Household Fish Ponds in Nepal: Their Impact on Fish Consumption and Health of Women and Children

Marketing, Economic, Risk Assessment, and Trade/Study/13MER06UM

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ABSTRACT

This study focused on the value of household ponds by comparing fish consumption and indicators of health for children and women in households with fishponds to those without access to ponds. Specific objectives of the study were to determine the frequency and amounts of fish eaten by children ages 1-5, as well as women, from households with or without fish ponds; and to evaluate the health characteristics of children from households with or without fish ponds. In Kathar, Chitwan and Kawasoti, Nawalparasi, 51 and 55 households, respectively, each including children between the ages of one and five years and owning at least one fish pond were recruited for participation through door-to-door visits. Similarly, in Majhui, Chitwan and Pragatinagaar, Nawalparasi, 54 and 55 households, respectively, each including children between the ages of one and five years and not owning fish ponds were recruited.

Mothers from locations that had access to fish ponds consumed 132% more fish than those without ponds, a significant increase in consumption. They also reported 126% higher rates of fish consumption by their children. Owners of household ponds also consumed fish more frequently, particularly Small Indigenous Species (SIS) (97% more frequently in households with ponds). However, height at weight regressions and body mass index data were not significantly different between children from households with or without ponds. Health of children evaluated using details on stunting and wasting indicated that there were no significant differences between households with or without ponds. Overall, children from our study groups averaged 19% underweight, 18% stunted, and 12% wasted. These values are quite low compared to 2013 estimates for the entire country for stunted (40.5%) and underweight (28.8%), but not for wasted (10.9%) children.

INTRODUCTION

The government of Nepal has recognized that chronic malnutrition is a major problem in the country. The most common forms of malnutrition include undernutrition (insufficient energy) and deficiencies of vitamins and minerals, including vitamin A, iodine, and iron. About 41% of children less than five years of age are stunted (below two standard deviations of median height for age; UNICEF 2012a), and 48% are anemic (MoHP 2006). Also, 36% of women, aged 15-49 are anemic (MoHP 2006). Realizing this, the government of Nepal signed the Declaration of Commitment for Accelerated Improvement in Maternal and Child Nutrition and launched the Multi-sectoral Nutrition Plan (MSNP) on 17 September 2012 (UNICEF 2012b). Much of our research and outreach in Nepal has focused on providing fish culture alternatives to improve the nutrition and health of poor farmers, but we have not yet done much to assess the success of increased fish production on human health.

Fish has been recognized as a nutritionally beneficial food source around the world. Fish provide high-quality protein and important micronutrients, such as vitamin A, vitamin D, and iodine, and they can also be a source of phosphorus, fluoride, and calcium if bones are consumed (Speedy 2003). Additionally, the benefits of consuming fish for Omega-3 fatty acids have recently been widely documented (Oken and

Belfort 2010, Mahaffey et al. 2011). While certain fishes can provide all of these health benefits, there currently exists a difference in the perceived nutritional gains in developed versus developing countries: in the former, individuals, the media, and researchers are primarily concerned with omega-3 fatty acids (Domingo et al. 2007, Oken and Belfort 2010), while in the latter, the primary concerns are protein and micronutrients (Aiga et al. 2009, Parajuli et al. 2012). In Nepal, the benefits of fish consumption have been linked with such outcomes as improving protein intake (Bhujel et al. 2008) and increasing vitamin A and zinc ingestion (Parajuli et al. 2012). Approximately half of all fish produced in Nepal during 1994-95 was done so through aquaculture (FAO 2012). It is believed that the majority of fish currently consumed in Nepal is produced through aquaculture practices, since nearly all fish sold in markets in Kathmandu and surrounding areas are raised in ponds.

