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TOPIC AREA

FOOD SAFETY, POST HARVEST, AND VALUE-ADDED PRODUCT MANAGEMENT

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ENHANCING FOOD SECURITY AND HOUSEHOLD NUTRITION OF WOMEN AND CHILDREN THROUGH AQUACULTURE AND CAPTURE FISHERIES IN CAMBODIA AND VIETNAM IN THE DRY SEASON

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Food Safety, Post Harvest, and Value-Added Product Management/Study/16FSV01UC

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Objective
The objective of this investigation is to understand the food safety and nutrition security of women and children by analyzing the nutrient density of commonly consumed fish and other aquatic animals (OAAs) from capture fisheries and aquaculture and its products in the dry season and proposed wise nutritional recommendations for adaption options and strategies for improving household food security and nutrition of vulnerable women and children in Cambodia and Vietnam.

Significance
Population growth and other changing variables, such water flow (hydrology), sedimentation (nutrient transport), salinity, and other human activities (e.g., hydropower development dams) are said to affect fish production, livelihood opportunities, food security, nutrition and its implications for human health (MRC, 2009; Sriskanthan & Funge-Smith, 2011; and Halls, 2012).

The prevalence of malnutrition among women and preschool children (under age of five years) continues to be a major problem in Cambodia. The Cambodia Demographic Health Survey 2014 (CDHS, 2014) showed that a high level of protein/energy malnutrition among children under five years of age, with a stunting prevalence rate of 32% (severe stunting -3SD was 9%). The prevalence of wasting was 10 % (severe wasting -3SD was 2%) and the prevalence of underweight was 24% (severe underweight -3SD was 5%), (CDHS, 2014). The CDHS 2014 indicates that more than 4 in 10 mothers are anemic (about 43.9%) and an overall 53 % rate of anemia among children under age 5 years. The prevalence of vitamin A deficiency among women and children are a major public health problem (CDHS, 2014).

Based on the research of the third phase of the AquaFish Innovation Lab (2013-2015), fish and aquatic animals (frog, crabs, snails, and shrimp) are the second largest staple food for women and children in Cambodia with consumption of 145.3 g/women/year and 53 g/child/year in the rainy season, respectively, after rice (Bunthang et al., 2015). They form an integral part of the diet of millions of rural Cambodians. Poor households in particular, with little alternative food production capacity, turn to such sources not only for additional food for themselves as source of their food security, but also for their daily nutritional

requirement and for sale to earn income. It is reported that these fish and aquatic animals, particularly small indigenous fish species, have high nutrient content and high bioavailability of micronutrients (Roos et al., 2003, 2006, 2007). Fish, OAAs and products are the major contributor of energy and nutrients from an animal source, providing more than three-fourths (80%) to the total animal protein intake of women in the rainy season (Bunthang et al., 2015). Fish, OAAs and products are also the major contributor to energy, fats, carbohydrate, iron, zinc, calcium, and vitamin A of women, and contributed 69.7%, 54%, 99%, 74.5%, 44.6%, 83% and 87.4%, respectively. Fish, OAAs and products are the largest contributor to the total daily energy and nutrient intake from animal food source, providing around 80% to the total animal protein intake, of children in Cambodia. Fish, OAAs and products were also the major contributor to energy, fats, carbohydrate, iron, zinc, calcium, and vitamin A, contributed 72.1%, 60%, 93%, 57.2%, 44.1%, 92.8% and 56.4%, respectively, in the rainy season (Bunthang et al., 2015).

The application of traditional food processing/preservation technologies in Cambodia dates back in the ancient times and these techniques are often used, especially fish (fermented fish, salted, smoked, fish sauces, and fish paste called "Prohoc". These uphold the Cambodian cultural identity. Fish processing provides many with a continuous source of protein throughout the year. Moreover, the fermentation process of some foods have potential to improve its nutritional qualities, reduce anti-nutrients, decrease pH, increase minerals and provide potential pro-biotic effects through lactic acid bacteria.

The availability of fish and aquatic products in Cambodia should normally be adequate for a balanced diet, but productive capacity or purchasing power of many households is limited, and in these circumstances the diet become more restricted to fish. Trade and market impacts in production levels is said to be changed throughout the value chain such as reduced trade volume and values reduced export earnings and reduced livelihood opportunity and increasing malnutrition.

Seasonality, ecological zones, family size and food distribution among the family members, especially seasonal differences, are the influential indicators affected to food consumption pattern of Cambodian individuals and households especially women and children.

