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# A Synergetic Linkage between Agricultural Productivity, Nutrition and Health

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**ABSTRACT**
This study examined the effect of health and nutrition on labour productivity of farmers in South-western Nigeria. Within this geo-political zone of the country, primary data was collected through a field survey of 470 rural farmers. Descriptive statistics, Anthropometric measures of nutrition (BMI and DDS) and the Tobit model were used to show the effect of nutrition and health on the productivity of farmers. Estimated results show that body mass index (BMI) and dietary diversity score (DDS), which are nutritional variables, have effect on the frequency of the occurrence of sickness of rural farmers in the study area; thus affecting their productivity. These results help to establish the synergy between health, nutrition and productivity. Moreover, the policy implication of these findings point to the fact that poor health and malnutrition adversely affect productivity of labour, inversely establishing the fact that good health is a key element of development and a driver of growth. The need arises, therefore, to invest more on human capital, especially health in order to enhance the productive capacity of rural farmers.

**Keywords:** Agriculture, Health, Nutrition, Farmers' productivity, Southwestern Nigeria.



## INTRODUCTION

Agriculture, health and nutrition have long occupied and operated within separate realms. Analyses of agricultural production seldom recognize that health status can affect productivity or, that the production and use of agricultural goods can have health consequences. This separation is strange given that agriculture, health, and nutrition are tightly wedded. Agriculture is the primary source of calories and essential nutrients and is, presently, a major source of income for eighty percent of the world's poor (IFPRI and ILRI 2010). Agriculture-related health losses are massive, accounting for up to twenty-five percent of all disability-adjusted life years lost and ten percent of deaths in low-income countries (Gilbert et al. 2010 cited in IFPRI and ILRI 2010).

Agricultural productivity refers to the rate at which goods and services are produced in relation to the amount of materials used. It is the measure of how specified resources are managed to accomplish timely objectives stated in terms of quality and quantity. Eatwell and Newman (1991) defined productivity as a ratio of some measure of output to some index of input use; agricultural labour productivity is defined as the marginal efficiency level attained per unit of labour supplied for a specific task while health refers to "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO 1948). Nutrition is a dimension of health relating to the

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macro and micro nutrient adequacy of an individual's diet. Anything that affects agriculture will affect health and nutrition. Conversely, anything that affects health and nutrition will have implications for agriculture and productivity. As a result, we could assert that agriculture is the only realistic way for most people to get the nutrition they need. In many poor countries, agriculture is highly labour intensive, and productive agriculture requires the labour of healthy, well-nourished people. However, more than half of the world's poorest people live in farming communities, including many suffering from under-nutrition. Recent estimates suggest that globally, the combined effect of inadequate macro (protein–energy)- and micro-nutrient (including iron and iodine) intakes underpin 35 per cent of all child deaths and are responsible for 11 per cent of the global disease burden (Black et al. 2008). Finally, there is a reciprocal process in this relationship, whereby the health of individuals involved in agriculture may affect agriculture itself; an unhealthy agricultural population may provide less labour and resources, with consequences for productivity and implications for consumers.

Hunger and poor nutrition have severe and sometimes fatal consequences for people's health, particularly, women and children. Such consequences include greater susceptibility to a range of infectious diseases. Agriculture is dominated by smallholders; many of these suffer from poverty, malnutrition, and poor health. World Health Organization (2008, 2009) reports show that 35 million people died in 2005 due to diet-related, non-communicable diseases, amounting to 60 percent of total deaths globally – this number is expected to rise by 17 percent over the next decade. Health costs and loss of production, due to non-communicable diseases in 23 low and middle-income countries, have been estimated at $84 billion between 2006 and 2015 (Abegunde et al 2007). Agriculture and disease affect one another in a bidirectional manner. While agricultural development projects may affect disease causation, diseases that afflict farmers may negatively affect their productivity (or require adjustments in labour allocation).