During summer 2012, we conducted our first study on the influence of household ponds on the health and nutrition of children in the household (Stepan 2013). This study focused on small household ponds in Kathar and Kawasowoti, with a control population in Bhandara. The concept of small household ponds was originally extended to local residents to improve the nutrition of poor families in Nepal. These ponds have been deemed so successful by local residents that the number of ponds has increased from approximately 100 in the early stages to over 1,000, with the additional ponds built by local owner groups. All of the adopting communities are in the Terai region and are comprised mainly of Tharu people. The earlier study showed that children from homes with household ponds consumed about five times more fish than children in households without ponds. While it was clear fish consumption did increase dramatically in households with ponds, it was less clear this consumption resulted in increases in the height at age or weight at age for children from those households, or in the health of mothers or pregnant women. This was due in part to problems with the timing and intensity of our sampling; in addition, it was affected by the similar socioeconomic status of all participants. However, the survey did help us detect some consistent patterns and design better surveys for the future. One purpose of this study is to conduct such an expanded survey.

One issue related to the expected health improvements from people eating fish would be what other sources of protein are available to them. Most Nepalese families eat a largely vegetarian diet, focused on rice and some vegetables, with fish or meat added when available (Stepan 2013). The Terai region of Nepal is its main agricultural area, with much production of rice, as well as some livestock. Health improvements might not be measureable if households without ponds eat meat instead of fish. Our earlier survey had some flaws, mostly in the timing of sampling (in summer, eight months since the last fish harvest), as well as in finding sufficient families with young children (under age 5) whose growth trajectories would be reflected by recent consumption history. It was our intent in this study to improve on these limitations by also measuring the amount of meat consumption and by sampling more families to include adequate numbers of children under age 5.

Women play an integral role in the aquaculture and fisheries sectors throughout the world. Even though women's roles and responsibilities are changing in some countries, there are constraints that limit female participation in aquaculture (Egna et. al. 2012). A few such constraints women face in aquaculture and fisheries are: time availability and allocation, land ownership, and access to water, credit, training, and labor. Lack of training opportunities can trap women in vulnerable and poorly paid positions with no prospects of advancement (FAO 1998). However, the situation in Nepal with household ponds differs considerably from this norm. In most of the poorer Nepalese households, women tend and manage gardens and ponds, while men seek work at outside locations (Bhujel et al. 2008). Therefore, household ponds enhance the income, nutrition, and status of women and provide them with alternatives for their families.

OBJECTIVES

This study is intended to focus on the value of household ponds by comparing fish consumption and indicators of health for children and women in households with fish ponds to those without access to ponds. Specific objectives of the study were:

- To determine the frequency and amounts of fish eaten by children ages one through five, as well as women, from households with or without fish ponds; and
- To evaluate the health characteristics of children from households with or without fish ponds.

MATERIALS AND METHODS

A total of 13 undergraduate students from the Agriculture and Forestry University, Nepal were involved in survey work. The surveyors were trained on the methods of data collection and height/weight measurement before implementation. Survey protocols were submitted to the University of Michigan and received Institutional Review Board approval (HUM00093052).

A list of participating households was determined with the help of local village leaders, who also guided surveyors to the homes during the surveys. Before surveying, an informal meeting was organized with the local village leaders to discuss the purpose and methodology of the survey. They informed participating households and determined a suitable survey date and time.

In Kathar, Chitwan and Kawasoti, Nawalparasi, 51 and 55 households, respectively, each including children between the ages of one and five years and owning at least one fish pond were recruited for participation through door-to-door visits. Similarly, in Majhui, Chitwan and Pragatinagaar, Nawalparasi, 54 and 55 households, respectively, each including children between the ages of one and five years and not owning fish ponds were recruited for participation through door-to door-visits.

After obtaining informed consent, mothers — the traditional care-givers and food preparers in Nepali culture — were specifically targeted to respond to survey questions. Interviews were conducted in the local language with the aid of a skilled Tharu/Nepali translator and cultural "broker," whose duties included ensuring that cultural sensitivities were considered at all times. In order to compensate survey respondents for their time, each family that participated was given US$5. All data for this study were collected from 10 October to 10 November 2015.

Questions were asked regarding fish pond information, age, sex, duration of breastfeeding, introduction of first complementary food, history of child illness, socioeconomic, parental education level, number of children in the household, and regular dietary intake (Appendix 1).

