium, iron, and vitamin B12. So these are very critical nutrients as we know for young children, and these are present in variable quantities in these different animal source foods. So not all animal source foods are alike, but they all bring value to the table.

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On the flip side of that is the discussion of animal source foods as being unhealthy foods, and we are very aware of the discussions around the unhealthy nature of animal source foods, not only for individual health, but also for planetary health. And for those of you who haven't looked at this, I would recommend the Lancet Commission on Healthy Diets for Sustainable Food Systems piece which really highlights the importance of looking at animal source foods from the perspective of it being an unhealthy food. And then the other piece that comes along with that is the fact that we don't actually classify animal source foods as unhealthy or healthy, or for that matter it's really hard to do that because they bring in such nutrients, they have such nutrient-dense value, but they also have the element where they if they're consumed in large quantities they could be... they're not beneficial particularly for certain populations. But for the purpose of this presentation and for this webinar, we are looking at animal source foods in small quantities that are quite vital and critical for the growth and development of young children.

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Thank you, so the first question one wants to ask is: Do types and numbers of ASFs matter, and what do we know about the research in the realm of the type of ASF provided and its effect on growth? And there have been... if you look at the literature, there is a lot that has been discussed around animal source foods. And the discussion that has begun from the early 1900s or even earlier, and some of you might be even more familiar and aware of literature that goes back further in time, this particular slide shows the sort of advertisement that was used from the British Medical Research Council Study that was conducted on the diet of boys during the school age, where they found conclusively that cow's milk intake did improve the growth of these boys, and that sort of led the mandate for milk consumption to be included in for schoolboys and schoolgirls in Britain.

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I'm sorry who is doing the slides? Thank you. Yes, so coming closer to time... so over I've kind of gone back to the 1920s, but if you come closer to time, you do find ecological and multi-country analyses where the relationship of intake of ASFs, whether the quantity, the quality, the number of ASFs has been correlated with specific nutrition outcomes. And in this slide, I'm looking only at those studies that looked at stunting as an outcome measure, which is one of the primary interest... outcome of interest if you will, and without going into major details, these four studies, the first two studies were using two different data sets and so they have a very ecological level at the national level looking at the quality of the ASF and its association with stunting or its association with DALYs, or disability life adjusted years, linked to stunting in children under five. And the last two studies, which are the second two bullets, are focused on using demographic health survey data where they looked at the consumption of ASF and the number of ASFs in the past 24 hours, and the probability of being stunted. And essentially, what was found was three types of ASF's, egg, meat, and dairy, were highly correlated with lower rates of stunting.

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So it's fine when you're looking at cross-sectional assessments, large-scale cross-sectional assessments, and ecological assessments, but what really is important for us is to consider what the intervention studies tell us. And this is one of the first one that I'd really like to present, because this was a study that was done in Kenya on school children. This study was a result of what was the first Nutrition Innovation Lab, actually the Nutrition Collaborative Research Support Program that was hosted by UCLA in the 1980s, and this is a RCT that was conducted by Charlotte Neumann and her colleagues in Kenya, where

they found that the provision of meat improved growth, cognitive, and behavioral outcomes in Kenyan children.

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And what Neumann and her colleagues did was they provided 900 children in 12 schools, so these were schools assigned to four groups, where one received nothing, the other received a supplement that was a local dish of maize, beans, and vegetables; the third received the same supplement along with the milk supplement; and the fourth received a meat supplement. And what they found was that the children who received the meat supplement had the best Raven scores. Now the Raven scores are essentially a measure of fluid intelligence, of abstract reasoning, and problem solving, as well as reasoning by analogy. So it's a metric that is used for assessing cognitive development in young children. And so what they found very consistently that the meat group had in much, much better scores than the other three groups

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And in addition to improved cognitive performance, they also had higher levels of physical activity, they showed increased initiative and leadership behaviors, and they had improved lean mass. And the authors concluded that this was associated with the B12, iron, and zinc that was present in the meat supplement. They also did show improved linear growth in the children who received milk, but this was in younger and already stunted children.

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And further work done by the same group found an association of the energy and the multiple nutrients that they received or they provided from those animal source foods, with both weight and height gain in those kids. And this was very indicative of the fact that the source of energy protein and micronutrients from the animal source foods that were provided were critical for the growth and development of these young children.

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This one... I'm moving into from the meat and milk supplementation study. I think many of you will be familiar with the egg intervention - providing an egg per day starting at six months of age - which the first RCT that was conducted was by Laura Iannotti and her colleagues in Ecuador, where they provided children aged six to nine months on one egg per day for six months of age. And they had a very rigorous, tightly managed study, where they monitored mobility, distributed the eggs, and monitored the egg intakes. This is called the Lulun project in case you are interested, there is a website where you will get additional information. But if you go to the next slide, I'll show you one of their primary results. What they reported was that the change in LAZ from baseline to end line and panel b is essentially the egg group, the children who received the egg. And what you see is that there is a distinct shift and a significant movement to the right of the LAZ score. And so the authors concluded that providing an egg per day along with appropriate social messages translated into an improved LAZ at endline.

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However subsequent to that, when they did a follow-up on those kids who received the intervention...after two years of receiving the intervention, what you see in this slide is they found that the egg intervention effect was no longer present.