During the third phase of AquaFish Innovation Lab (2013-2015) the study of food and nutritional consumption on women and children in Cambodia was conducted in the rainy season under the UConn's Investigation 13HHI02UC. The recommendation provided from the final national workshop on 26 September 2015 at IFReDI in Phnom Penh is that the study of food and nutritional consumption should be conducted in the dry season in Cambodia in order to cover the whole year. There are two major seasons in the Lower Mekong Basin region and they bring about change in food consumption patterns. During the wet season, there is an abundance of fish, while during dry season there is less fresh fish available and people use more processed fish products. This study will allow us to make comparisons of food consumption patterns between the seasons to better assess ways to improve nutrition for women and children. Morever, information of consumed fish and other aquatic animals (OAAs) from capture fisheries and aquaculture on women and children in the Mekong Delta of Vietnam is limited. This investigation will focus on this issue. A better understanding of the food and nutritional consumption of women and children can lead to support for both the public and private sectors to increase trade and investment in aquaculture in the Lower Mekong basin.

Quantified Anticipated Benefits
- Two Master (all females) and 3 Bachelor (all females) students will be involved in this investigation. The investigation will support for their university fee and theses.
- At least 6 IFReDI and Cantho University staff will be involved in the survey such as the project preparation, data collection and training activities.
- At least 1000 IFReDI/FiA and Cantho University staff, scientists, researchers, government officers and managers, and NGOs will understand the nutrition contexts especially in women and

> children in Cambodia through in series of consultation meeting/workshop; and sharing research result findings such as policy brief and technical report.

- At least 450 women and 450 children will benefit from the project by improving nutritional status through the proposed nutritional recommendations for adaption options and strategies in Cambodia and Vietnam.
- Many other people in the Lower Mekong Basin region will benefit from this project through sharing of research findings.

Research Design and Activity Plan
Location
Inland Fisheries and Development Institute (IFReDI), Phnom Penh, Cambodia. The field activities will be undertaken in Upstream Mekong (Stung Province), Downstream Mekong (PoeumRour, Prey Veng province), and Tonle Sap area: (Thom province) in Cambodia; and An Giang province in Vietnam.

Methods
The project activities are organized using a systematic, stepwise approach from collection of information on utilized and analyzed foods, followed by promotion and dissemination of the results, and development of recommendation policy. The activities are conducted by a multi-disciplinary research team, using appropriate quantitative and qualitative research methods.

Activity 1. To assess food and nutrient intakes by women and children; and identify commonly consumed fish and other aquatic resources, aquaculture and its products in the dry season in Cambodia and Vietnam.

Stung Treng province (Upstream Mekong River); Prey Veng province (Downstream Mekong River); and Kampong Thom province (Tonle Sap Area) in Cambodia and An Giang province in Vietnam will be selected for study sites. The data collection will conduct in the dry season (November 2016 to May 2017). The target of the study subjects are women and preschool children (aged six months to five years old). Three hundred (300) eligible women and 300 eligible preschool-age children will be selected in Cambodia and 150 eligible women and 150 eligible preschool-age children will be selected in Vietnam by using simple randomized sampling from the four provinces. Dietary intake will be examined through face-to-face interview by using a single 24-hour food recall to estimate the amount of food that has been eaten in the past 24 hours (Bunthang et al., 2011). IFReDI will provide the dietary assessment survey training to Cantho University staff and support the survey activity. Food models will be used to identify food items that have been eaten by the subjects. All food and beverage consumed will be recorded using standard household measurement and electronic scale (precision to 0.1 g). The names of local dishes consumed will also be recorded. The amount of each food item consumed will be estimated from the real food models. Mothers will be asked to show the amount of food consumed by her child, which have then been weighed. All food item consumption of women and preschoolers will be converted to weight in grams and the nutrient content of the foods consumed computed by using the ASEAN Food Composition Table (ASEAN FCT, 2000). Included nutrients for evaluation will be energy, macronutrients (Protein, Carbohydrate and fats), and key micronutrients (i.e., iron, zinc, calcium, phosphorus and Vitamin A). The nutrient intakes of women and preschool children will then be compared to the Recommended Dietary Allowances harmonization in Southeast Asia (Barba, 2008; RENI, 2002.) to determine the level of nutritional adequacy of the food intake to estimate the amount of food that has been eaten. Letters to the village authorities informing them on the conduct of the survey will be sent at least one week before the actual survey. The data will collect by trained field enumerators. The training aims to educate field enumerators how to conduct dietary assessment by using the 24-hour food recall questionnaire; educate the interviewers to get familiar with fish species; reinforce the recall interviewers with exercise practices and pilot testing; and educate the interviewers to be familiar with questionnaire before data entry will be

employed. Pilot pre-test questionnaire will be conducted in order to identify the potential problems encountered in questionnaires, questions and recall. A letter of the survey objective will be used to inform the local authorities on the conduct of the survey before the actual field work will be started. Questionnaires will be cross-checked by the members of the team for any missing pieces of information followed by data entry. Microsoft Excel 2013 and SPSS Statistics Version 20.0 will be used for data entry and analysis. Data coding, cleaning, and cross-checking will be conducted. Descriptive statistic will be used.

