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MATERNAL FACTORS ASSOCIATED WITH CHILD NUTRITION IN RICE-BASED FARM HOUSEHOLDS IN CENTRAL LUZON, PHILIPPINES

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Abstract: Mothers play key roles in the development of children's eating behavior, food consumption, and nutrition. This study primarily aimed to determine the maternal factors associated with child nutrition. A cross-sectional community survey was conducted in rice-based farm households in Central Luzon to obtain anthropometric measurements from 275 children 0 to 10 years old and their mothers. Socio-demographics were collected on mothers. Mothers' knowledge level on health and nutrition was also assessed. Among pre-school children, stunting (15.2%), underweight (16.8%), and wasting (19.5%) were low, medium, and very high, respectively. The corresponding figures in school-age children were 16.9%, 18.9%, and 22.1%. Compared with males, female children exhibited higher prevalence in almost all malnutrition indicators (stunting, wasting, and underweight), pre-school age (16.9% to 20.4% vs 16.7% to 19%) and school-age (13.7% to 25.5% vs 19.1% to 23.1%). Logistic regression analyses revealed that low educational attainment for mothers [AOR=2.78 (CI: 1.03, 7.48)] and low household income [AOR=2.28 (CI: 01.08, 4.82)] led to higher odds of underweight. Absence of a major illness or disability [AOR=0.33 (CI: 0.12, 0.87)] in mothers resulted in lower odds of wasting. Mothers with lower BMI [AOR=5.47 (CI: 1.43, 20.95)] and non-membership in organizations (e.g. farmers association) [AOR=2.21 (CI: 1.12, 4.35)] led to higher odds of wasting. Living in rural areas [AOR=2.61 (CI: 1.22, 5.57)] resulted in higher odds of stunting. Maternal factors such as education, nutritional and health status, and other factors such as income and place of residence were associated with the occurrence of malnutrition in children. Hence, this study recommends gender-sensitive nutrition interventions directed to mothers for improved child nutrition.

Keywords: anthropometric data, child nutrition, maternal factors, stunting, underweight, wasting

Introduction

Child undernutrition is a public health concern among developing countries. UNICEF (2014) considers good nutrition as the hallmark of any economic, social, and human development initiatives. Although malnutrition has received massive attention globally, it remains pervasive. Halim et al. (2015) noted that child malnutrition in low- and middle- income countries accounted to 42% and 53%of all stunted and wasted children in the world, respectively. Additionally, malnutrition in developing countries annually contributes to 40% of the 11 million deaths of children under 5 years old, globally (UNICEF 2003). In the Philippines, malnutrition also remains a major public health concern. In fact, findings from the 8th National Nutrition Survey conducted by the Food and Nutrition Research Institute (FNRI) indicated a high prevalence of stunting, underweight, and wasting in both pre-school and school-age children in 2013.

Mothers play key roles in improving the nutritional status of children (Muller & Jahn 2009, Melo et al. 2013). Shrimpton stated that "if women have control in resources at family level, there would be less malnutrition; if they are oppressed, malnutrition tends to increase" (UNICEF 2003). Poor maternal nutrition and women's

inadequate or lack of access in education, employment, and technology have greatly hindered the improvement of children's nutritional status (UNICEF 2013). This is obvious in South-Asia where women's limited access to education and employment has been identified as major reasons explaining the very high malnutrition among children(UNICEF 2003).

While these factors are already known to greatly impact children's nutritional status globally, a close rexamination in a local scale might provide the most relevant information to policymakers to address hyperlocal issues. This study set out to identify maternal factors (e.g. demographic, social, and economic) that are associated with children's nutritional status in rice-based farm households in Central Luzon, Philippines using cross-sectional data with the ultimate goal to inform policies and programs that are directed to address the secular issue of children's malnutrition in the region.

Methods

Study Area, Sampling Design, and Survey Participants

This study was conducted in Central Luzon which is the top rice producing region of the Philippines. In 2013, the region produced 3,409,468 metric tons of rice. It has contributed one-third of the total rice production in the country. Central Luzon is a combination mountainous areas, plain fields composed of farm lands, and sea harbors. It is located between North Luzon and the National Capital Region (PSA 2013). It has seven (7) provinces namely Aurora, Bataan, Bulacan, Nueva Ecija, Pampanga, Tarlac and Zambales. Based on the 2015 Census of Population, the region is the third largest which accounted for about 11.1% of the country's population (PSA 2016).