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And... but they did find that if the child ... if you will, the intervention child had received an egg in the past 24 hours in the Lulun II assessment, it was associated with lower growth faltering. Similarly, another study... it's exactly the same design that was conducted in Malawi by colleagues Stuart et al., and their sample size was about over 600 children. They found no effect of egg provision on LAZ, but they did see a significant improvement in head circumference for age. Now a critical point that was noted in the Mazira trial study was that there was existing fish consumption in the communities where they had recruited these children, because this is along Lake Malawi that the study was implemented, and in addition they found that the stunting levels at baseline were much lower.

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And then, so in addition to looking at type and number of ASFs and comparing the ASFs to each other, there is also the question of: What happens if you provide multiple ASFs? And that was...that is being observed in the ecological analysis or the multi-country analyses, but what if you had to look at it from an intervention study perspective and this is a really new publication by Mahfuz et al. from Bangladesh,



where they... it's called the Bangladesh Environmental Enteric Dysfunction Study, and they provided over 400 children one egg and 150 ml of milk for 90 days, and they added a micronutrient mix for 60 days. And they had about 174 children as comparison and they did see a change in the intervention group. The effect was largest again in those children that was stunted. So there's something emerging here about the effect in already stunted children

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And moving on to a sort of another outcome of interest, which is head circumference for age Z score... now head circumference is a very simple measurement and it allows pediatricians to measure or assess brain size and development. It's very interestingly a very simple field-friendly technique which is not often very used, but one of our colleagues who has been working with the Nutrition Innovation Lab since 2011, Lori Miller, had as a pediatrician... had always included head circumference measurements in her studies and this particular slide we are presenting is her finding, where the head circumference for age z score, excuse me, progressively improved with the number of ASFs provided. So this is an associative analysis and what she also found was if ASFs were provided... if this intake was in children under three years of age, but not in children over three years of age.

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So we were able to replicate the same analyses that Lori had done in the Chitwan study. In our study which was conducted in Banke district in Nepal, called the Aflacohort Study, its main objective was to assess aflatoxin levels in pregnancy and early life, and its relationship with health outcomes like stunting. And but we were able to use the data on the children... the diet data on children from 6 to 12 months of age, and see... look at what foods were associated with what types of ASF was associated with improved head circumference for z-score. And we found that chicken and dairy were the strongest... the strongest and most significant associations. And we did find this weird odd negative relationship with fish which unfortunately I don't think we are able to explain other than the fact that the number of kids who were consuming fish were very small.

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So I think in conclusion what I'd like to say is that there's a lot of literature out there that says ASFs do matter, so there's no question over there; but what I'd like to say is that the causal nature of these

relationships is very contextual and I'm sure I have colleagues on here who would want to talk about the fact that we need to consider the WASH, hygiene, sanitation, the dirty chicken environment if you will within the context of provision of these ASFs with metrics or outcomes of interest like stunting or head circumference for z-score, which is around development of children. Keeping all that in mind is very critical when you're trying to understand the causal nature of these relationships. I also think that we're seeing and we need to see more on number of ASFs as a function of total quantity. I don't think we do enough on assessing total quantity consumed and what exactly... what is the nutrient value of the total quantity consumed. The next thing is the data is showing that type of ASF seems to be a function of geographic location. Introduction of certain ASFs is going to be linked to cultural and dietary practices, and that I don't think is very well studied. And finally, we do need to understand more on the timing and age of introduction, the length of time of consumption, as well as the lagged impacts of consumption of ASFs, whether single or multiple. And that particular note I'm going to hand over to Sonia Zaharia, who is going to talk a lot more about these specific issues. Thank you.

### Sonia Zaharia

Yes, thank you Shibani. I hope I'm on now, yes. Hello everyone. I'm Sonia Zaharia. I'm going to present today our findings from a multi-country analysis on the relationship between animal source foods consumption and child growth. I want to mention that this is joint work with our colleagues from Johns Hopkins University and Makerere University in Uganda.

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Thank you. So our goal was to study how anthropometric outcomes that measure child growth are related with both contemporaneous, as well as past consumption of animal sourced foods. And our target group are children aged between six months and two years old. And the main difference between our study and existing empirical evidence is the fact that while other such studies use cross-sectional data, we use longitudinal panel data, which means that we observe the same child at multiple points in time. And this is an advantage, because it allows us to test for potential lagged effects of animal source foods consumption on child growth. And this is important because child growth is a cumulative process, and we expect that the effects of diet on growth are not necessarily visible right away.

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Yes. Sorry, so the data that we are using is derived from a series of surveys from three different countries. These data were collected at different time intervals. For Nepal, we have yearly data...the sample is also nationally representative. For Bangladesh, we have data that was collected every six months from three divisions... divisions of Southwestern Bangladesh. And for Uganda, the data was collected every two years, and we are looking at six districts from northern and southwestern Uganda. And these surveys contain detailed information about the household, about the mother and the child. And they also have dietary... 24 hour dietary recalls, which we use to determine animal source foods consumption. So what we do is to divide the food items into food groups, and we are using the classification provided by the World Health Organization. So the animal source foods...

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Somehow the remote control I don't reach it I don't know why, sorry. Yes so here you can see the four food groups that we aggregate into animal sourced foods. These are eggs, dairy, flesh foods, and fish and other aquatic products. What you can see in this graph is the share ... is for each country the share of children who consumed a given ASF type in their daily diet. And what you can see is that we have a high heterogeneity across the three countries. And Uganda is by far the country where children consume the least ASFs. We can also see that dairy is a widely... is the most widely consumed animal source foods, except for Bangladesh, where interestingly more than 40 percent of the children under two are consuming in their daily diet some type of fish. But we don't only look at animal source foods. We also take into account these children's diets.

