Recent Evidence of Health Effects of Women Empowerment: A Case Study of Northern Ghana[1]

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Abstract

Women empowerment could be the key to unlocking women's productivity potential in Africa. Women's contribution to the agricultural sector is greatly influenced by their health status. This paper examines the impact of women's empowerment in agriculture on women's health and the implications for the African food and agricultural sector. It utilizes a unique dataset from a 2012 survey of 2,405 women in northern Ghana and the Multiple Indicators Multiple Causes modeling approach. Findings provide insight on how gender-sensitive policies and private-public initiatives can translate into better health outcomes for women and improved capacity to meet future needs of food and agriculture in Africa. Initiatives focusing on increasing women's membership in social and economic groups, easing women's access to credit, and increasing women's incomes are some key empowerment strategies for improving women's health status and production capabilities.

Key words: women empowerment, agriculture, health, Ghana, Africa

Introduction

Women play a significant role in the agricultural sector in developing countries. Recent evidence from developing countries indicates that women supply, on average, 43 percent of the agricultural labor force, but in Sub-Saharan Africa, this contribution is nearly 50 percent (FAO 2011). They also constitute a significant proportion of the wage workers in the agri-food supply chain (FAO 2011, 2010). In addition to their roles in agriculture, women have a vital role in household production and are usually the primary care givers within the household.

A woman's role, responsibilities, and activities in household production and, particularly, in agricultural production are time consuming and physically demanding, requiring significant energy and physical capacity. This implies that women's ability to effectively undertake these agricultural and household production activities is greatly influenced by their physical capability and their health status.

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Smith et al. (2003) states that improving women's health status can effectively enhance their performance in their socioeconomic responsibilities, including increasing agricultural production by becoming more efficient and skilled laborers.

A woman's health status is influenced by her access to and control over resources that affect food availability and her ability to be responsible for her health care needs (Mabsout 2011, Sahn and Younger 2009). Therefore, the empowerment of women to have more decision rights over the dimensions of their lives that affect their health and capability in performing income generating and care giver responsibilities has been receiving significant attention in recent years (De Schutter 2013, FAO 2011).

Empowering women is a complex concept given the socio-cultural dimensions embedded in gender relations and politics (Samman and Santos 2009). This complexity also confounds the development of a good definition for the concept of women's empowerment. The two main elements that are widely accepted in the definition of empowerment are "process" and "agency". Empowerment is considered to be a process, a transition in an individual's decision-making capability from where she is denied choices to a position where she has the ability to choose for herself. The second element, agency, states that an individual must play a role in this process of change. The concept of agency is the "ability to define one's goals and act upon them" (Kabeer 1999). These two key elements are expressed in the following definition for women's empowerment that is adopted in the study: "women's ability to make decisions and affect important outcomes for themselves and their families as well as have control over their life and over their resources" (Malhotra, Schuler, and Boender 2002).

The purpose of this study is to gain insights into the relationship between women's empowerment in agriculture and women's health status. This research uses survey data that includes a newly developed index, Women Empowerment in Agriculture Index (WEAI). The WEAI is designed to meet the need for a robust and comparable tool that measures the empowerment, agency, and inclusion of women in the agricultural sector. This study contributes to the literature by utilizing the WEAI to examine the impact of women's empowerment in agriculture on women's health status. To the authors' best knowledge, this is the first peer-reviewed research study to analyze these survey data and the WEAI in relation to women's health status in northern Ghana. The Multiple Indicators Multiple Causes (MIMIC) model is used to assess how two primary indicators of women's physical health status - body mass index (BMI) and women's dietary diversity score (DDS) - are influenced by empowerment and autonomy indicators. The paper hypothesizes that a greater degree of women's empowerment and

decision-making capabilities leads to a higher health status. The insights gained from testing this hypothesis will contribute to a greater understanding of how women's empowerment in agriculture is associated with women's health status. The findings from this study can help guide public-private initiatives in developing more appropriate and effective empowerment strategies that are focused on improving the health and well-being of women in northern Ghana. These strategies may also help to enhance women's productivity in agriculture in northern Ghana and other Sub-Saharan Africa countries.

Health is a complex multidimensional concept, encompassing physical, mental and emotional components of an individual. For the purpose of this study, only the physical aspect of health will be examined. Universally accepted physical health measures that are commonly used are BMI and women's DDS. BMI is an unobtrusive measure and is defined as the ratio of an individual's weight in kilograms to her height in meters squared (kg/m2) (WHO 2014, CDC 2014). BMI provides a reliable measure for body composition, which is used in health screenings for potential health problems associated with body weight. BMI is both age and gender independent, making this measurement very versatile, consistent, and easy to compute. The women's DDS serves as an indicator of women's consumption of diverse foods with adequate micronutrients and nutritional quality, which is universally recognized as a key component of healthy diets. This score helps identify if particular micronutrient deficiencies exist within a certain population, and it also provides insights for policy makers and health professionals to effectively promote good health and diets with adequate intake of essential nutrients. Each of these health measures is assumed to be a component of a woman's health status, which is unobserved.