Activity 2. To determine the nutritional composition of nutrient dense fish, OAAs and their products that are identified as commonly consumed by women and children with a focus on macronutrients (protein and fats) and key micronutrients key micronutrients (iron, zinc, calcium, phosphorus and Vitamin A).

The selection of the commonly consumed fish species, OAAs and its products from the result of activity one will be analyzed the nutrient dense. At least 15 of commonly consumed fish species, OAAs, and its products will be analyzed. The selected samples of fish and OAAs will be randomly collected as fresh from different landing sites, local markets, fishermen, and farmers for nutrient-dense analyses, while processed samples will be randomly collected from different market and processors. Proximate composition will use standard methods (AOAC, 1990). Proximate analysis is a quantitative method for determining the macronutrients in food. This includes moisture, total ash content, crude fat, and protein. Moisture will be determined by using a drying oven, ash in a muffle furnace, protein by the Kjeldahl method and fat by Soxhlet extraction. Key micronutrients will be determined by atomic absorption spectrometry or the standard analytical methods of Association of Official Analytical Chemist (AOAC, 1990). Phosphorus, iron, and calcium were also analyzed by AOAC (1990) methods, specifically the molybdovannate method for phosphorus, the hydroxylammonium method for iron, and the muricide method for calcium. The content of non-heme iron will be determined by the widely use ferrozine colorimetric method. Heme iron and complex-bound non-heme iron will be calculated as the difference between total iron and inorganic iron. Microsoft Excel 2013 and SPSS Statistics Version 20.0 will be used for data entry and analysis. The two-way analysis of variance (ANOVA) will be used for the comparison of nutrient density of different selected samples with the statistical significance will be tested using 5% level. The analysis will be conducted at the Industrial Laboratory Center (ILCC), Ministry of industry in Cambodia.

Activity 3. Provide recommendations for policy and strategy development for enhancing food security and nutrition of women and children in Cambodia and Vietnam.

Merely identifying the proposed wise nutritional recommendations for adaption options and strategies will not be sufficient to improve household food security and nutrition of vulnerable women and children in Cambodia and Vietnam. There is a need to provide this information to policy makers, government organizations, NGOs, vulnerable households, especially women and children, to be able to make informed and deliberate decisions on adaptation. As an investigation, the purpose is to generate new information, and disseminate and communicate information generated by the project. Specifically, science-based policy recommendations. This investigation will provide this information through a suite of different communication methods and approaches for each audience.

Audience analysis. The identification of target audiences such as policy makers, government organizations, and NGOs in the fields of fisheries and aquaculture and food and nutrition security as well as poor, rural households who produce fish, and vulnerable women and children.

Project products. The project documents will be reviewed to extract key messages to be presented in the communication products. There will be a scientific-based policy recommendation, two protect technical reports and factsheet in English and Khmer.

Communication and dissemination strategy. The communication strategy is a combination of approaches, techniques and messages to reach different audiences. This will be done through workshops and meetings as well as training of field staff, and home-based providing materials as nutritional education materials for women and mother.

Trainings and Deliverables
Trainings
- Short-term trainings - IFReDI and Cantho University staff will be trained on dietary assessment by using the 24-hour food recall, fish species, food safety, nutrition, and data cleaning and entry. The training will be conducted at IFReDI, Cambodia and Cantho University, Vietnam. The training will be conducted between October-November, 2016;
- Long-term trainings-Two masters students and 3 Bachelor students.

Deliverables
The deliverables of this investigation will include (1) final technical report, (2) policy brief recommendation and (3) factsheet in English and Khmer.

Schedule

Activities	Sub-activities	Year	2016									2017									
		Month	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O
1. Project Design, Management and design	Review project document		x																		
	Project financial arrangement		x	x																	
2. To assess food and nutrient intake and identify commonly consumed-fish and other aquatic resources by women and children in Cambodia.	1. Design survey				x	x															
	2. development, training, pilot testing, refinement of survey questionnaire					x	x														
	3. undertaken the survey						x	x	x	x											
	4. database development and training									x	x										
	5. data encoding										x	x									
	6. nutrient calculation and data analysis											x	x	x	x						
	7 interpreting the result and report writing														x	x	x				
3. To determine the nutritional composition of nutrient dense identified commonly consumed-fish and other aquatic resources, aquaculture and its products.	1. Sample selection and preparation															x					
	2. Conduct analysis															x	x	x	x		
	3. Interpreting the result and report writing																			x	x
4. Analysis of recommend policy strategy for women and children and the communication product outreach for improving women and children	1. Consultation meeting with women and local agency in Stung Treng, Kampong Thom and Prey Veng																				x
	2. Proposed the recommendation for adaption options and strategies for women as policy recommendation																				
	3. Communication product outreach																				
	4. Writing and submission of final technical report																				