Yes thank you next slide.

The other diets that they have and here you can see the other food groups that we look at. Nepal and Uganda use the same classification, and for Bangladesh we have a slightly different classification, where fruit and vegetable are all in the same category, and you can see that starchy staples are consumed by most children in the sample, by far the largest category.

Thank you

So we are interested in two outcomes: the length-for-age-z-score of these children, and whether a child is stunted or not, which is a binary variable. And we want to look at their relationship with contemporaneous as well as past consumption of animal sourced foods. And for animal source food consumption, we look at two sets of variables. The first is whether a child consumed any animal source foods or not. The second set is whether a child consumed one type of animal source foods or whether he consumed two or more type of animal source foods. And all these are binary variables as well. And to test our hypothesis, we use fixed effects panel regressions, where the unit of observation is a child at time T. And in our regressions, we control for the consumption of other foods, and we also adjust for other confounding factors - so children characteristics, as well as relevant household and other characteristics. And the advantage of having longitudinal panel data is that we can also include fixed effects. So we use district time fixed effects. This allows us to adjust for changing local conditions that are common to all children in a given district at a given point in time. For example, changing market ... changing market availability or local food prices that would affect animal source foods consumption and at the same time the outcome as well. So moving on to our results.

Thank you

We start by looking at contemporaneous animal source food consumption and what we find confirms existing evidence from the literature that those children who consume animal source foods in their daily diet, especially if they consume two or more types, have on average higher length for age z scores. So for instance in Bangladesh, if a child consumed any animal source food, the length for age z score would be by 0.12 standard deviations higher than that of a child that didn't consume any ASF at all. And we obtained similar results for stunting, which I'm not going to show here. These were significant for Bangladesh and Uganda.

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We also break down the analysis by different food groups and here you can see that the most important animal source foods in all three countries was dairy. In Nepal we also find that fish foods were significantly related to length-for-age Z score. And of course the diet matters as well and in Nepal you can see that we obtain significant coefficients on other food groups as well. Now I will move on to our next result. Yes so what happens when instead of looking at contemporaneous animal sources

consumption we look at what these children consumed in the past? So that means in Nepal, what they have consumed in their daily diet one year ago and in Bangladesh what they have consumed in their daily diet six months ago. And what you can see here is that length-for-age z scores of children who had consumed animal source foods were significantly higher than those of children who hadn't consumed animal source foods.

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Yes and our results are similar for stunting. I just want to mention that what you see in this table are not odds ratios. These are fixed effects panel regressions, so we read them like the result of a linear regression. So children who had consumed in the past animal source foods have a lower likelihood of being stunted. In Nepal, the share of stunted children would be reduced by almost 10 percent if the children consumed any ASFs. In Bangladesh we have a result if they consumed two or more types of animal source foods.

Yes, thank you

So, what is ... what are we adding to existing evidence? Again, I want to mention that using longitudinal data where these children can be followed up is really valuable because we can look at both contemporaneous and past animal source foods consumption. And in regressions that I haven't shown here, where we include both contemporaneous and past animal source food consumption in the same regression, we find that past consumption matters in addition to, and sometimes even more, than contemporaneous consumption. So this kind of confirms our expectation that child growth is a cumulative process and only after a while we can see the effects of diet on growth. And again we are able to use fixed effects which allow us to account for any observable or unobservable changing local conditions. So to sum up what we found is that animal source food consumption is associated with both higher LAZ and lower stunting rates. And this confirms existing evidence from the literature. We also found that the association is stronger if more types of animal source foods are consumed. This can indicate a higher diversity of the diet so animal sources might be complementing each other, but it can also indicate that there are larger quantities that are consumed, and this makes the effect stronger. Yeah I haven't mentioned that the diet recalls that we are using have counts and not quantities, so we don't know the quantities eaten by these children. And most importantly we find that past animal source food consumption matters in addition to and in some cases even more than contemporaneous animal source foods consumption. Thank you and with this I'm going to hand over to Patrick.

Hannah J. Koehn

It actually looks like Patrick has unfortunately dropped off. We had a giant storm last night in the Boston area so he has lost power in his house and that might be the cause of some of these technical difficulties. Shibani would you mind jumping in and taking over until Patrick is able to come back?

Shibani Ghosh

Sure absolutely yes I don't know everybody if I'm going to do justice to Patrick slides, but I'm going to try. I think following up from what Sonia has presented, which is instead of a very in-depth rigorous econometric analysis, we thought we should present some of the published literature that Nutrition Innovation Lab has produced around agricultural and multi-sectoral interventions, and how they may or may not improve the intake of animal source foods, particularly in areas where diets are lacking in diversity. Sonia, sorry not Sonia... Hannah next slide please thank you.

So one of the first analyses that was done by a colleague of ours Nasul Kabunga, who was at FP Uganda and who's one of our research fellows, was to look at a national survey ... it's a nationally representative survey in Uganda, and assess the relationship of owning and improved dairy cow and improve nutrition. And I think we will be happy to share these papers at the end of the session. I'm sure Hannah can facilitate that. But the key thing that we also found in his econometric analyses was that if households adopted the improved dairy cows they did have an increased milk yield and they had increased consumption. So it was not just yields and sales, but it was also consumption and what was very interesting was that those sales raised food expenditures by 16 percent, and the improved cows owning... an improved cow was associated with lower levels of stunting. But the critical point here was, in the case of Uganda, was that the adoption of these improved breeds was by far in in larger farms. So it's that same conundrum again that we land up with, where agricultural technologies often do get adopted, but they get adopted by those that are probably in a higher socio-economic strata within the context of that rural area.