Methods

In this study, a special specification of the Structural Equation Modeling (SEM) approach is used, the Multiple Indicators Multiple Causes (MIMIC) model. This MIMIC model is an ideal model to use when multiple dependent variables need to be associated with a "single" variable. Two women's health status indicators represent the dependent variables in this research – BMI and DDS. Since these indicators are not independent of each other, the MIMIC model is more appropriate for this analysis than other traditional structural equation models. The MIMIC model was used by Mabsout (2011) to study women's health as indicated by their BMI and anemia status. The results from his study indicated that women's health can be improved by changing household decision-making patterns.

Following Joreskog and Goldberger (1975) and Spanos (1984), a vector, $K = (k_1 ... k_n)'$, of observable latent causes of a woman's health status, H^* is developed. Equation 1 describes this relationship with the error term, ε, assumed to have a zero mean and a unity standard deviation, and $a = (a_1 ... a_n)'$ is a vector of the parameters to be estimated:

$$H^* = a'K + \varepsilon \qquad (1)$$

It is assumed that the latent women's health status determines the observable health status indicators of interest in this study, H. This relationship is expressed in Equation 2 as follows:

$$H = bH^* + \upsilon \qquad (2)$$

where $H = (h_1 ... h_m)'$ represents a vector of observable endogenous variables, $b = (b_1 ... b_n)'$ is a vector of parameters to be estimated, and $\upsilon = (\upsilon_1 ... \upsilon_m)'$ is a vector of mutually independent error terms. It is assumed that $E(\varepsilon\upsilon') = 0$, $E(\varepsilon^2) = \sigma^2$, and $E(\upsilon\upsilon') = \Theta^2$, with Θ being an $m \; x \; m$ diagonal matrix.

The MIMIC model, which is the reduced form of equations (1) and (2), presents the observable health status indicators, H, as a function of the observable exogenous variables, K, suggesting that:

$$H = \lambda'K + \mu$$
$$where \; \lambda = ab \; and \; \mu = (b\varepsilon + \upsilon) \qquad (3)$$

At least two observable indicators and at least one exogenous variables are needed to ensure that the MIMIC model is identified, provided that one of the factor loadings of the indicators is set equal to one to form the scale of the latent variable. Since the problem in this study meets the criteria for identification, the MIMIC model can be used in the estimation. The MIMIC model is estimated by the maximum likelihood method.

The exogenous variables do not all have the same units, which makes comparison among the variables uninformative. Following the approach recommended by Bollen (1989), the coefficients are standardized to eliminate their measurements. Standardization of the coefficients will allow

comparisons across the variables. It is essentially the same approach as elasticities, which are commonly used by economists to determine the relative importance of the contributions of variables in a model and provides the same information. We can determine which independent variables' one percent change leads to the largest percent change in dependent variables. With elasticities, the contribution or effect of the independent variable approaches infinity as the point of estimation reaches zero. The point of estimation is typically the mean. Thus, a mean of zero results in no solution.

To avoid this risk, other unitless indicators are used to determine relative influence. The standardized regression coefficients, $\hat{a}_{ij}^{s}$ and $\hat{b}_{ij}^{s}$ are represented as follows:

$$\hat{a}_{ij}^{s} = \hat{a}_{ij}\left(\frac{\hat{\theta}_{jj}}{\hat{\theta}_{ii}}\right) \quad \text{and} \quad \hat{b}_{ij}^{s} = \hat{b}_{ij}\left(\frac{\hat{\theta}_{jj}}{\hat{\theta}_{ii}}\right)$$

where i is the dependent variable, j is the explanatory variable, $\hat{\theta}_{ii}$ and $\hat{\theta}_{jj}$ are the model-predicted standard deviations of the ith and jth variables, respectively. The standardized coefficients represent the mean response in standard deviation units of the dependent variable for a one standard deviation change in the explanatory variables, ceteris paribus.

The outcome of interest is women's health status measured by the BMI and DDS indicators. These indicators, therefore, are the dependent variables in the estimation models. The explanatory variables are the WEAI and the ten principal components of the WEAI, as well as the demographic and socio-economic characteristics of the women. The summary statistics, along with the variable definitions, are presented in Table 1.

Data

The research uses data from a USAID-funded, population-based survey conducted during July and August of 2012 in northern Ghana. A two-stage stratified random sampling technique is adopted in the survey, and probability weights are developed to account for differential probabilities of selection and non-responses from the households, resulting in a design representative of the population in northern Ghana. For this particular study, the focus is on the health conditions of the self-identified primary woman in each household. Primary members of the household are the ones responsible for making social and economic decisions, and are, typically, a husband and wife.

The study sample is comprised of 4,513 women, aged 15 to 49 years, with complete dietary diversity information and anthropometric measurements. There are 23 women with "extremely high" BMI measurements for their weight/height profiles; they are treated like outliers and excluded from the study's sample. Of the remaining 4,490 women, 2,405 are the primary women and are the focus of this study.