The study sample was taken from all the provinces of the region. Stratified random sampling was used. A multi-stage sampling procedure was made with barangay (village) as the primary sampling unit and farm households as the secondary sampling unit. Intensity of farming activities was a major consideration in selecting the barangays. The barangays were drawn using probability proportional size, where size can be measured as the number of farm households. Fifty five (55) households were selected from each of the 11 sample barangays in each province. A total of 385 households were obtained. One hundred sixty-six (166) households with children who were 0 to 10 years old were taken as the final sample. There were a total of 275 children and 166 mothers included in the study with children as the unit of analyses.

Anthropometry

Anthropometric measurements including height-for-age (HFA), weight-for-age (WFA), and weight-for-height (WFH) were collected. All participants who gave their informed consent were interviewed face-to-face by one of the trained interviewers using a pre-tested structured questionnaire. Mothers and children were asked to remove their shoes and other excess clothing before any anthropometric measurements were taken. All anthropometric measurements followed the procedures described in Lohman et al.(1988).Body weight was measured using a portable electronic digital scale (National NS-05). Height was measured using a tape measure and was read to the nearest 0.1 cm once correct positioning was confirmed. Body mass index (BMI) was computed as weight in kilograms divided by the square of height in meters.

Maternal Knowledge and Awareness

Health and nutrition knowledge of mothers was assessed in terms of knowledge on nutrient quality and diet-health relationship awareness using standard diet-health questions following Wilson et al. (2014) and USDA (2013) methods with modifications in terms of food choices and nutrients of interest.

Data Analyses

Anthropometric data were analyzed using two Word Health Organization (WHO) software to assess the growth of children in terms of HFA, WFA, WFH, and BMI-for-age z-scores or standard deviations. Anthropometric data for children 0 to 5 years old were analyzed in WHO Anthro version 3.2.2 (2011) (WHO 2010) while WHO AnthroPlus 2009 (WHO 2009) was used to analyze data of children from 6 to 10 years old. The anthropometric measurements were used to determine the implications of the three malnutrition indicators. Stunting means that a child is too short for his or her age and it reflects chronic undernutrition. Underweight is a combine result of stunting and wasting and refers to a child whose weight is lower for his or her age. Wasting implies acute malnutrition and it refers to a child who is too thin for his or her height (UNICEF/WHO/World Bank Group 2016). A z-score below -2 standard deviation (SD) in HFA, WFA, WFH, and BMI-for-age indicates that a child is experiencing stunting, underweight, and wasting/thinness, respectively (UNICEF 2013; WHO 2006). The two WHO software provided the percentage of prevalence of the three (3) malnutrition indicators at different levels of analysis: within age groups, provincial, and regional levels. Stunting prevalence is categorized as low at <20%, medium at 20-29%, high at 30-39%, and very high at ≥40%. Likewise, underweight prevalence is low at <10%, medium at 10-19%, high at 20-29%, and very high at ≥30%. Wasting/thinness prevalence is low at <5%, medium at 5-9%, high at 10-14%, and very high at ≥15%(WHO 2010).

To assess the association of child and various maternal factors (e.g. mother's age, health condition, nutritional status, and education) with the children's nutritional status, Pearson Chi-square test and logistic regression were employed using IBM SPSS Statistics version 20 software. Logistic regression was used to assess how well the pre-identified factors explain the occurrence of the three malnutrition indicators (stunting, underweight, and wasting), and likewise how these factors are related to the outcomes, whether positive or negative (IBM Corporation 2011, Makoka 2013, Wong et al. 2014). There were three models generated and these were assessed using goodness-of-fit (e.g. Omnibus Tests of Model Coefficients and Hosmer and Lemeshow Test). The regression analysis results included coefficients (B), *p*-value (Sig.), and odds ratio [Exp (B)] with confidence interval (CI) of 95%. Coefficients indicated the direction of relationship, whether positively or negatively related. Odds ratio indicated the association of a variable with the odds of the outcome. If the odds ratio is less than 1, a variable is associated with lower odds of the outcome. Otherwise, a factor is associated with higher odds of the outcome (Pallant 2005). The *p*-value indicated the statistical significance of the relationship of a factor to a malnutrition indicator. Levels of significance (e.g. at 1%, 5%, and 10%) were likewise indicated.

Results

Socio-economic characteristics

Among the 275 children aged 0 to 10 years, 45% were female and 55% were male. The average age of these children was 5.4 ± 3.1 years. More than half of them were living in rural areas (53.1%) and the rest were from urban areas (46.9%). Many of them (41.5%) belonged to households whose annual income ranged from PhP 100,000 to 249,000. Mean age of mothers was 39.9 ± 11.3 years. Livelihoods of 28.3% of the respondents were from non-agricultural sources while 7.8% rely on agricultural sources. The average household size was 6.0 ± 4.7, and the average household income was PhP 237,731 (Table 1).