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The second analysis that was done also by Nassul, and this was linked to the evaluation that the Nutrition Innovation Lab conducted for the Uganda community connected project, and this project was conducted in about 25 districts in Uganda - in the north and the southwest of Uganda. And we collected

in six of the districts where the intervention was implemented, in some parts of the district and not in others... so there was a within district - control comparison - we had three rounds of data that were collected. And what Nasul found was that crop cropping diversity or production diversity of crops did... was associated with improved diet diversity score, particularly the consumption of vegetables and meat intake by women.

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And then and then one of the other sets of analyses and this is unpublished, the previous two are published as papers and reports, but this is just been presented in our symposium in Bangladesh I say just but it's in December 2019. I think we've kind of lost track of time with the COVID situation. But what we did find was that households that were engaged in aquaculture did have children more than two years of age ... older than two years of age that had improved fish intake over time. So they were likely if they were producing the fish they were more likely to introduce the fish to the children and that intake increased over time. And just to contextualizes that this data was collected from 2016 to 2017, in six month intervals so that we could account for any seasonal differences in intake of different food groups.

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And there was also a change in small fish consumption, particularly in those households that were exposed to multiple USAID programs. I'm not going into the details of this, but we were essentially working on this particular analysis and assessment in the Feed the Future zone of influence in Bangladesh where we were able to retrospectively divide the four regions within the future zone of influence into those that were exposed to no USAID program, that is the communities that had never received any exposure, those that have received one exposure, and those that had received multiple exposures. And what we find is that these households that had multiple exposures to multi-sectoral interventions had a change in small fish consumption.

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Similarly what we also found that households that had both aquaculture and horticulture engagement had improved household expenditure, not just total but also household food expenditure, as well as household dietary diversity

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Sorry ah Hannah next, oh sorry i think we missed one slide. I think there's one with the egg consumption Hannah with [Swahara]. Here we go, thank you. and this is something that Patrick has presented in Nepal as well, where we looked at the production of eggs and I believe this is work that was done by [Prajula Numy], of our graduate students using the data from the Johns Hopkins study POSHAN, where she found that households that did produce the eggs did have an increased intake of eggs in that household, as well as by the children in the household, especially in the poorest of households.

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And finally, this is a study again. this was Lori miller's work that was conducted in [] where they provided ... and this is along [] in Nepal a full package with livestock management, plus nutrition, education, and social capital, development activities, along with a partial package, which didn't include the social capital activities and the control. And what you find is the WHZ in kids increased over time. there's about 900 households and 1,300 kids that were followed over five different time points, and I believe it was that same 40=8-month study that we were looking at the head circumference and age z-score. So in general what you do find is that a full package of a multi-sectoral intervention in this case the work that [] in Nepal did with Lori was linked to a significantly improved WHZ at the end line.

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oh all right sorry so I think in Patrick's conclusions and unfortunately I'm not doing justice to this at all, agriculture and multi...what we're seeing from our data and our analyses is that agriculture and multi-sector interventions can increase output and intake of ASFs among both women and children, particularly if they're producing households, and in the case of Nepal, they seem ... if they are especially poorer households, if they're producing those foods, they will be consuming it. And that the increased diet intake is not just from the production but being able to make market purchases. I think that that's one of the critical points that was also made in our second webinar by Bill Masters and Jerry Shively. And I urge you to look at that webinar online if you haven't you want logged on for that one. And at the end of the day access to markets is key to both productivity and dietary gains. So on that note I think I'm going to thank everybody. I believe Hannah there isn't another slide. Yes I think we're open for Q&A. Thank you so much.



## Grace Namirembe

All right thank you. So we have a question from [Bola] at the Sudan. What is your explanation ... what is your explanation for the head circumference response to milk and eggs, but not meat in the Nepal study?

## Shibani Ghosh

Yes, so I think... thank you Bola for a very, very good question. There are two different ways of taking this apart: one is that we have to look at...and I and I'm not sure we have done that analysis...is that is it because of the number of kids that were introduced to dairy and chicken...they're more likely to be introduced to those foods early in life because this was about kids who were to 6 to 12 months of age. So we need to look at that. That's one... could be an explanation that you know they just were not exposed... not that many kids were exposed, but from a nutrient perspective I think the idea is that there is discussion around the fact that cow's milk in fact has growth factors that might be more beneficial or more important for the growth and development of the children. So insulin growth factor is one of these. There are several other sort of non-nutrient components that I have already mentioned about that ... seem to be in cow's milk that people have speculated about. So I don't have the data to say that that's necessarily that was what happened here, so we can definitely look at it if it was a function of you know just not having much consumption of meat in the diet.

## Grace Namirembe

All right and then Naveen would like to know what the average egg intake requirement per child is.

## Shibani Ghosh

so I don't think that... the way this functions would be... and I think somebody else asked me about how do you know how much ASF to add for complementary food... and I think if you take a step back instead of saying what are the needs, nutri-needs of that child, whether it's the calories, protein, fat, and the micronutrients determine that and then determine what animal source food can be added into their diet, which has to be very contextualized to the country and concerns, and that will allow you to determine the actual animal source food to be provided and the amount of the value that it is going to bring to that individual's diet. And I don't know whether I answered that question Grace. So in general,

it seems to me what Lulun, and Mazira, and some other projects have done is provided an egg per day starting at six months of age , that's like one egg a day.