Health Indicators: BMI and DDS

BMI is currently considered the standard in determining nutritional status and health risk conditions (Wells and Fewtrell 2006). It provides a very economical way to classify people by their potential health riskiness: BMI of less than 18.5 kg/m2 are underweight; BMI between 18.50 kg/m2 and 24.99 kg/m2 is normal; and BMI greater than 25 kg/m2 is overweight or obese. Women with BMI values in the underweight category face a serious problem in developing countries, given their role in the economic well-being and health of their families. For women whose daily economic activities involve agricultural and other physically-demanding work, being underweight impedes their ability to perform their activities efficiently. Women who are underweight spend more time performing their daily activities (Kennedy and Garcia 1994), and they are at a higher risk of developing functional disabilities (Ferraro et al. 2002) compared to their counterparts with BMIs in the normal range. Kennedy and Garcia (1994) show that having a healthy (or normal) BMI increases the capacity to perform domestic and agricultural activities.

The women's DDS is estimated using a count of nine food groups consumed over the preceding 24 hours; the food groups were developed by Kennedy et al. (2011). The nine food groups are: (1) starchy staples; (2) dark green leafy vegetables; (3) other vitamin A rich fruits and vegetables; (4) other fruits and vegetables; (5) organ meat; (6) meat and fish; (7) eggs; (8) legumes and nuts; and (9) milk and milk products. The three categories of the DDS score – low, medium, and high – are based on the number of these food groups consumed (Kennedy et al. 2011). A low DDS has no more than three of the food groups, while a medium DDS includes four to five of the food groups. A high DDS represents the consumption of more than five of the food groups. Dietary diversity scores have been positively correlated with macronutrient and micronutrient adequacy of diets for adults (Olge et al. 2001, Foote et al. 2004, Arimond et al. 2010). Savy et al. (2005) report a positive relationship between dietary diversity scores and nutritional status of adult women in rural Burkina Faso. Bhagowalia et al. (2012) found that Bangladeshi women who have a greater level of empowerment, as measured by their education, height, and attitudes towards abuse, decision-making power, and mobility, were associated with greater dietary

diversity scores and reduced levels of stunted children. Low DDS may present risks of micronutrient deficiencies, such as iron deficient anemia, that can affect a woman's ability to provide adequate care for her family and lower her income-generating potential (Haddad et al. 1994, WHO 2013).

Table 1: Summary Statistics

Variable	Description	Mean	Std. Dev
Demographic and Socio-economic Variables			
Age	Years	32.32	7.93
Education	1 = Some formal educational training; 0 = No education	0.09	0.28
Marital Status	1 = Married/Cohabitation; 0 = Not Married/ Cohabitating	0.96	0.20
Income Deciles		5.14	2.76
Household Hunger Scale	1= Moderate to severe hunger; 0 = Little to no hunger	0.38	0.48
Household Characteristics and Location Variables			
Household Size	Household members	6.21	3.08
Safe Drinking Water	1 = Household drinking water is safe; 0 = is not safe	0.70	0.46
Access to Electricity	1 = Access to electricity; 0 = No access to electricity	0.27	0.45
Private Toilet	1 = A private toilet in household; 0 = No toilet	0.14	0.35
Urban Locale	1 = Urban; 0 = Rural	0.23	0.42
Women Empowerment in Agricultural Variables			
WEAI Inadequacy Count	Inadequate > 0.20	0.34	0.18
Input in Productive Decisions	1 = Inadequate; 0 = Adequate	0.33	0.47
Autonomy in Production	1 = Inadequate; 0 = Adequate	0.26	0.44
Ownership of Assets	1 = Inadequate; 0 = Adequate	0.44	0.50
Purchase, Sale, or Transfer of Assets	1 = Inadequate; 0 = Adequate	0.73	0.44
Access to and Decisions on Credit	1 = Inadequate; 0 = Adequate	0.79	0.41
Control over Use of Income	1 = Inadequate; 0 = Adequate	0.22	0.42
Group Member	1 = Inadequate; 0 = Adequate	0.29	0.45
Speaking in Public	1 = Inadequate; 0 = Adequate	0.30	0.46
Leisure Time	1 = Inadequate; 0 = Adequate	0.13	0.34
Work Burden	1 = Inadequate; 0 = Adequate	0.45	0.50
Women Well-being Variables			
BMI	Underweight if BMI < 18.5	22.33	3.62
DDS	Score ranges from 0 to 9	3.99	1.59
Total Sample		**2,405**	

Women's Empowerment in Agriculture Index (WEAI)

The WEAI is a newly developed survey-based index that was created to monitor and evaluate women's empowerment in the agricultural sector. Development of the WEAI was a collaborative effort between USAID, International Food Policy Research Institute (IFPRI), and the Oxford Poverty and Human Development Initiative (OPHI). The WEAI measures the multi-dimensional aspects of gender inequality in agriculture. Previous empowerment measures are limited in their ability to measure women's decision-making and autonomy outside of the household and domestic activities (Alkire et al. 2012). Given the importance of women in agriculture, it is essential to have a tool, such as WEAI, that measures

the effect of agriculture interventions on women's empowerment within that sector. The WEAI is constructed using two weighted sub-indices developed by Alkire et al. (2012): (1) The Five Domain Empowerment Index (5DE); and (2) The Gender Parity Index (GPI).2 The 5DE index encompasses five domains of empowerment: production, resources, income, leadership, and time. The GPI, on the other hand, measures the empowerment of women compared to their male counterparts in the household. Thus, GPI is useful for male and female gendered households and not particularly useful when employed for female only gendered households. Given the study's focus on women's health and their empowerment, the GPI dimension is not included in the analyses.