Maternal status, knowledge and awareness on nutrition and health

Most mothers (89.1%) in Central Luzon considered themselves healthy as only a few indicated that they had major illnesses or disabilities (10.8%). This was also supported by the higher percentage of mothers that were classified as normal (71.1%) in their nutritional status based on their BMI with a mean of 21.8 ± 3.4. There were only few who suffered from mild (10.2%), moderate (3.01%), and severe (1.81%) chronic energy deficiency (Table 1). Additionally, almost all of them were not smokers (98.8%) nor alcohol drinkers

(95.8%). Seminar or training attendance regarding nutrition, however, was not impressive (20.5%). Membership in local organizations (e.g. farmers association) is relatively good (47.6%) (Table 1).

As regards the knowledge of the mothers on the nutrient content of some food items, majority (57%) answered correctly. There were 21 questions asked where 10 of them measured diet-health relationship knowledge of mothers. Interestingly, most of them (79 – 95%) were aware of the health problems related to being overweight, smoking, and having too much fat, alcohol, salt, sugar, and cholesterol intake. However, only 52.2% and 54.8% of the respondents were familiar with health problems related to low fiber and iron intake, respectively (Table 2).

Children's nutritional status

Among pre-school children (0 to 5 years old), wasting (19.5%) was very highly prevalent in the region. Underweight (16.8%) was of medium prevalence. Low prevalence of stunting was observed (15.2%). Wasting was particularly very high in the provinces of Aurora (33.3%), Nueva Ecija (28.6%), Pampanga (20%), Tarlac (18.8%), and Bataan (18.8%). Wasting was not a major concern in Bulacan (5.6%) and Zambales (10.5%). Underweight was very highly prevalent in Bataan (36.8%), followed by Nueva Ecija (16.7%) and Tarlac (15%) both classified under medium prevalence. Generally, stunting was low in the region but highly prevalent in Aurora province (34.5%).Among school-age children (6 to 10 years old), thinness/wasting (22.1%) was very high in the region. On the other hand, both stunting (16.9%) and underweight (18.9%) were medium. Tarlac (35.3%) had the highest prevalence of wasting, followed by Pampanga (31.3%) and Bulacan (28.6%). Stunting was high in Bataan (37.5%) and Pampanga (29.4%). Underweight was also very high in Bataan (34.8%), and high both in Bulacan (25.0%) and Tarlac (23.5%) (Table 3).

Additionally, stunting (20.7%) and thinness/wasting (24.1%) were highest from 84 to 95 months old. On the other hand, underweight (21.7%) was highest in children from 96 to 107 months old (Table 4). Female school-age children had higher prevalence of underweight (25.5% vs 23.1%) and wasting (25.5% vs 19.1%) compared with males. However, male school-age children had higher prevalence of stunting (19.2% vs 13.7%) than females.

Association of maternal factors with child nutrition

Bivariate findings

Pearson chi-square tests between maternal factors and children's nutritional status are presented in Table 5. Findings indicated that maternal education was an important factor in the occurrence of underweight ($\chi2=9.6$; *p*-value=0.002). Underweight was high (24.6%) among children whose mothers had low educational attainment (elementary level up to high school level). Place of residence was also found to have significantly contributed to stunting ($\chi2=5.2$; *p*-value=0.023). There was a higher percentage of stunting in rural areas (24.0%) than in urban areas (13.2%). Lower household income was positively associated with the occurrence of underweight ($\chi2=7.1$; *p*-value=0.008). Underweight was higher in households with income below the poverty threshold level (31.3%) than households that were not.

Multivariate findings

Child's characteristics

In logistic regression analysis, the child factors considered were age and sex. The relationship between these factors and the occurrence of malnutrition was not found statistically in all malnutrition indicators.

Maternal factors

Logistic regression analysis also revealed some maternal factors that were significantly associated with certain malnutrition indicators in children of rice-based farm households in Central Luzon (Table 6). Higher level of educational attainment was inversely related to the occurrence of underweight. Children whose mothers had lesser education, did not reach college level, are 2.78 times more likely become stunted than children whose mothers attained tertiary education [AOR=2.78 (CI: 1.03,7.48)]. Children whose mothers did not have major illnesses are 0.33 times less likely become wasted than children whose mothers had major illnesses [AOR=0.33 (CI: 0.12, 0.87)]. Mothers with underweight and normal BMI are 3.55 [AOR=3.55 (CI: 1.09, 11.60)] and 5.47 times [AOR=5.47 (CI: 1.43, 20.95)], respectively, more likely have wasted children than mothers who were overweight/obese.