### Grace Namirembe

And then Andrea says: Should we be measuring cognitive development in our interventions, so where are we the nutrition community on this?

### Shibani Ghosh

yes I think that there is discussion that we should be going beyond measuring height for age and stunting because those are technically proxies of not just... that physical development yes but it's more cognitive development that is critical... and that we should be looking at metrics of cognitive development, which go beyond head circumference and WAZ, and I urge people to look at the articles by Charlotte Neumann, where they have utilized different metrics for assessing cognition. And I believe that there is an entire field of cognitive psychology that has different tools that can be used for assessing cognitive development in young children and older children. It's a fascinating field and it's a lecture by itself.

### Grace Namirembe

And then we have a question for Sonia, and this is from [Michelle]; how were the data on food consumption collected and validated?

### Sonia Zaharia

Yes I think I will have to defer this question to Shibani though because I was not involved in the data collection. So I know the data but I don't know exactly

### Shibani Ghosh

Can you repeat the question?

### Grace Namirembe

How were the data on food consumption collected and validated?

Shibani Ghosh

Right so for all the studies I believe, we have used a 24 hour dietary recall, where we assess ... and it's a qualitative recall, so it's a list of foods that the household, if it's a household recall, it's the mother; if it's a mother's recall or the child, it's usually the mother responding... was requested to provide information for the past 24 hours. And I believe in most cases there was also a seven-day qualitative recall that was conducted. So that it's a combination of a 24 hour recall and a seven day recall.

Grace Namirembe

Okay, and then [Pat Makhumar] would like to know if there's any indication about animal source food consumption and income elasticity.

Shibani Ghosh

And?

Grace Namirembe

Income elasticity.

Shibani Ghosh

Oh. Patrick do you want to grab this one if you can hear us?

Patrick Webb

Yes, can you hear me now?

Shibani Ghosh

Yes.

Patrick Webb

I apologize, my battery died, and I've been scurrying around neighbors trying to find a connection that works. So I'm assuming Shibani presented my section. We have not calculated income elasticities and cross-price elasticities. One could go down that route. What we were trying to flesh out at this point, as you've heard, was bring some clarity to the question of which foods matter most, and different foods matter in different contexts depending on levels of pre-existing diet. Clearly different foods have different effects on growth versus cognition and behavioral effects, especially by age. Right, so all of those things were the biological functions we were trying to look at. And importantly, we were trying to make sure, as you heard from Sonia, that we assess the whole diet, so the contribution of other nutrient-rich foods within the diet so that we're not just saying it's one ASF versus another that matters on its own, it's a variety of ASFs contributing to other diversity and quality within the diet that matters. So we do have ...we can look at expenditure patterns we do on the different foods versus staples and non-foods, but we've not explicitly calculated the elasticities in this work.

### Grace Namirembe

And then Jackson Efitre from Makerere University would like to know: What could be the explanation for the low consumption of fish in Uganda? Is it related to availability, access, or cultural issues?

### Patrick Webb

Shall I take that Shibani? I mean it's high relative to the other countries. But there still seems to be... So two things ...two important are happening in in southwest Bangladesh. One is a gradual success and acceptance that aquaculture production should ... should contribute to home consumption, right. There was for many years an emphasis on growing what they call big fish, large fish, carp, and so on, for sale in the market, which didn't leave much for home consumption. That's gradually changing with an emphasis on polyculture and small fish production. And where that is happening, we are seeing an increase in home consumption by women and children of small fish in particular of varying species. So it is happening, but there is still a need for emphasis SBCC and other communications, and education to introduce various fish products early on after six months, and that's only happening slowly.

### Grace Namirembe

So Ralph says: Is there a major challenge for cool box of course is the cost. Was there any data on ability of users to pay?

Shibani Ghosh

Sorry Grace?

Grace Namirembe

Was there any ability to pay? The cost is the major issue for cool box.

Shibani Ghosh

Yes, was there an ability for whom to pay?

Grace Namirembe

For the users to pay.

Shibani Ghosh

Yes, so Patrick I think this was one of the Q&A questions that had come up and I had indicated that we've talked about cool box as a way to support reduction in waste around animal source foods. And the example is the sort of aquaculture, horticulture project in Bangladesh. And yes, I think that that is one of the key concerns that came up in discussions in Bangladesh that these cool rooms should probably be centrally located in markets and there needs to be some kind of a model that makes them sustainable, because otherwise they're too expensive. So I'm sorry I'm answering the question by sending back a point that yes I think we need to have people who are financial and marketing experts develop models, so that these technologies can then be implemented... and also people who have an understanding of how the market works on the ground ...that you're implementing these technologies correctly. And then the cost is absorbed into the cost of the product itself. I and by no means an expert here. I'm a nutritionist. I'm not an expert on these matters, but this is my experience in Bangladesh. I don't know Patrick if you wanted to add something?

Patrick Webb

Yes, I'll just add that refrigeration is not the only way forward and current electric electricity powered methods are out of reach at most ... certainly at most farm households. There's progress on solar

powered refrigeration, but you know we need more innovation in that space. But that doesn't mean there aren't other approaches of more rapid drying and careful drying, other means of both protecting and generating value added, especially for perishable products, and not just fish, it's fruits, and vegetables, and other, and meats, and so on. So, the nutrient-rich which are typically the value added commodities with higher prices in the market, we need to spend a lot more time figuring out not just how to encourage their production and their own consumption but the ability of households to produce more to sell them at high prices of the market and a lot of USAID and other programs are working in that space. I think we simply have to pay more attention to price of technologies, cost, and scalability, in relation to protection of nutrients, not just the production side.