Health and nutritional status are directly linked through a synergetic relationship. undernutrition is one of the major causes of immune deficiency. Illness on its part impairs nutritional status by reducing both appetite and the body's ability to absorb nutrients, which in turn lowers the individual's resistance to further illness (Scrimshaw 2003). Health status can have a significant impact on nutritional outcomes by affecting a household's ability to take part in productive activities that generate food or income to purchase food. Poor health potentially contributes to undernutrition through a number of pathways such as: decreased work productivity resulting from ill or deceased household members; increased medical and health care costs for households and villages, especially with the return of many sick urban dwellers and migrant labourers; increased household dependency ratios through loss of productive adults and addition of orphans of dead relatives into households; and loss of local intergenerational knowledge and skills (FAO 2002; UN 2004).

Following the pathways above, it has been shown that sickness and death result in a reduction of cultivated land, yields, and crop varieties (UN 2004; Gillespie and Kadiyala 2005. Health problems may trigger a cycle of lowered agricultural productivity and poverty. Improvement in agriculture labour productivity is crucial to developing economies, where agriculture is a major source of employment and livelihood for citizens. Studies carried out in countries like Sierra Leone, India, Sri Lanka, the Philippines, Ethiopia, and Mali to assess the impact of health and nutrition on productivity of agricultural workers show that poor health (defined broadly in terms of nutritional and health status) has significant impacts on farm productivity. Other studies have measured farm-labour productivity as output per unit of time per farm worker; or, as value of goods and services produced in a period of time, divided by the hours of labour used to produce the goods and services. It should be noted, however, that labour productivity may not completely capture workers' efficiency: a farm can boost output per worker by introducing machinery or adopting a new technology. Conversely, a farm can lose output per worker if a disease strikes the workforce. This study focused on farm-labour productivity, a term widely used in the empirical literature. However, the full impact of diseases on productivity is captured by measuring days of work missed at the household level. Poor health (from whatever cause) can inflict great hardships on households, including debilitation, substantial monetary expenditures, loss of labour, and sometimes death. More broadly, the health and nutritional status of adults affects their ability to work, and thus underpins the welfare of the household, including the children's development. Moreover, clinics in rural areas often lack adequate equipment or trained health personnel, and in many countries they require payment before providing service. In the absence of health insurance, rural people are often unable to afford healthcare of any kind. Poor health in turn affects agricultural productivity. Poor health or illness impairs farmers' ability to innovate, experiment, and implement changes, and to acquire technical information available through extension activities. Healthcare expenses may consume resources that otherwise might be used to purchase improved seed, fertilizer, equipment, or other inputs. Households with sick members are less able to adopt labour-intensive techniques. In reality, health threats affect the demand for agricultural output. The long-term household impacts of ill health include loss of farming knowledge, reduction of land under cultivation, planting of less labour-intensive crops, reduction of variety of crops planted, and reduction of livestock. Farm households attempt to address the shortage of labour through various methods, such as reducing the area under cultivation or narrowing the range of varieties planted on the farm. Beyond the direct impacts due to loss of labour, illness undermines long-term agricultural productivity in a number of ways. When illness leads to long-term incapacitation, households may resort to withdrawing savings, selling important assets, withdrawing children from school, or reducing the nutritional value of their food consumption. All of these emergency responses can have adverse effects on the long-term labour productivity of household members (Asenso-Okyere et al. 2011).

Low labour productivity is a distinguishing characteristic of developing-country agriculture. Labour productivity (measured in terms of agriculture value-added per worker) is quite low in low-income or developing countries, compared to high and middle-income countries, which rely more on farm machinery than labour. Rampant poor health among the adult population in developing countries contributes to low productivity. For instance, in Oyo State, one of the Southwestern states of Nigeria, the estimated average number of workdays lost per year due to malaria was 64 days in agrarian households (Asenso-Okyere et al. 2011). Caregiving responsibilities also take time away from productive work.