The 5DE is constructed from the weighted summation of the adequacy scores of the ten indicators in the index's five domains. A woman is empowered if she is deemed adequate in four out of the five domains or has a score that reflects at least 80 percent adequacy (Alkire et al. 2012). In this study's sample, the average inadequacy score is 0.34, which is above the inadequacy threshold of 0.20 set by Alkire et al. (2012). Of the 2,405 respondents interviewed about women's empowerment, 1,740 have inadequacy scores above the threshold. In other words, over 72 percent of the women in this study are considered to not yet be empowered. Compared to other African countries where the WEAI survey has been conducted, Ghana has the highest rate of women who are not yet empowered; followed by Liberia and Kenya at 70 percent, and Zambia with 60 percent. At 30 percent, Rwanda has the lowest rate, and Uganda and Malawi have the second and third lowest rates, 42 and 48 percent, respectively (Malapit et al. 2014).

Table 2 provides the criteria used to determine adequacy in the ten indicators. For example, the production domain consists of two indicators that evaluate a woman's role in joint and sole decision-making with regards to agricultural practices and autonomy in agricultural product decisions, such as input purchases, livestock and cropping decisions, and whether or not to participate in marketing activities. In the survey, the autonomy questions focus on whether a woman makes a decision that is more in-line with her beliefs and values rather than the desire to please someone or avoid harm, e.g., being coerced into a decision. As measured by the 5DE, women in previous research reported having higher decision-making abilities and autonomy with regard to minor expenditures, health problems, or protection from violence (IFPRI, 2012).

The resource domain assesses a woman's ownership of, access to, and decision-making authority over resources such as land, livestock, equipment, and credit. Three indicators are included in

[2] For a complete discussion on the WEAI and pilot applications in various countries, see http://www.ifpri.org/publication/women-s-empowerment-agriculture-index.

this domain: (1) ownership of land and other assets; (2) decision-making on land and other assets; and (3) access to credit and decisions about credit. Compared to men, women are more likely to be credit constrained and have higher repayment rates, but choose to invest larger proportions of their resources into the well-being of their children and family (de Aghion and Morduch 2005, Pitt and Khandker 1998). A woman's control and influence over household decision-making processes is positively related to her ability to independently access financial resources (Sharma 2003).

A single indicator comprises the income domain, and it measures a woman's input into decisions concerning the use of income generated from agricultural-related activities and non-farm activities. This indicator also measures a woman's perceived control over personal decisions on wage/salary employment and household expenditures. Leadership, in the leadership domain, evaluates a woman's involvement in the community, and it is measured by two indicators: her membership in economic and social groups and her comfort speaking in public. These two indicators provide a perspective on a woman's comfort and ability to exert her voice and engage in collective action. The two indicators in the time allocation domain measure the time allocated to productive and domestic tasks and the availability of time for leisure activities, such as socializing with friends and neighbors, watching TV, or playing sports. In their 2012 study, Bhagowalia et al. found that women who are not yet empowered faced more time constraints than their counterparts.

Table 2. Adequacy Criteria for the Ten Indicators in the 5DE

Indicator	Adequacy Criteria
Input in Productive Decisions	A woman is adequate if she participates or feels she has input in at least two types of decisions.
Autonomy in Production	A woman has adequate achievement if her actions are motivated more by her values as opposed to her fear of disproval or feelings of coercion.
Ownership of assets	A woman is adequate if she has joint or sole ownership of at least one major asset.
Purchase, sale, or transfer of assets	On assets owned by a household, a women is adequate if she is involved in the decisions to buy, sell, or transfer assets.
Access to and decisions on credit	An adequate woman belongs to a household that has access to credit and when decisions on credit are made, she has input in at least one decision regarding at least one source credit.
Control over use of income	A woman is adequate if she has some input (or perceived input) on income decisions provided that she participated in the income generating activity.
Group Member	A woman is considered adequate if she is a member of at least one group from a wide range of economic and social groups.

Speaking in Public	A woman is deemed adequate if she is comfortable speaking in public in at least one context.
Leisure Time	A woman has adequate leisure time if she does not express any level of dissatisfaction with the amount of leisure time available.
Work Burden	A woman is considered to have an excessive workload and thus, inadequate if she worked more than 10.5 hours in the previous 24 hours.