### Grace Namirembe

And, □ would like to know what other interventions shall be included with behavior change communication about consumption of animal source foods? What other interventions will be included?

### Shibani Ghosh

I think this is an important question because I just typed an answer to Shiva Bhandari's comment about the fact that you know promotion of ASFs we need to be a little careful because of the fact that we don't want ASFs that are highly processed or unpackaged, which is one of the issues linked to not just sustainability, but also to the fact that these are linked to poor health. And we are dealing with a nutrition transition. So my response to him was that we should really be thinking about messaging that includes good quality ASF, what are the types of ASF, quantities. And I don't think I made that very clear in my message Shiva. But I also think it has to be linked to the consumption of ...increasing consumption of fruits and vegetable. So it's the whole diet approach. What we are trying to say here is ASF do matter because when they are given in really, really small quantities, and I think someone asked me how much... and the Kenya study gave 60 grams to school children... so that's a very, very small amount. But because there's they have such high bioavailability with respect to the nutrient base... that a small amount of a good quality animal source food is what should be promoted, along with behavior change communications. I don't know if that answers, Grace.

### Patrick Webb

Yes, I would just add you know... I think we've all seen programs that have said ... that assumed that if productivity or numbers of livestock are increased through some kind of agricultural intervention that

animal source food consumption will increase. And that's simply not a tenable assumption, because it depends very much on existing diets, access to markets, and nutrition education. So what we saw what Shibani showed you in in Nepal, through a small NGO program by Heifer, the introduction of livestock alone did not see any major impact on child diet or nutritional status. But then adding nutrition education and various components of social capacity development achieved quite significant changes, in both diet and nutrition. Right so, just making something available whether it's meat milk, dairy, or eggs doesn't automatically mean it will be consumed by the household, but we are finding that where it is available for the household and there is an encouragement to consume, those households that produce more of an egg or a fruit or a fish sell more and consume more within the household. So it is a package that has to be promoted.

### Grace Namirembe

Naomi Seville says I found Laurie Miller's study finding interesting that the intervention with social capital in the full package was the only one that actually had significantly improved WFC by the times of four and round five. And she said it's strange that the WFC got worse at those rounds in the other intervention arm. What was the social capital intervention and why do you think this had so much of a strong effect on wasting? So the question is what was ...

### Patrick Webb

Yes, I get it and thanks Naomi for the eagle eye. Between rounds three and four was the earthquake and we in many cases saw some... some effect when we were looking at longitudinally child effects, particularly of younger children. The social capital was actually quite a range of activities which includes peer-to-peer support, development of savings and credit activities, non-farm income earning by women, a whole range of things, right. So that's essentially my last response was very similar right. It goes beyond delivering one food. One has to understand the context in which that food can make a greater difference and try and encourage that through multiple interventions... multiple forms of intervention

### Grace Namirembe

[Shetrak Halla] would like to know: Is there any recent study... sorry. I'll come back to your question... it moved a bit... So what [Sakinah] would like to know: Fish is common in Bangladeshi diet and also affordable, what about including fish in child diets to improve nutritional status?

Patrick Webb

Shibani?

Shibani Ghosh

So including fish in children's diets. Yes, I think so what seems to be coming out, at least from a lot of the work that we've been looking at and that we have done, is that it's really contextual to the environment that you are in. Small fish for instance... and I just responded to a comment on that, are very high in calcium because of the fact that they are often eaten whole with the bones, particularly in countries like Bangladesh. And if you are able ... I believe in Ghana they have processed fish into fish powder, and so if that can be done I think that's one way of supporting... you know adding fish in, and particularly for pediatric populations because you don't want to bones and all that becomes a big bit of a problem when you're dealing with very young children. But I think I would sort of emphasize the need to go be local in your solutions because I remember this having this conversation with Robin Shrestha, who is our colleague from our coordinator and he's from Nepal, and apparently eggs are not necessarily or chickens I believe not eggs but chickens are not considered a good food in certain parts and they are not the preferred meat. So I think that I say yes you can include fish. I think it's just you have to make sure that you contextualize it to where you are trying to do that intervention. Patrick, you have something to add?

Patrick Webb

Yes, I see Katherine Reba talking about fish powder, and yes there are quite a number of innovations that [ ] fish have been experimenting with fish powder, and the introduction of processed fish in various forms for child complementary foods in Bangladesh, in Cambodia, and elsewhere. It was part of our Innovation Lab Network has been doing a lot of work in that space. Others also, ICCRB has been doing some research in this area. S at some point there needs to be a connection between researchers and commercial R&D to bring those opportunities together. They won't work unless they are desirable, and at a price point that is affordable for very poor households. But there are certainly obviously opportunities in countries that are fish-friendly like Bangladesh

Shibani Ghosh



Yes, and I have to say that I you know I had one of the slides which was on fish and fish and studies that looked at fish consumption and growth. Unfortunately I was... I think I was running out of time so I didn't keep that in there, but there is definitely evidence from both Malawi and Zambia of the association of fish consumption and lowered risk of stunting, and then... but there was you know many of you might be familiar with Anna Lariti's work in Ghana; where she looked at in the late 90s she looked at four complementary foods in which a cereal legume blend was fortified with one was I think fish powder; and I'm not sure whether the other one milk powder, and the other one was just a serum like a cedar legume blend. excuse me so I'm completely messing this up but the point I'm making is that what they found was an equivalence that all groups did similar with respect to their length-for-age z score including the fish powder group. They didn't find any improvements, but that they also report on the same trajectory with respect to growth. So I think that that's a paper from 1999 by Anna Lariti and colleagues I think it's university of Ghana and UC Davis in case anyone was interested. So yes, over to you Grace.