Child measurement data were collected immediately following the interviews. In cases when children were not available, return visits were made to the household on the same day. For weights, a digital balance was used. The balance was carried from house to house and was placed on a hard, level surface. Children were weighed individually. Parents were asked to remove their children's shoes and any heavy clothing before weighing. If a child was incapable of standing on the balance, the child's mother was asked to stand on the balance while holding the child. She was then weighed without the child, and the child's weight was determined by subtraction. A child's height was determined by a portable measuring scale. The parent was asked to remove the child's shoes, bring the child to the plane surface near a straight wall, and to kneel in front so the child remained comfortable and cooperative. A total of 225 children were weighed and measured. Stunting in children was estimated by comparing height at age with countrywide values, and a child was considered stunted if their height was more than two standard deviations below the country median (UNICEF 2015). Underweight values were determined similarly, except using values of weight at age. Wasting in children was estimated by comparing weight at height

with countrywide values, and a child was considered stunted if the value was more than two standard deviations below the country median. We determined the number of wasted, underweight, and stunted children in each of our populations and compared those using Chi-square tests.

RESULTS AND DISCUSSION

Mothers from locations that had access to fish ponds consumed 132% more fish than those without ponds, a significant increase in consumption (Figure 1, $p<0.05$). They also reported significantly higher rates of fish consumption (126% higher) by their children (Figure 2, $p<0.05$). They also consumed fish more frequently (Figures 3 and 4), particularly SIS. Again, these differences were also statistically significant, with overall consumption frequency being 97% higher in households with ponds. However, height at weight regressions and body mass index data were not significantly different between children from households with or without ponds.

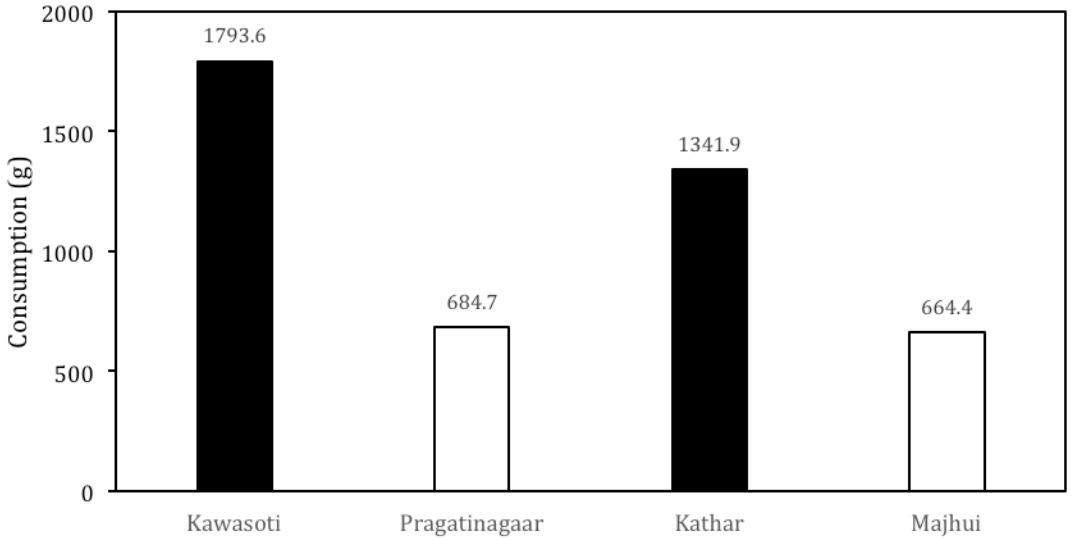

Figure 1. Monthly estimates of fish consumption by mothers interviewed from households with ponds (solid bars) and without ponds (open bars) in four locations in Nepal.