Membership in local organizations was also found to be a significant determining factor of nutrition deficiencies. Having no membership in these organizations was associated with higher cases of stunting, underweight, and wasting, but was only statistically significant for wasting. Children whose mothers were not members of local organizations would be 2.21 times more likely become wasted than children whose mothers had memberships [AOR=2.21 (CI:1.12, 4.35)].

Other household factors

Children living in rural areas are 2.61 times more likely become stunted than children living in urban areas [AOR=2.61 (CI: 1.22, 5.57)]. Urban areas are places with a population density of at least 1000/km^2 (PSA 2014). Lastly, lower household income showed higher occurrence of stunting, underweight, and wasting. This relationship, however, was found to be statistically significant in underweight only. Households with annual income below poverty threshold in the region are 2.28 times [AOR=2.28 (CI: 1.08, 4.82)] more likely have underweight children than households with income above poverty threshold (Table 6).Poverty threshold in the region is PhP 7,890 per month (PSA 2012).

Discussion

Acute malnutrition was highly prevalent in pre-school and school-age children among rice-based farm households covered in this study. Indeed findings showed high prevalence of wasting and underweight among children in this region. Additionally, female children exhibited higher prevalence in almost all malnutrition indicators than males. In the Philippines, poverty remains a major problem in rural communities where agriculture is the major source of income (IFAD 2009).This is because agricultural productivity and profitability have decreased in the recent years that resulted in lower income especially in rice farming. These communities have rice as their staple food, and it is not common to diversify their diet. These situations have made them highly vulnerable to malnutrition.

Results showed that maternal factors such as education, nutrition and health status, and others such as lifestyle and place of residence were strongly associated with the occurrence of malnutrition in children. These findings are supported by the results of several studies showing that low maternal education, knowledge and beliefs on nutrition and health, and poor child care practices are risk factors contributing to child malnutrition (Muller & Jahn 2009, Melo et al. 2013, Wong et al. 2014).

A mother who attained at least college level or a college graduate had lower chance of having a stunted child than a mother who had primary to secondary education only. A child whose mother did not reach tertiary education are 2.78 times more likely become stunted than children. This is supported by the study of Rohner et al. (2013) in the Philippines indicating that mother's education was inversely related to stunting, lower chances among children whose mothers are highly educated. Stunting imposes a serious threat in a child's future, socially and economically. Poor health and cognitive development of children brought by stunting will make them into adults who are less educated, poorer, less healthy, and more prone to non-communicable diseases (UNICEF Indonesia 2012).One of the underlying causes of malnutrition is the lack of education and

knowledge of the child's caregiver (UNICEF 2013).Stunting is a manifestation of an early chronic exposure to undernutrition of a child (UNICEF 2013). Hence, nutrition interventions should also be done at the early stage of child development. The first 1000 days (0 to 2 years old) of child is considered as crucial, most especially for stunting, as its occurrence cannot be reversed beyond this period (UNICEF 2013). Mothers who does not have enough knowledge on child nutrition and health will most likely give insufficient care and feeding to their children. Corollary to this, Stewart et al. (2013) explained the issues surrounding complementary feeding and how it correlates with stunting. Under this practice, between ages 6 and 24 months, food items other than breast milk are being introduced to a child. Inadequate complementary feeding practices such as introducing poor quality food items with low micronutrient and dietary diversity, inadequate feeding especially during and after illness, and unsafe food and water will contribute to stunted growth and development.

Living in urban areas was found to be inversely related to stunting. The probability of having a stunted child in urban areas is lower by 42% than in rural areas. Smith et al. (2005) stated that "urban children have better nutritional status than their rural counterparts because of the cumulative effect of series of more favorable socioeconomic conditions such as employment, social networks, better access to health care facilities and other services that will eventually provide better caring practices for mothers and children."

This study also established that a healthy mothers as indicated by the self-reported presence or absence of major illness or disability is a strong predictor of wasting in children. Probability of wasting among children was noted to be 0.33 times lower if mothers were healthy than those who reported that they had major illnesses or disabilities. It was reported that foods, diets, and nutritional status are associated with increased blood pressure and blood cholesterol that are risk factors for non-communicable diseases and also serve as major causes of illnesses (WCRF 2013). Undernutrition and unhealthy practices increase the chance of mother to get afflicted with illnesses that consequently will have negative repercussions on their children. Hypertension is another maternal factor that can also influence stunted growth and development (Stewart 2013). Unhealthy household environment is also identified as an underlying cause of malnutrition (UNICEF 2013). The odds ratio also indicated that wasting is 2.47 times more likely among children whose mothers are not members of any local organizations as compared with those who are. This could be attributed, but not solely, to the very high prevalence of wasting among pre-school (19.5%) and school-age (22.1%) children in the region which were remarkably higher compared with the national prevalence of only 7.9% and 8.6%, respectively (FNRI 2013).