Agriculture has made remarkable progress in the past decades but progress in improving the nutrition and health of poor farmers in developing countries is lagging behind. Agriculture has the potential to greatly reduce poverty- a key contributor to poor health and undernutrition. Some 75 percent of the world's poor people live in rural areas. In sub-Saharan Africa, for example, agriculture employs 65 percent of the labour force and generates 32 percent of growth in gross domestic product (World Bank 2007). Impaired human health lowers both labour productivity and human capital accumulation. Malnutrition is responsible for 3 percent of the disease burden in low-income countries, enhances vulnerability to disease leading to decline in productivity (WHO 2010). The dilemma posed by poverty and low agricultural productivity of farmers in tropical countries in spite of generous natural resource endowments has continuously baffled agricultural policy makers. Most farmers in Nigeria have not yet achieved a high level of productivity using improved technologies developed over the past two decades.

As pointed out earlier, agriculture, health and nutrition are already deeply entwined. There is therefore the need for multi-disciplinary studies linking general welfare, nutrition, health and labour productivity. The basic question in the theory of human capital is: what contribution of changes in the quality of the life of the people to economic development is attributable to health and nutrition? A person's physical productive ability does not only depend upon his skills, but also upon his physical and mental health as well as the level of his nutritional status from which he derives his immediate energy requirements (Okoruwa and Agulanna, 2004).

In this study the effects of nutrition and ill health on labour productivity in Southwestern Nigeria was examined with the following as objectives:

(i) to identify and examine the causes of farmers' ill health in the study areas;

(ii) to assess the nutritional status of farmers in the study areas;

(iii) to determine the effect of the nutritional intake of farmers on their health status;

## MATERIALS AND METHODS

**The Study Area:** This study was carried out in Southwestern Nigeria – an area that falls on latitude $6^0$ to the North and latitude $4^0$ to the South. It is marked by longitude $4^0$ to the West and $6^0$ to the East. The geographical location of Southwest Nigeria covers about 114, 271 kilometres square, that is, approximately 12 percent of Nigeria's total land mass. The vegetation in the area is typically rainforest. The total population of the area is put at 27,581,992, out of which more than 96 percent is Yoruba (NPC, 2006). Southwestern Nigeria is bounded in the North by Kogi and Kwara states, Edo and Delta states in the East, the Atlantic Ocean in the south and by Republic of Benin in the West. Southwestern Nigeria comprises of six states (Oyo, Osun, Ogun, Lagos, Ondo and Ekiti) out of which Osun and Ogun states were randomly selected for this research.

**Sampling Procedure:** Primary data was used in this study. The data was sourced by participatory observation and administration of well-structured questionnaires to sampled farmers in the study areas. Data were collected from the farmers and their households on socioeconomic and demographic characteristics, education, housing and housing conditions, living conditions and their environment, consumption patterns, health and nutritional status. This was supplemented with information from secondary sources such as World Bank and National Bureau of Statistics (NBS).

**Methods of Data Analysis:** Analysis was carried out using descriptive statistics, anthropometric measures namely Body Mass Index (BMI) and Dietary Diversity Score (DDS) and the Tobit regression model. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters square and classified into categories defined by the World Health Organization (WHO). Individuals are considered to be chronically energy deficient if they have BMI below 18.5, overweight if they have BMI greater than 25 and obese if they have a BMI greater than 30.

$$BMI = \text{Weight (in kilograms)}/\text{Height}^2 \text{ (in meters)}$$

Diet diversity score (DDS) was calculated as the number of food groups consumed during the diet-recording period. In this study, DDS was based on 16 food groups, namely cereals, vitamin A rich vegetables and tubers, white tubers and roots, dark green leafy vegetables, other vegetables, Vitamin A rich fruits, other fruits (Including wild fruits), organ meat (Iron rich), flesh meats, eggs, fish, legumes, nuts and seeds, milk and milk products, oils and fats, sweets, spices, condiments and beverages. The DDS is the sum of all the food groups consumed by an individual. The effects of the nutritional intake of farmers on their health status were identified with the use of the Tobit Regression model.