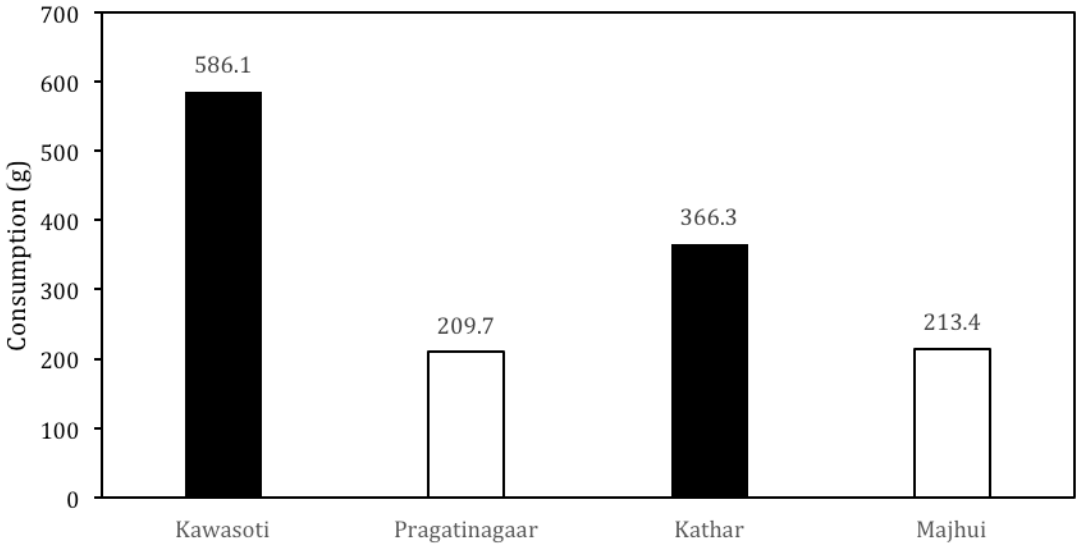

Figure 2. Monthly consumption estimates by children estimated for households with or without ponds.

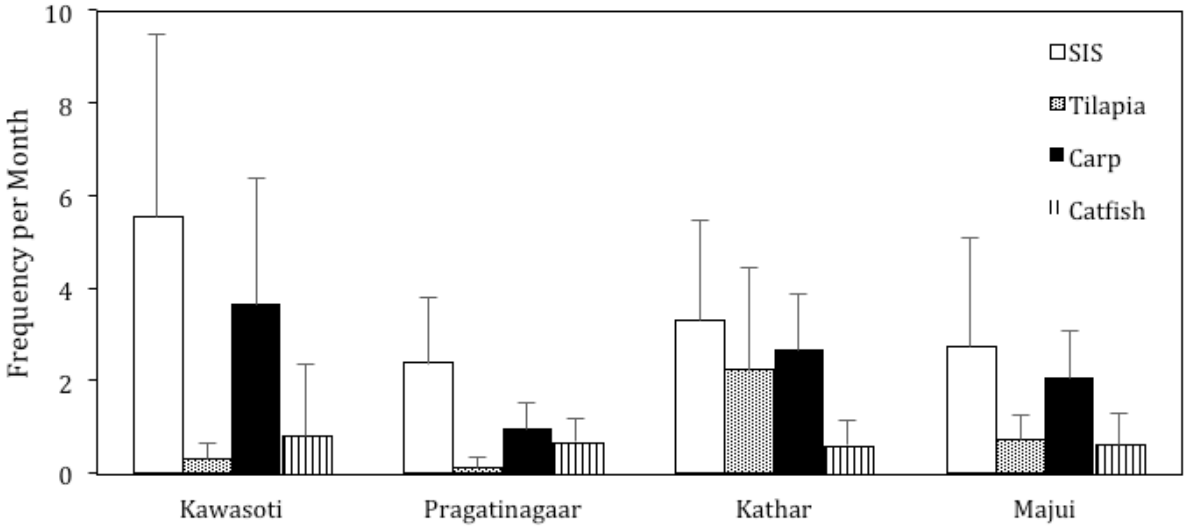

Figure 3. Reported frequencies (mean ± SE) of mothers consuming fish from four species groups for households with or without ponds.