Source: Alkire et al. 2012

Demographic and Socioeconomic Variables

The demographic and socioeconomic variables included in the model are income, age, education, and marital status. Per capita daily household expenditure is used as a proxy for income to form income decile groups to address outlier risks. Per capita daily household expenditure is computed based on a composite of four main sub-aggregates of consumption: (1) food items; (2) non-food items; (3) consumer durables; and (4) housing. Food items are comprised of purchased, home produced, and gifts. The monetary value of the home produced and food gifts is imputed using the unit price of the purchased good, provided that the household purchased food as well as consumed home produced and gifted food. In the case where the household did not purchase food but did consume home produced and gifted food, the monetary value of these home produced and gifted food items is based on the median price of food items consumed by similar households in the same district within the survey area. The four main consumption sub-groups are aggregated to estimate the total annual consumption expenditure for each household. That sum is then divided by household size and by 365 days to estimate the per capita daily expenditure3. Expenditures are reported in 2010 US dollar equivalents. Definitions for the remaining demographic and socioeconomic variables and the household characteristics are presented in the summary statistics table (Table 1).

Analysis and Results

The model is developed and estimated in two specifications. In the first specification, the overall aggregate 5DE, denoted by WEAI inadequacy count, is included in the model to isolate the effect of women's empowerment in agriculture on women's health status. In the second specification, the 5DE is decomposed into its ten indicators to investigate how each of these indicators directly impacts women's

[3] The composite variable for expenditure does not take into account the effect that seasonality may have on consumption patterns.

health status. As indicated in the methods section, women's BMI and DDS represent the observable endogenous variables determined by the latent variable, health status. In both specifications, individual and household variables are used for control purposes. The final analytic sample is 2,002 women with data on the overall adequacy score (Specification I) and 1,323 women with data on the ten indicators (Specification II)[4].

Prior to estimating the two specifications, correlation analyses were performed to address possible multicollinearity issues between the independent variables in both specifications. In each pairwise comparison, the correlation coefficient is less than 0.60 for Specification I and less than 0.50 for Specification II, implying that multicollinearity is not a large issue in these analyses. Also, the Variance Inflation Factors are less than ten and have a tolerance level greater than 0.10, suggesting that no severe multicollinearity issues are present within the two specifications.

The results from the two specifications are presented in Table 3. The results from the structural model are in the upper panel, and results from the measurement model for the health conditions are in the lower panel. To form the scale of the latent variable, the factor loading of the BMI indicator was set to one.

For comparison purposes, the results contain both unstandardized and standardized coefficients. The standardized coefficients are used for ease of interpretation and comparison of variables that are measured in different units. Additionally, the standardized coefficients display the actual weight, or factor loadings, on the BMI indicator that is fixed, i.e., constrained to one in the unstandardized results. In both specifications, probability weights are used to account for differential probabilities of selection and non-responses from the households rendering the estimation results representative of the population in northern Ghana. When using such probability weights, goodness of fit indicators are given by the Standardized Root Mean Squared Residuals (SRMSR).

[4] To assess the possibility of systematic differences between the two samples, Specification I was estimated using the sample size for Specification II (1,323 observations). The results from this estimation were consistent with the results from the original estimation of Specification I using 2,002 observations; thus, providing no evidence of significant systematic differences.

Table 3. Results of MIMIC Model of Women's Health Status in Northern Ghana

Structural Model	Specification I				Specification II			
	Coef.	**Stand. Coef.**	**Stand. Std. Err.**		**Coef.**	**Stand. Coef.**	**Stand. Std. Err.**	
Education	0.003	0.089	0.058		0.002	0.047	0.059	
Age (in yrs)	0.001	0.085	0.071		0.000	0.011	0.079	
Marital Status	0.003	0.014	0.052		-0.005	-0.020	0.063	
Household Hunger Scale	-0.018	-0.161	0.055	***	-0.016	-0.158	0.064	**
Income Deciles	0.010	0.541	0.070	***	0.010	0.558	0.085	***
Household Size	0.002	0.114	0.066	*	0.001	0.092	0.068	
Safe Drinking Water	-0.007	-0.054	0.051		-0.001	-0.007	0.059	
Access to electricity	0.018	0.152	0.064	**	0.007	0.064	0.070	
Private Toilet	0.008	0.050	0.054		0.001	0.008	0.061	
Urban Locale	0.043	0.337	0.062	***	0.041	0.315	0.067	***
WEAI Inadequacy Count	-0.015	-0.051	0.058					
Input in Productive Decisions					0.006	0.060	0.065	
Autonomy in Production					0.039	0.339	0.069	***
Ownership of Assets					-0.017	-0.164	0.072	**
Purchase, Sale, or Transfer of Assets					0.010	0.093	0.071	
Access to and Decisions on Credit					-0.026	-0.223	0.061	***
Control over Use of Income					-0.005	-0.036	0.070	
Group Member					-0.018	-0.155	0.057	***
Speaking in Public					0.007	0.063	0.064	
Leisure Time					-0.019	-0.136	0.056	**
Work Burden					-0.006	-0.061	0.062	
Measurement Model								
Log of BMI	1.000	0.339	0.041	***	1.000	0.3239	0.051	***
DDS	11.999	0.404	0.048	***	13.210	0.429	0.056	***
SRMR	0.016				0.014			
R-squared (overall model)	0.749				0.925			
Number of Observations	2,002				1,323			

*, **, *** denotes significance of standardized coefficients at the ten, five, and one percent levels, respectively. SRMR refers to Standardized Root Mean Squared Residual.