### Grace Namirembe

All right. We have a question from [Nishesh Singh]: do you believe putting emphasis on animal source protein puts economic strain on the poor people of developing countries, especially when they are considered high value food and are more expensive? What if we could compare growth in children fed ASFs or growth in children or I think compared to growth in children fed a variety of plant-based foods?

### Shibani Ghosh

Patrick, do you want me to take this?

### Patrick Webb

Yes go ahead sure.

### Shibani Ghosh

Okay so I think that Nishesh I think that's a very important question. There is... the paper that I was talking about by Anna Lariti was looking at cereal legume blends versus a cereal legume blend that had an animal source food added into it. So there's evidence out there... I think ... what you realize when you're looking at cereal legume blends is the issue is the satiety factor, but it's also the issue of the

amount that a child can consume particularly the group that we are looking at is really young children, that they are not able to consume large quantities of that product. And that's why the animal source foods again... repeating the whole point of its small quantities. I think that that's one particular point. The other point is that and there was some discussion in the Q&A... I hope you'll be looking at it... about the fact that this... yes there are issues of food safety, there are issues of technology and cooling, there are issues around sustainable production, and issues of the type of animal source foods that you would support. and I think I urge our my colleagues who are livestock scientists on this... who are working in this space to think about how to support climate-smart efficient production that is going to be economic, particularly within the context of the populations we're dealing with. So I know it's a huge tall order but I think that this is an area of really urgent consideration, if we if we want to think about ASFs as a as a way forward. We have the evidence that it helps and it works, it's nutrient dense, it has to be packaged in a certain way, but that then the question is: How do you scale this up? And this is outside the realm of generating the nutrition to ASF relationship. I don't know Patrick if you wanted to add that?

### Patrick Webb

No just on the price issue. I mean most of what USAID programming is trying to do is promote small scale production of whatever ASF. It's not so much meat. It's really more dairy, eggs, and fish. For those small holder relatively poor... relatively poor producers to be able to both sell and consume more themselves, right. so the effect that you're looking for is producers to be able to consume more of their own production, and so benefit from not just the protein, but all the nutrients... the rate-limiting nutrients that may be addressed by nutrient dense ASFs, but also by increasing supply into the market hopefully bring down prices for those consumers who don't produce those products, right. So the effects need to be looked at not just by from a farm smallholder household perspective, but by also poor households who go to the market to buy these products, by increasing local supply should hopefully reduce price... relative prices and allow their effective demand to allow them to consume more. So ideally you have to look at a population-wide level to understand this.

### Grace Namirembe

We have another question from Ahmed Kaplan: Can you speak more about how much intensity of nutritional training matters? I remember a similar result in the SHINE study that implied that intensity that is how often the trainer visited the household matters?

## Patrick Webb

Well I'll let Shibani answer that but yes it does matter. I mean it's not just the number it's the intensity and the quality of interaction, especially if it's face-to-face or even small group. Absolutely, there has to be a trust... a level of trust built up, and a level of engagement that makes the messaging not theoretical and abstract, but very practical and actionable, otherwise it's wasted. Shibani.

## Shibani Ghosh

Yes, and I think that what you start seeing as folks like Patrick, myself, and my colleagues on here. We are researchers that sort of straddle the realm of doing applied studies in the field, and working with programming... folks who do programming, which is really the real life scaling-up of actions if you will. At least my experience has been that when you're doing an intervention study, not necessarily a programmatic intervention, but if you do an intervention like the ones that we presented today, you they are very tightly coordinated and monitored and that sort of shows... that that data is showing that the more interaction you have and the more rigorous your monitoring is. You're going to see a shift in behavior or in the use of that particular product or whatever action that you are supporting through your study or your program. So I think to answer Ahmed's question, yes it does matter. But I think it's sort of ... on a programming end, when you're talking about the scale, what is the feasibility of having more rigorous and more intensive follow-ups is a question that needs to be answered that is very linked to logistics, finances, logistics, and operations. And I think that that is something that's a whole different discussion that should and must be had.

## Grace Namirembe

So Katherine would like to know...she says: I've heard of goat programs. Do you know how their meat stacks up against beef or poultry with regards to nutrients? I assume they're easier to feed and keep than cows and more practical to sell at the market for goat programs.

## Shibani Ghosh

So I'm sorry. Could you repeat the first part of this, Grace? Goat? It is goat?

## Grace Namirembe

Goat programs, yes.

### Shibani Ghosh

Yes, I have to say I thought I'd gotten all the sort of common ASFs, and obviously miss out on goat. So I'm going to say that goat is probably somewhere between beef and poultry with respect to the nutrient value. It's you know it's going to have the iron, it's going to have the B12, calorically and protein-wise. I can't actually say, unless I actually look at the data. So I think that they are somewhere between beef, pork, and poultry. Yes and I don't know very much about goat programs. Maybe folks...other folks might have something to say about this.