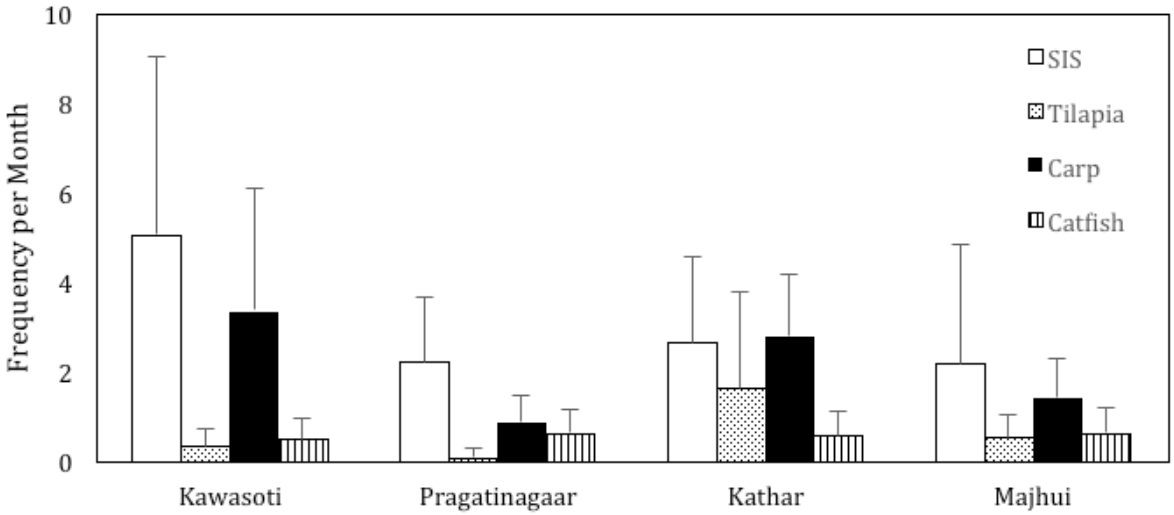

Figure 4. Reported frequencies (mean ± SE) of children consuming fish from four species groups for households with or without ponds.

Health of children evaluated, using details on stunting and wasting, indicated that there were no significant differences between households with or without ponds (Chi-square, $p>0.05$; Table 1). Overall, children from our study groups averaged 19% underweight, 18% stunted, and 12% wasted. These values are quite low compared to 2013 estimates for the entire country for stunted (40.5%) and underweight (28.8%), but not for wasted (10.9%) children (UNICEF 2015).

Table 1. Frequency and overall percentage for children under five in the study populations that were stunted, underweight, and wasted.

	Underweight	Stunted	Wasted
Kawasoti	26.7% (16/60)	20% (12/60)	16.9% (10/59)
Kathar	19.6% (10/51)	21.6% (11/51)	8.3% (4/48)
Total	**23.4% (26/111)**	**20.7% (23/111)**	**13.1% (14/107)**
Pragatinagaar	12.7% (7/55)	20.7% (12/58)	3.5% (2/57)
Majhui	16.4% (9/55)	12.7% (7/55)	20% (11/55)
Total	**14.5% (16/110)**	**16.8% (19/113)**	**11.6% (13/112)**

CONCLUSIONS

Overall, women and children from households with ponds ate more mass of fish and ate fish more frequently than comparable groups from households without ponds. However, the overall health of children from these homes did not differ among study group, but in general was considerably better than health based on country-wide statistics.

QUANTIFIED ANTICIPATED BENEFITS

This study provides a robust database on the nutrition of children in rural Nepal families and the role of fish consumption in their health. We surveyed 225 families, and, as a result, all of these families gained a better understanding of nutrition and the role of protein in the health of their children. Families with household ponds ate 130% more fish than people from households without ponds. The results of this survey help inform aquaculture extension programs in the country, as they clearly indicate that ownership of small household ponds is truly aiding in the nutrition of these families, and is growing in the country.

ACKNOWLEDGMENTS

Surveys were conducted by 13 undergraduate students, and we acknowledge the help of Anjana Khanal, Anusha Lamichhane, Bhuwan Devkota, Sarita Neupane, Kiran Khadka, Manish Devkota, Nita Dhakal, Pratikshya Neupane, Sajani Thapa, Sandesh Khanal, Santosh Lamichhane, Subodh Pokhrel, and Sujata Timalsina. Six local village leaders assisted in gaining acceptance for the surveys, and we thank Renuka Choudhary, Shanti Choudhary, Ishori Singh Mahato, Kabita Mahato, Bisram Mahato, Sita Tamang, Indra Thanet, and Shiva Adhikari for their assistance.