Income was found significantly associated with underweight in bivariate analysis (Pearson chi-square test) and in multivariate analysis (logistic regression). Underweight occurs 2.28 times more likely in children whose household income were below poverty threshold level.

Conclusion

Children, 0 to 10 years old, in Central Luzon experienced greater acute malnutrition than chronic malnutrition with significant gender differences. Maternal factors such as education and health status, and other factors such as lifestyle and place of residence were highly associated with the occurrence of malnutrition in children. Therefore, interventions should be nutrition- and gender-sensitive to ensure health security for both male and female children in rice-based farm households. Health and nutrition education may be more effective in improving the household nutrition if targeted towards mothers.

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Tables

Table 1. Socio-demographic characteristics and maternal nutrition and health status (n=166 mothers, 275 children)[a]

Variables	Frequency	Percentage (%)	Mean	SD[b]
Children Factors				
Age of child			5.4	±3.1
Female child	125	45.6	5.4	±3.1
Male child	150	54.5	5.4	±3.2
Maternal Factors				
Mother's Age			39.9	±11.3
Education Attainment				
Elementary Level	4	2.4		
Elementary Graduate	28	16.9		
High school Level	17	10.2		
High school Graduate	55	33.1		
College Level	19	11.5		
College Graduate	30	18.1		
Vocational Course/Graduate	13	7.8		
Occupation				
Not working	106	63.9		
Agricultural	13	7.8		
Non-agricultural	47	28.3		
Nutrition based on BMI[c]				
Mother's weight (kg)			54.2	±8.7
Mother's height (cm)			158	±6.2
Average BMI			21.8	±3.4
Mild CED	17	10.2		
Moderate CED	5	3.0		
Severe CED	3	1.8		
Normal	118	71.1		
Overweight	19	11.5		
Obese	4	2.4		
Health & Lifestyle				
Healthy/ without Illness/ without disability	148	89.2		
With major illness/ disability	18	10.8		
Smoking				
Yes	2	1.2		
No	164	98.8		

Drinking				
Yes	7	4.2		
No	159	95.9		
Others				
Household Size			6.0	±4.7
Household Income				
under 40k	17	6.2		
Php40,000-59,999	15	5.5		
Php60,000-99,999	42	15.3		
Php100,000-249,999	114	41.5		
Php250,000 & over	87	31.6		
Average Annual Household Income			PhP237,731	PhP221,637
Residence				
Rural	146	53.1		
Urban	129	46.9		
Trainings & Organizations				
Attended Training				
Yes	34	20.5		
No	132	79.5		
Membership to Organizations				
Yes	79	47.6		
No	87	52.4		

[a]Sample population *(n)* only includes mothers with 0 to 10 years old. [b]SD, standard deviation. [c]BMI Classification: Severe Chronic Energy Deficiency or CED=<16.0, Moderate CED=16.0-16.9, Mild CED=17-18.9, Normal=18.5-24.9, Overweight= 25.0-29.9, Obese=≥30.0

Table 2. Maternal knowledge and diet-health awareness in rice-based farm households (n=385)[a]

Nutrition and Diet-Health Questions	Correct/Positive response by mother	
	Frequency	%
Nutrition Question and Answer[b]		
Which has more fiber?		
Fruit or Meat	344	89.4
White rice or White corn	168	43.6
Brown bread or White bread	176	45.7
Fresh fruit or Apple juice	169	43.9
Mungbean or Cabbage	266	69.1
Which has more cholesterol?		
Liver or Lean Meat	188	48.8
Butter or Margarine	178	46.2
Egg White or Yolk	244	63.4

Skimmed Milk or Whole Milk	227	58.9
Fish or Beef	346	89.9
Which has more fat?		
Loin pork chops or Pork spare ribs	52	13.5
Hotdogs or Ham	114	29.6
Peanuts or Popcorn	306	79.5
Ice candy or Ice cream	333	86.5
Roast chicken or Fried chicken	314	81.6
Which has more sugar?		
Soft drink or Beer	365	94.8
Raisins or Candies, hard	279	72.5
Grapes, raw or Mango raw	155	40.3
Peanut butter or Cheese	269	69.9
Brown sugar or White sugar	237	61.6
Are you aware that there is good and bad cholesterol?	140	36.4
Diet-Health Question[c]		
Have you ever heard about any health problems that might be related to how much:		
Fat a person eats?	339	88.1
Saturated fat a person eats?	335	87.0
Fiber a person eats?	201	52.2
Salt a person eats?	360	93.5
Cholesterol a person eats?	364	94.6
Sugar a person eats?	361	93.8
Iron a person eats?	215	55.8
A person is overweight?	304	78.9
A person smokes?	357	92.7
A person drinks alcohol?	357	92.7

[a]Sample population *(n)* includes all mothers with and without 0 to 10 years old children. [b]Measured maternal knowledge on nutrient quality of some food items; Correct answers are underlined. [c]Measured diet-health awareness of mother.