In the first specification, the household hunger scale, income decile groups, and urban locale variables are significant at the 1 percent level and have the expected signs. Access to electricity is significant at the 5 percent level, and household size is significant at the 10 percent level. The WEAI inadequacy count is not statistically significant in Specification I.

In Specification II, income and urban locale are significant at the 1 percent level as in Specification I, but household hunger scale is only significant at the 5 percent level. Access to electricity and household size are not significant. Half of the ten indicators in the decomposed 5DE are significant. Three of the indicators are statistically significant at the 1 percent level: autonomy in production, access to and decisions on credit, and group membership. The other two indicators are significant at the 5 percent level: ownership of assets and leisure time.

In the measurement model for both specifications, the coefficients on the latent variable for the health indicators, BMI and DDS, are positive and statistically significant, suggesting a causal structure with the single common latent variable, health status. The R2 value for the overall model in Specification II is 0.92 implying that nine-tenths of the variance in the latent variable is accounted for by the model's explanatory variables; compared to the lower R2 value of 0.75 in Specification I. The SRMR score was less than 0.05 for both specifications, indicating a good fit of the model.

Discussion

The results indicate that women's empowerment in agriculture, based on the 5DE index, does not have an impact on women's health status. However, when the index is decomposed into its ten component indicators, five of the indicators exhibit a statistically significant relationship with women's health status: access to and decisions on credit, ownership of assets, autonomy in production, group membership, and leisure time. These results and the direction of the relationship provide some support for our hypothesis that women with a high degree of empowerment have a high health status.

Adequacy in ownership and access to credit have a positive impact on women's health status. This is in-line with findings from previous studies that state that women's relative control over resources has a positive impact on their families' nutrition and health (Thomas 1997, Pitt and Khandker 1998). Owning assets may be a source of confidence for women, giving them increased bargaining power, so they can make better health-enhancing decisions. Women can also use these assets as collateral to secure resources that would increase their health status. These acquired resources may also be used to increase their productivity in income generating activities such as farming and other entrepreneurial activities. In addition, access to credit can enhance a woman's ability to pursue entrepreneurial opportunities. As previous literature has indicated, women's lack of resources is a major constraint on their productivity, despite being as efficient producers as men (FAO, 2011). By removing this resource

constraint and providing access to credit, women can procure resources that can effectively enhance their productivity and profitability.

Autonomy in production has a significant relationship with women's health status, and the direction of the relationship is negative. Thus, higher autonomy in production is associated with lower health status. Given the hypothesis that women's empowerment, which includes having autonomy in production, will improve women's health status, the direction of this relationship is unexpected. Further investigation into this variable uncovered a significant, positive association between autonomy and income. That is, a woman in a higher income group has a lower autonomy in production. The direction of this relation is also unexpected. These findings warrant further investigation into the relationship between a woman's autonomy in production and her health status, and between autonomy in production and income.

When looking at the effect of income decile groups on women's health status, the results indicate a significant positive effect. As income increases, a woman's health status increases. The results also indicate that income has the largest impact on women's health status. These findings are consistent with existing literature. An increase in a woman's income implies that she has the financial ability to purchase more nutritious foods for herself and her family and/or pay for the healthcare services that she or her family needs. Rubalcava et al. (2009) discovered that women living in a dual headed household allocated the additional income they received from a cash transfer program to expenditures on improved nutrition, child well-being, and small livestock animals – activities that are within their domain of responsibilities. This finding supports the belief that women are active in caring for and investing in child and household well-being. The foregoing research and the current study's findings validates the development and implementation of numerous income-generating initiatives in developing countries, and particularly in northern Ghana, which focus on shifting individuals and households from lower to higher income decile groups.

The fact that the indicators for group membership and leisure time play a significant role in improving women's health status provides support to Robeyns' (2003) selection of relevant capabilities. In her article, Robeyns expresses the importance of forming nurturing social relationships and enjoying leisure activities as a means for relaxation and fostering creativity. Building social networks and having the freedom to think creatively increases a woman's self-esteem and intrinsic sense of well-being and improves her health status. These social relationships and leisure time also give women resources and capabilities, i.e., mental clarity, strategic partnerships, and social support, to develop strategies to overcome challenges that they face and to maximize opportunities. Membership in agricultural or

economic groups provides a woman a forum to voice her opinions, challenge cultural prejudices and misconceptions, and participate in decision-making that can improve her productivity in agricultural-related activities, and ultimately, improve her and her family's well-being.

Incorporating women's views into local decisions is a primary focus for many women empowerment initiatives. In one particular initiative by the World Bank in Burkina Faso, women must provide at least 30 percent of the deciding vote for local decisions (Quisumbing et al. 1995). Being a part of a cooperative, particularly women-formed cooperatives, gives a woman an opportunity to improve their access to transportation, storage markets, and value-added processing. These groups also provide a social network that women can use to build strategic relationships within and outside their community and improve their position in supply chains by forming partnerships or alliances with downstream supply chain members.