LITERATURE CITED

Aiga, H., S. Matsuoka, C. Kuriowa, and S. Yamamoto. 2009. Malnutrition among children in rural Malawian fish-farming households. Transactions of the Royal Society of Tropical Medicine and Hygiene 103: 827–833.

Bhujel, R.C., M.K. Shrestha, J. Pant, and S. Buranrom. 2008. Ethnic women in aquaculture in Nepal. Development 51: 259–264.

Domingo, J.L., A. Bocio, G. Falco, and J.M. Llobet. 2007. Benefits and risks of fish consumption Part I. A quantitative analysis of the intake of Omega-3 fatty acids and chemical contaminants. Toxicology 230: 219–226.

Egna, H., L. Reifke, and N. Gitonga. 2012. Improving gender equity in aquaculture education and training: 30 years of experiences in the Pond Dynamics/Aquaculture, Aquaculture, and AquaFish Collaborative Research Support Programs. Asian Fisheries Science 25S: 119–128.

FAO (Food and Agriculture Organization). 1998. Women feed the world. Prepared for World Food Day, 16 October 1998. Rome, Italy.

FAO (Food and Agriculture Organization). 2012. Fisheries and Aquaculture topics. Statistics — Introduction. Topics Fact Sheets. *In*: FAO Fisheries and Aquaculture Department [online]. Rome. Updated. [Cited 21 February 2012].

Mahaffey, K.R., E.M. Sunderland, H.M. Chan, A.L. Choi, P. Grandjean, K. Marlen, E. Oken, M. Sakamoto, R. Schoeny, P. Weihe, C.H. Yan, and A. Yasutake. 2011. Balancing the benefits of n-3 polyunsaturated fatty acids and the risks of methylmercury exposure from fish consumption. Nutrition Reviews 69: 493–508.

MoHP. 2006. Nepal Demographic and Health Survey 2006. Ministry of Health and Population, New Era, and Macro International Inc., Kathmandu.

Oken, E., and M.B. Belfort. 2010. Fish, fish oil, and pregnancy. The Journal of the American Medical Association 304(15): 1717–1718.

Parajuli, R.P., M. Umezaki, and C. Watanabe. 2012. Diet among people in the Terai region of Nepal, an area of micronutrient deficiency. Journal of Biosocial Science 44: 401-415.

Speedy, A.W. 2003. Global Production and Consumption of Animal Source Foods. Journal of Nutrition 133: 4048S–4053S.

Stepan, Z. 2013. Aquaculture and child nutrition in rural Nepal. Master of Science Thesis, University of Michigan, Ann Arbor.

UNICEF. 2012a. A Milestone Plan Launched to Improve Maternal and Child Nutrition in Nepal. Accessed 4 February 2016 at http://unicef.org.np/media-centre/press-releases/2014/03/14/a-milestone-plan-launched-to-improve-maternal-and-child-nutrition-in-nepal.

UNICEF. 2012b. Multi-sectoral Commitment to Improve Maternal and Child Nutrition. Accessed 4 February 2016 at http://unicef.org.np/media-centre/press-releases/2014/03/14/multi-sectoral-commitment-to-improve-maternal-and-child-nutrition.

UNICEF 2015. State of the world's children 2015 country statistical tables - Nepal. Accessed 4 February 2016 at http://www.unicef.org/infobycountry/nepal_nepal_statistics.html .

APPENDIX

Questions asked in the fish consumption survey. Questions were translated into Nepali and asked by a trained surveyor with knowledge of local dialects.