Table 3. Prevalence of malnutrition per province in Central Luzon among children 0 to 10 years old in rice-based farm households (n=275)

Province	Height-for-age (Stunting)[a]						Weight-for-age (Underweight)[b]						Weight-for-height (Wasting)[c]					
	0 to 5 years old			6 to 10 years old			0 to 5 years old			6 to 10 years old			0 to 5 years old			6 to 10 years old		
	% below -2 SD[d]	Mean[e]	SD	% below -2 SD	Mean[e]	SD	% below -2 SD	Mean[e]	SD	% below -2 SD	Mean[e]	SD	% below -2 SD	Mean[e]	SD	% below -2 SD	Mean[e]	SD
Bataan	6.3	-0.65	1.3	37.5	-1.02	2.13	36.8	-0.72	2.26	34.8	-0.91	1.56	18.8	-0.19	1.92	16.7	-0.25	2.04
Bulacan	5.6	-0.47	1.57	5.3	-0.52	1.59	5	0.45	2.21	25	-0.77	2.26	5.6	0.68	2.05	28.6	-0.81	1.48
Nueva Ecija	14.3	-0.63	1.6	7.7	-0.17	1.37	16.7	-0.83	0.99	7.7	0.2	1.56	28.6	-0.02	3.06	0	0.28	1.67
Pampanga	13.3	-0.12	1.83	29.4	-0.05	2.1	5.9	0.45	1.69	11.8	-0.7	0.81	20	0.04	2.25	31.3	-0.99	2.25
Tarlac	4.8	0.37	2.07	6.3	-0.54	1.78	15	-0.25	1.6	23.5	-0.89	1.3	18.8	-0.76	1.45	35.3	-1.46	2.1
Zambales	15.8	-0.51	1.99	23.5	-0.26	2.09	5	0.08	2.12	5.6	-0.59	1.26	10.5	0.62	2.32	22.2	-0.44	2.44
Aurora	34.5	-1.06	1.87	4.2	0.26	1.85	27.6	-1.54	1.18	16.7	-0.76	1.12	33.3	-1.08	1.75	19	-0.75	1.36
Regional	15.2	-0.46	1.82	16.9	-0.34	1.89	16.8	-0.4	1.89	18.9	-0.68	1.48	19.5	-0.17	2.1	22.1	-0.64	1.97

Ns???

WHO classification of severity of malnutrition by prevalence: [a]Stunting low (<20%), medium (20-29%), high (30-39%), very high (≥40%); [b]Underweight low (<10%), medium (10-19%), high (20-29%), very high (≥30%); [c]Wasting low (<5%), medium (5-9%), high (10-14%), very high (≥15%). [d]% below -2 SD (standard deviation) indicates percentage prevalence of a malnutrition indicator (stunting, underweight, wasting). [e]Mean of SD or z-scores.

Table 4. Prevalence of malnutrition per age group in Central Luzon among children 0 to 10 years old in rice-based farm households (n=275)

Age (in months)	Height-for-age (Stunting)			Weight-for-age (Underweight)			Weight-for-height (Wasting)		
	% below -2 SD[a]	Mean[b]	SD	% below -2 SD	Mean[b]	SD	% below -2 SD	Mean[b]	SD
0-5	33.3	-1.36	1.93	45.5	-1.05	2.26	42.9	-0.01	3.11
6-11	20	-1.04	1.76	0	-0.2	1.48	10	0.48	2.3
12-23	21.4	0.12	2.46	6.3	-0.3	1.81	21.4	0.06	1.99
24-35	20.7	-0.37	2.03	9.7	0.12	1.66	14.3	0.25	2.18
36-47	6.3	-0.39	1.54	29.4	-0.7	2.07	25	-0.72	2.05
48-60	8.5	-0.42	1.54	17.3	-0.54	1.98	18.6	-0.48	1.87
(0-60)	15.2	-0.46	1.82	16.8	-0.4	1.89	19.5	-0.17	2.1
72-83	11.1	-0.3	2.11	17.6	-0.4	1.9	17.6	-0.26	2.27
84-95	20.7	-0.35	2.03	16.7	-0.69	1.62	24.1	-0.78	1.87
96-107	13	-0.06	1.85	21.7	-1.05	1.48	21.1	-0.76	2.05
108-120	18.3	-0.45	1.81	19.4	-0.61	1.3	22.8	-0.64	1.93
(72-120)	16.9	-0.34	1.89	18.9	-0.68	1.67	22.1	-0.64	1.97
N???									