### Patrick Webb

Well we do have goats in many of the households in these countries, but they're relatively small numbers - sheep and goats - obviously. But none of the programs we looked at were actively promoting goat productivity or goat ownership. So we could tease out the role of goats as part of the livestock portfolio, but their contribution both to nutrition was quite limited and they were not part of any of the program interventions that we were looking at.

### Grace Namirembe

A few more questions. Heidi Crew says I would appreciate your valuable commentary on the practice of continued breastfeeding in relation to the findings of his study.

### Patrick Webb

Well I don't think... I don't know that Shibani started by saying the very best animal source food of all is breast milk. And that is what every child everywhere in the world should be consuming for the first six months. What we're focused on is that transition period post-exclusive breastfeeding, and to what extent can a different source food enter into the child's diet in a way that is... make the contribution. So we obviously ... we look at breastfeeding status as part of controlling for the effects that we're looking at. And yes you do see some extended periods of breastfeeding beyond six months obviously; as far as a year, sometimes more, but the amounts the quantities are not easy to gauge. So we just ask mothers are they still proceeding or not. The contribution of breast milk to the child as he or she grows declines over time, obviously as they grow as they consume other products. So we're not you know ... it plays a

role in birth spacing, it plays a role in continuing the availability of milk to children where milk is absent from their diet from other sources, but we're not coming to any conclusion on a recommendation that x number of months should be... should be considered for exclusive... for continued breastfeeding sorry.

### Shibani Ghosh

Yes, and you know just to also add on to that, I kind of realized that I didn't mention this in that second slide, where we looked at the composition. And what you find is the last column on that slide was actually the intake requirement from complementary foods. So the implicit and I know that's not ... that the implicit assumption is that these children are going to receive in addition to continued breastfeeding x calories from foods. And that was the comparison I was making that this would be the add-on component to their diet about and beyond the breast milk that they should be receiving. And it's a different ... and it's a big discussion and debate to be had. And I know I believe it's the World Breastfeeding Week or it was last week, I might have lost track of time there. But it is definitely an important decision that I believe requires its own webinar as to how do you support women continue breastfeeding whether it's rural or urban women. There's so many pressures that sort of reduce her ability to continue and I think that's a different discussion altogether and an important one.

### Grace Namirembe

So we have time for just one more question, and that's going to come from Katherine: Were any of these conclusions surprising to you because it seems they could have been predicted based on previous knowledge and studies? How can the study participants be helped to actually increase the amount of ASFs in their diets?

### Patrick Webb

Well what was not known before and certainly surprising in its strength was the detailed... the significance of the lagged effects by following the same child and looking at prior consumption of different ASFs and current consumption and change in length-for-age z score. This is a significant new finding. It's not out there in the literature. It's alluded to but only through cross-sectional data. I think also we have been a little surprised that dairy came out really strongly as the ASF contributing most new stuff, new nutrients across all three countries, and yet very few of the programs we were looking at were explicitly promoting dairy output, they were more focused on fish, and eggs, and horticulture, and

that matters. And then finally I would say what really was quite surprising was the strength of our findings that it doesn't matter if you promote just aquaculture. The significant effects on dietary in terms of dietary impacts came through aquaculture combined with horticulture or egg production combined with legume production, right. so interactions and I think that speaks volumes to the importance of agriculture programs seeking not just to change... move the dial on one thing, one animal source food and not just to overlay nutrition education; but to look at growth-limiting nutrients, the problems that are facing these locations in these diets, and how a multi-sector approach can raise all boats not just for the households producing but the consumers who are not producing as well. I think all of those are quite new and quite important findings to tell USAID, and implementing partners, and the host countries.

### Grace Namirembe

Okay, so that marks the end of our Q&A session. I'd like to invite all the panelists to say some closing thoughts.

### Patrick Webb

I did already, over to Shibani.

### Shibani Ghosh

I think I've been ... thank you so much for everybody for joining us and just adding to Patrick's point on the last question you asked us Grace, was very critical because it's often we as researchers are so focused on trying to understand the sort of nitty-gritty and the nuances but the bigger picture is out there and this is just one step towards the bigger picture. so I have to say Katherine we may not have answered it the way you would have liked to hear it but I think what is very critical is that we continue having this kind of a discourse where academic information and findings are presented to folks who are really down on the ground and who are the ones who should ask us those critical questions. So on that note I thank everybody for joining us and I'm going to pass it over to back to you Grace I think or Hannah. I'll let you all figure that out.

### Grace Namirembe

Okay, anything from Sonia?

## Sonia Zaharia

Oh yes. So thank you all for joining and listening to us, also thank you for the many questions. There are some that we haven't talked about but I answered in writing and there are actually some good points for our analysis. So thank you all for being so active

## Grace Namirembe

Okay and just as a reminder, this webinar is part of a series that the Innovation Lab for Nutrition is co-hosting with USAID Advancing Nutrition. We will have two to three webinars each month, always on Wednesdays at this time. Next week on August 12<sup>th</sup>, the Innovation Lab for Nutrition will be presenting on aflatoxins and maternal and child nutrition. To register for any of these events, you can visit [nutritioninnovationlab.org](http://nutritioninnovationlab.org) or [advancingnutrition.org](http://advancingnutrition.org). Our recordings and slides for each webinar will be posted on our websites. And thank you again everyone.

## Shibani Ghosh

Thank you

## Patrick Webb

Thank you.



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