Urban locale also has a significant and large impact on women's health status, which is not unexpected. Women living in urban areas have more access to markets with diverse foods. This is reflected in our study by women living in urban areas having a higher diet diversity score than those living in rural areas. Also expected is the positive impact that the household hunger scale, i.e., having adequate quantity of food to eat, has on women's health status. Both the quality and quantity of the food available to a woman has a positive impact on her health as captured by the significance of the locale and household hunger scale variables. A woman who lives in a household with little to no hunger does not have to spend time, one of her limited resources, searching for and providing food to feed herself and her family. Instead, a woman with a diverse diet and adequate amount to eat, can focus her attention and efforts on developing strategies and investing in entrepreneurial activities to increase her earning potential from both on- and off-farm, income-generating activities.

Conclusions

A substantial amount of attention from the development and agricultural communities has been focused on the importance of empowering women because of their significant role in agricultural production. However, for women to be effective in their responsibilities, women need to maintain an adequate health status. This study sought to examine the impact of women's empowerment in agriculture on women's health status using data from a 2012 population-based survey from northern Ghana. Results from the study indicate that some of the women empowerment indicators - ownership of assets, access to credit, autonomy in production, group membership and leisure time - have a significant impact on women's health status. Income, urban locale, and household hunger are important socio-economic variables that also have a significant impact on women's health status.

While empowering women is a goal within itself to achieve gender equality, our results indicate that women's empowerment can lead to achieving other development goals through its effect on women's health status, such as gains in human capital formation and improved agricultural productivity. Some key empowerment strategies for improving women's health status and production capabilities include developing initiatives that focus on increasing women's membership in social and economic groups, easing women's access to credit, and increasing women's incomes. Leaders in the agribusiness community, who know and understand these linkages between women's empowerment in agriculture and women's health status, can leverage these relationships and develop gender sensitive policies and programs that will have a positive impact on agricultural productivity and support growth in the agriculture sector.

References

Alkire, S., R. Meinze-Dick, A. Peterman, A.R. Quisumbing, G. Seymour, and A. Vaz. 2012. The Women's Empowerment in Agriculture Index. OPHI Working Paper no. 58. Oxford Department of International Development, Oxford. http://www.ophi.org.uk/wp-content/uploads/ophi-wp-58.pdf. [accessed Apr 30, 2013]

Arimond, M., D. Wiesmann, E. Becquey, A. Carriquiry, M. Daniels, M. Deitchler, N. Fanou-Fogny, M. Joseph, G. Kennedy, Y. Martin-Prevel, and L.E. Torheim. 2010. Simple Food Group Diversity Indicators Predict Micronutrient Adequacy of Women's Diets in 5 Diverse, Resource-Poor Settings. Journal of Nutrition 140: 20595-20695.

Bhagowalia, P., P. Menon, A.R. Quisumbing, and V. Soundararajan. 2012. What Dimensions of Women's Empowerment Matter Most for Children Nutrition? Evidence Using Nationally Representative Data from Bangladesh. IFPRI Discussion Paper 01192, International Food Policy Research Institute.

Bollen, K. A. 1989. Structural Equations with Latent Variables. New York, NY: John Wiley & Sons, Inc.

de Aghion, B.A. and J. Morduch. 2005. The Economics of Microfinance. Cambridge, MA: Massachusetts Institute of Technology.

De Schutter, O. 2013. Gender equality and food security: Women's empowerment as a tool against hunger. Asian Development Bank. http://www.adb.org/sites/default/files/pub/2013/gender-equality-and-food-security.pdf [accessed Dec 20, 2013].

(CDC) Centers for Disease Control and Prevention. 2014. Healthy Weight: Assessing Your Weight: BMI: About Adult BMI. http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html [accessed Aug 18, 2014].

(FAO) Food and Agriculture Organization of the United Nations. 2010. Agricultural value chain development: Threat or opportunity for women's employment? http://www.fao.org/docrep/013/i2008e/i2008e04.pdf [accessed August 18, 2014].

____. 2011. The State of Food and Agriculture 2010-11. Women in Agriculture: Closing the gender gap for development. http://www.fao.org/docrep/013/i2050e/i2050e00.htm [accessed May 27, 2014].

Ferraro, K. F.,Y. Su, R. J. Gretebeck, D. R. Black, and S. F. Badylak. 2002. Body Mass Index and Disability in Adulthood: A 20-Year Panel Study. American Journal of Public Health 92(5): 834–840.

Foote, J., S. Murphy, L. Wilkens, P. Basiotis, and A. Carlson. 2004. Dietary Variety Increases The Probability of Nutrient Adequacy Among Adults. Journal of Nutrition 134: 1779-1785.

Haddad, L., E. Kennedy, and J. Sullivan. 1994. Choice of indicators for food security and nutrition monitoring. Food Policy 19:329–343.

(IFPRI) International Food Policy Research Institute. 2012. Women's Empowerment in Agriculture Index. Feed the Future http://feedthefuture.gov/sites/default/files/resource/files/weai_brochure_2012.pdf [accessed Sept.13, 2013].