[a]% Below -2 SD (standard deviation) indicates percentage prevalence of a malnutrition indicator (stunting, underweight, wasting). [b]Mean of SD or z-scores.

Table 5. Pearson Chi-square analysis for child and maternal factors of stunting, underweight, and wasting in children aged 0 to 10 years old in Central Luzon (n=275)

	Stunting			**Underweight**			**Wasting**		
Independent variables	**No.**	**%**	**χ2**	**No.**	**%**	**χ2**	**No.**	**%**	**χ2**
Child Factors									
Age of Child									
0-2	20	27.78	8.41**	10	13.89	2.51	15	20.83	0.96
3-5	6	8.70		14	20.29		18	26.09	
6+	26	19.40		31	23.13		36	26.87	
Sex of Child									
Male	26	20.8	0.53	29	19.33	0.09	38	25.33	0.01
Female	26	17.33333		26	20.80		31	24.80	
Maternal Factors									
Mother's Age									
Below 30	7	18.42	0.04	8	21.05	0.74	6	15.79	2.27
30 to 40	26	19.40		24	17.91		34	25.37	
Above 40	19	18.45		23	22.33		29	28.16	
Health Condition									
no major illness/disability	46	19.49	0.37	45	19.07	0.90	55	23.31	2.82*
with major illness/disability	6	15.38		10	25.64		14	35.90	
Mother's nutritional status based on BMI									
Normal	40	20.62	3.25	37	19.07	1.89	50	25.77	5.96*
Underweight	9	20.45		12	27.27		15	34.09	
Overweight/Obese	3	8.11		6	16.22		4	10.81	
Smoking									
Not smoking	52	19.05	0.47	54	19.78	1.13	67	24.54	6.01
Smoking	0	0.00		1	50.00		2	100.00	
Drinking									
Not drinking	51	19.25	0.54	53	20.00	0	64	24.15	3.43*
Drinking	1	10.00		2	20.00		5	50.00	
Education									
Did not reach college level	37	18.59	0.05	49.00	24.62	9.62**	55	27.64	2.49
College level or college graduate	15	19.73		6.00	7.89		14	18.42	
Mother's Occupation									
None	37	20.11	0.58	40	21.74	3.16	44	23.91	0.70

Agricultural	4	18.18		6	27.27		7	31.82	
Non-agricultural	11	15.94		9	13.04		18	26.09	
Residence									
Rural	35	23.97	5.20**	33	22.60	1.32	40	27.40	0.88
Urban	17	13.18		22	17.05		29	22.48	
Household Size									
1-4	13	21.31	1.83	10	16.39	5.97*	17	27.87	0.93
5-8	36	19.57		34	18.48		43	23.37	
9+	3	10.00		11	36.67		9	30.00	
Household Income									
<poverty threshold	13	19.40	0.01	21	31.34	7.12**	18	26.87	0.15
>poverty threshold	39	18.75		34	16.35		51	24.52	
Others									
Distance to Market									
Below 1 km	3	10.71	1.49	10	35.71	4.85*	9	32.14	1.16
1-3 km	17	18.68		16	17.58		24	26.37	
4 km +	32	20.51		29	18.59		36	23.08	
Attendance to Trainings									
No trainings attended	39	17.73	1.00	45	20.45	0.14	53	24.09	0.59
Attended trainings	13	23.64		10	18.18		16	29.09	
Membership to Organizations									
No organization	29	19.46	0.07	36	24.16	3.52*	44	29.53	3.41*
With organization	23	18.25		19	15.08		25	19.84	

Chi square ($\chi 2$) estimate values are significant at different levels: *p-value<0.10, significant at 10% level, ** p-value<0.05, significant at 5%, ***p-value<0.001, significant at 1% level.