Pond Production Assessment

Do you own or manage a fish pond? _____ (if no, skip to fish consumption questions)
What is the size of your pond? _____
Where do you get fish to stock your pond? _____
Do you feed fish in your ponds? _____
How often? _____
With what? _____
What do you do with the fish you grow? (enter percentage of those that apply)
Sell ____ Trade ____ Give away ____ Eat in household ____
If you sell fish, who manages the sale? (check all that apply)
Myself ____ A fish purveyor ____ A community market ____
How much money does your family make a year from aquaculture? _____

Maternal Fish Consumption

Do you eat fish?
How do you get the fish you eat? (check all that apply)
Our own pond____ Community pond____ Buy or trade____ Do not eat fish____
When you eat meat or fish, estimate the average portion size for fish you eat at typical meals.
__ 25 g __ 50 g __ 75 g __ 100 g __ 200 g __ 300 g __ 400 g
Note: One portion = 100 g of grilled fish = the size of a deck of cards; two portions = a regular 200 g can of tuna.

During a month, how many meals did you eat the following?

Fish spp.	Never	Once	2–3 times	1 time/ week	2 times/ week	3–4times/ week	5–6 times/ week	Once/ day	Twice or more/day
SIS									
Tilapia									
Carp									
Catfish									
Mutton/ Buff									
Pork									
Chicken									

Socioeconomic Status

How much money does your family make in one month? _____

Does your household have: (Y/N)

Electricity ____ a radio ____ a television ____ a mobile telephone ____

A nonmobile telephone____ a refrigerator____ a table ____

A chair ____ a bed ____ a sofa____ a cupboard ____ a computer____

A clock ____ a fan _____ a dhiki/janto _____

In the past 12 months, did you worry that your household would not have enough food?

Often _____ Seldom _____ Never _____

Educational Status

What was the last grade level completed in school?

Mother _____ Father _____

Child Dietary Considerations

Yesterday, during the day or at night, did your child eat or drink any of the following: (Y/N/DK)

Plain water ____ Juice or juice drinks ____ Soup ____

Milk ___ (if yes, how many times?) ____ Infant formula, like Lactogen ___ (if yes, how many times?) ___

Any other liquids ____ Yogurt ____ (if yes, how many times?) ____

Any fortified baby food, like Cerelac, Nestrum, Champion, etc. ____

Roti, rice, maize, millet, noodles, porridge, or other foods made from grains ____

Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside ____

White potatoes, white yams, colocasia, or any other foods made from roots ____

Any dark green leafy vegetables, like spinach, amaranth leaves, mustard leaves ____

Ripe mangoes, papayas, bananas, or others ____

Any other fruits or vegetables ____

Liver, kidney, heart, or other organ meats ____

Any meat, such as pork, buff, lamb, goat, chicken, or duck ____

Eggs ____

Fresh or dried fish or shellfish ____

Any foods made from beans, peas, lentils, or nuts ____

Cheese or other food made from milk ____

Any other solid, semi-solid, or soft food (jaulo, lito, sarbottam pitho, etc.) ___

Does your child eat fish?

Often ____ Seldom____ Never____

At what age did your child first eat fish? _____
When your child eats fish, estimate the average portion size of fish he/she typically eats. _____
Note: One portion = 100 g of grilled fish = the size of a deck of cards; two portions = a regular 200 g can of tuna.

During a month, how many meals did your child eat the following fish?
__ 25 g __ 50 g __ 75 g __ 100 g __ 200 g __ 300 g __ 400 g

Fish spp.	Never	Once	2-3 times	1 time/ week	2 times/ week	3-4times/ week	5-6 times/ week	Once/ day	Twice or more/day
SIS									
Tilapia									
Carp									
Catfish									
Mutton/ Buff									
Pork									
Chicken									

Child Health
Did you breastfeed your child? _____
How long was your child breastfed? _____
At what age was your child first fed complementary food? _____
Has your child had a diarrhea related illness within the past two weeks? _____
Has your child had a respiratory illness within the past two weeks? _____
How many times do you take your child to the hospital in a year? _____
How much money do you spend for your child's medical treatment in a year? _____
How many children do you have? _____

Measurement Data

ID #_____	**ID #_____**	**ID #_____**
Age _____	**Age _____**	**Age _____**
Sex _____	**Sex _____**	**Sex _____**
Ht_____ (cm)	**Ht_____ (cm)**	**Ht_____ (cm)**
Wt_____ (kg)	**Wt_____ (kg)**	**Wt_____ (kg)**