Joreskog, K. G. and A. S. Goldberger. 1975. Estimation of a Model with Multiple Indicators and Multiple Causes of a Single Latent Variable. Journal of the American Statistical Association 70 (351):631-639.

Kabeer, N. 1999. Resources, Agency, Achievements: Reflections on the Measurement of Women's Empowerment. Development and Change 30(3):435-464. http://onlinelibrary.wiley.com/doi/10.1111/1467-7660.00125/pdf [accessed May 27, 2014].

Kennedy, E. and M. Garcia. 1994. Body mass index and economic productivity. European Journal of Clinical Nutrition. 48(S3): S45-53.

Kennedy, G., T. Ballard, and M. Dop. 2011. Guidelines for Measuring Household and Individual Dietary Diversity. United Nations, Food and Agriculture Organization: Nutrition and Consumer Protection Division.

Krishnakumar, J. 2007. Going Beyond Functionings to Capabilities: An Econometric Model to Explain and Estimate Capabilities. Journal of Human Development 8(1):39-63.

Mabsout, R. 2011. Capability and Health Functioning in Ethiopian Households. Social Indicators Research 101:359-389.

Malhotra, A., S. R. Schuler, and C. Boender. 2002. Measuring Women's Empowerment as a Variable in International Development. World Bank, Washington, DC. http://siteresources.worldbank.org/INTGENDER/Resources/MalhotraSchulerBoender. pdf [accessed Nov. 25, 2013].

Malapit, H. J., K. Sproule, C. Kovarik, R. Meinzen-Dick, A. Quisumbing, F. Ramzan, E. Hogue, and S. Alkire. 2014. Measuring Progress Toward Empowerment Women's Empowerment In Agriculture Index: Baseline Report. The International Food Policy Research Institute http://www.ifpri.org/sites/default/files/publications/weaireport2013.pdf [accessed Sept. 30, 2014].

Ogle, B. M., P. H. Hung, and H. T. Tuyet. 2001. Significance of Wild Vegetables in Micronutrient Intakes of Women in Vietnam: An Analysis of Food Variety. Asia Pacific Journal of Clinical Nutrition 10: 21-30.

Pitt, M., and S.R. Khandker. 1998. The Impact of Group-Based Credit Programs on Poor Households in Bangladesh: Does the Gender of Participants Matter? The Journal of Political Economy 106(5):958-996.

Quisumbing, A.R., L.R. Brown, H. S. Feldstein, L. Haddad, and C. Pena. 1995. Women: The Key to Food Security. Food Policy Statement No. 21, The International Food Policy Research Institute.

Robeyns, I. 2003. Sen's Capability Approach and Gender Inequality: Selecting Relevant Capabilities. Feminist Economics. 9(2-3): 61-92.

Rubalcava, L., G. Teruel, and D. Thomas. 2009. Investments, Time Preferences and Public Transfers Paid to Women. Economic Development and Cultural Change 57(3): 507-538. http://www.jstor.org/stable/pdfplus/10.1086/596617.pdf?acceptTC=true [accessed Aug. 18, 2014].

Sahn, D.E. and S. D. Younger. 2009. Measuring Intra-Household Health Inequality: Explorations Using The Body Mass Index. Health Economics 18: S13–S36.

Samman, E., and M. E. Santos. 2009. Agency and Empowerment: A Review of Concepts, Indicators and Empirical Evidence. Oxford Poverty and Human Development Initiative. http://www.ophi.org.uk/wp-content/uploads/OPHI-RP-10a.pdf [accessed Jan. 13, 2014].

Savy M, Y. Martin-Prevel, P. Sawadogo, Y. Kamel, and F. Delpeuch. 2005. Use of variety/diversity scores for diet quality measurement: relation with nutritional status of women in a rural area in Burkina Faso. European Journal of Clinical Nutrition 59:703–16.

Smith, L. C., U. Ramakrishnan, A. Ndiaye, L. Haddad, and R. Martorell. 2003. The importance of women's status for child nutrition in developing countries. Research Report 131, International Food Policy Research Institute.

Sharma, M. 2003. "Microfinance." In Household Decisions, Gender, and Development, edited by A.R. Quisumbing, 195-99. Washington, DC: International Food Policy Research Institute.

Spanos, A. 1984. Liquidity as a Latent Variable: an Application of the MIMIC Model. Oxford Bulletin of Economics and Statistics 46:125-143.

Thomas, D. 1997. Incomes, expenditures, and health outcomes: Evidence on intrahousehold resource allocation. In Intrahousehold resource allocation in developing countries: Models, Methods, and Policy, edited by L. Haddad, J. Hoddinott, & H. Alderman, 142-164. Baltimore, Maryland: The Johns Hopkins University Press.

Wells, J.C.K. and M. S. Fewtrell. 2006. Measuring body composition. Archives of Disease in Childhood 91:612-617.

(WHO) World Health Organization. 2013. Global Database on Child Growth and Malnutrition. http://www.who.int/nutgrowthdb/estimates2012/en/index.html [accessed Nov. 29, 2013].

_____. 2014. Global Database on Body Mass Index. http://www.who.int/mediacentre/factsheets/fs311/en/ [accessed August 18, 2014].