Table 6. Logistic regression analysis for child and maternal factors of stunting, underweight, and wasting in children aged 0 to 10 years old in Central Luzon (n=275)

Independent (Predictor) Variables	**Height-for-age** ***(Stunting)***			**Weight-for-age** ***(Underweight)***			**Weight-for-height** ***(Wasting)***		
	Coef.[a]	Odds Ratio[b] (95%CI[c])		Coef.	Odds Ratio (95% CI)		Coef.	Odds Ratio (95% CI)	
Child Factors									
Age of Child									
0-2	0.61	1.84	(0.86,3.94)	-0.52	0.59	(0.25,1.42)	-0.35	0.71	(0.33,1.53)
3-5	-0.94	0.39*	(0.15, 1.05)	-0.30	0.74	(0.34,1.60)	-0.08	0.92	(0.45,1.90)
6+[¶]									
Sex of Child									
Female	0.06	1.06	(0.55,2.05)	-0.05	0.95	(0.50,1.81)	-0.21	0.81	(0.45, 1.48)
Male[¶]									
Maternal Factors									
Mother's Age									
below 30	-0.54	0.58	(0.18,1.86)	0.39	1.46	(0.50,4.36)	-0.29	0.75	(0.25,2.24)
30 to 40	-0.28	0.75	(0.33,1.70)	0.21	1.22	(0.54,2.78)	0.28	1.32	(0.63,2.76)
41+[¶]									
Health Condition									
no major illness/disability	-0.01	0.99	(0.31,3.17)	-0.15	1.68	(0.39,3.53)	-1.12	0.33**	(0.12,0.87)
with major illness/disability[¶]									
Mother's nutritional status based on BMI									
Normal	0.99	2.69	(0.73,9.83)	0.19	1.20	(0.41,3.54)	1.27	3.55**	(1.09,11.60)
Underweight	0.58	1.79	(0.40,7.94)	0.71	2.04	(0.56,7.32)	1.70	5.47**	(1.43,20.95)
Overweight/Obese[¶]									
Drinking									
Not drinking	1.57	4.79	(0.49,47.17)	-0.36	0.70	(0.11, 4.15)	-1.40	0.25*	(0.06,1.09)
Drinking[¶]									
Education									
Did not reach college	0.14	1.15	(0.52,2.55)	1.04	2.78**	(1.03,7.48)	0.35	1.40	(0.64,3.06)
College level to college graduate[¶]									
Mother's Occupation									
None	0.40	1.49	(0.63,3.52)	0.01	0.97	(0.39,2.43)	-0.41	0.66	(0.31,1.41)
Agricultural	0.06	1.06	(0.24,4.70)	0.42	1.45	(0.38,5.49)	0.04	1.04	(0.31,3.51)
Non-agricultural[¶]									
Residence									
Rural	0.96	2.61**	(1.22,5.57)	0.20	1.22	(0.59,2.46)	0.23	1.26	(0.65,2.46)
Urban[¶]									
Household Size									
1-4	0.98	2.66	(0.56,12.60)	-0.96	0.37	(0.11,1.27)	0.37	1.45	(0.43,4.82)
5-8	0.61	1.84	(0.43,7.92)	-0.80	0.44	(0.15,1.26)	0.11	1.12	(0.37,3.37)
9+[¶]									
Household Income									
<poverty threshold level	-0.37	0.69	(0.30,1.60)	0.69	2.28**	(01.08,4.82)	-0.20	0.82	(0.38,1.79)

>poverty threshold level¶									
Others									
Distance to Market									
below 1km	-1.06	0.35	(0.07,1.70)	0.82	2.82	(0.68,7.55)	0.28	1.33	(0.40,4.40)
1-3 km	-0.11	0.90	(0.41,2.00)	-0.32	0.70	(0.31,1.60)	0.11	1.11	(0.54,2.27)
4 km+¶									
Attendance to Trainings									
No trainings attended	-0.36	0.70	(0.30,1.64)	0.22	1.25	(0.49,3.18)	-0.08	0.93	(0.41,2.07)
Attended trainings¶									
Membership to Organizations									
No organization	0.37	1.44	(0.80, 3.81)	0.44	1.57	(0.77,3.19)	0.79	2.21**	(1.12,4.35)
With organization¶									
Constant	-4.91	0.01		-2.13	0.12		-0.63	0.533	
Model									
-2 Log likelihood	240.37			246.61			283.50		
Accuracy Rate of Predicting the Occurrence of the Outcome	82.50%			80.00%			76.00%		

[a]Coefficient indicates direction of relationship (positive/negative) between the predictor/independent variable (IV) and dependent variable (DV) (stunting, underweight, wasting). [b]Odds ratio: 1= IV does not affect DV, <1= IV associated with lower probability of DV; >1=IV associated with higher probability of DV. [c]CI, confidence interval. ¶Reference Category. Significance of Odds Ratio (OR): *p-value<0.10, significant at 10% level, ** p-value<0.05, significant at 5%, ***p-value<0.001, significant at 1% level.