**The Tobit Model:** The Tobit model is a nonlinear model and thus, similar to the probit and logit models, it is estimated using maximum likelihood estimation techniques. The likelihood function for the Tobit model takes the form:

$$\text{Log } L = \sum_{Y_j>0} -\frac{1}{2}\left[\log(2\pi) + \log\sigma^2 + \frac{((Y_j - \beta X_j)^2)}{\sigma^2}\right] + \sum_{Y_j>0} \log\left[1 - F\left(\frac{\beta X_j}{\sigma}\right)\right]$$

$$SL = f(BMI, DDS, WT, ME, MF, RD, E, G)$$

Where:

**SL** = proportion of number of workdays lost by the farmers due to sickness e.g. if sick for 4 days out of 30 days then SL is 4/30 or 0.1333.

**BMI** = Body Mass Index

**DDS** = Dietary Diversity Score

**WT** = Source of drinking water scored as 1 for stagnant rainwater, otherwise 0; 1 for stream or river water and otherwise 0.

**ME** = Means of excreta disposal scored as 1 for latrine, otherwise 0; 1 for water closet and otherwise 0.

**RD** = Distance of place of refuse disposal from houses (metres)

**MF** = Type of medical facility or source of treatment {traditional with herbs (scored as 1, otherwise 0); hospital 1, otherwise 0; combination of traditional, self and hospital 1, otherwise 0; traditional and hospital 1, otherwise 0; self-medication 1, otherwise 0; hospital and self-medication 1, otherwise 0; traditional and self-medication 1, otherwise 0}.

**E** = Farmers' Educational level in years (6 for primary school, 11 for secondary school, 14 for college of education, 13 for polytechnic OND, 15 for polytechnic HND, 15 for university).

**G** = Farmers' age (years)

## RESULTS

### Socio-economic Characteristics of Respondents

The socio-economic characteristics of the respondents were described using descriptive statistics of frequency and percentage distribution tables. Table 1 reveals that majority of the respondents were males (98.1%), between the ages of 40-59 (64.9%) and married (94.9%). The mean age of the respondents was 51.9 while age 52 was the most common in the study areas indicating that they are still in their productive years. 37.9% of the respondents had secondary education.

**Table 1:**
**Socio-economic Characteristics of farmers**

| Variables | Frequency | Percentage |
|---|---|---|
| Gender | | |
| Male | 461 | 98.1 |
| Female | 09 | 1.9 |
| Age | | |
| 20-39 | 44 | 9.4 |
| 40-59 | 305 | 64.9 |
| 60-79 | 121 | 25.7 |
| Mean 51.9 | S.D. 9.7 | Mode 52 |
| Educational status | | |
| Primary | 171 | 36.4 |
| Secondary | 178 | 37.9 |
| Tertiary | 121 | 25.7 |
| Mean 9.9 | S.D. 3.2 | Mode 11 |
| Marital status | | |
| Single | 20 | 4.3 |
| Married | 446 | 94.9 |
| Widowed | 4 | 0.8 |
| Divorced/ Separated | nil | - |
| Labour type | | |
| Self | 132 | 28.1 |
| Family | 114 | 24.3 |
| Hired | 224 | 47.7 |
| Mean 2.2 | S.D. 0.9 | Mode 3 |
| Farm size( Hectares) | | |
| Less than 1 | 11 | 2.3 |
| 1-9 | 212 | 45.1 |
| 10-19 | 170 | 36.2 |
| 20-29 | 71 | 15.1 |
| 30 and above | 6 | 1.3 |
| Mean 2.7 | S.D 0.8 | Mode 2 |

*Source: Computed from Field Survey (2010)*

Farmers that owned between 1-9 hectares of land constituted the majority (45.1%) in the study areas with the average land size of 2.7+ 0.8 hectares. 47.7% of the farmers used hired labour for farm work.

### Description of farmers' health status

It was observed in table 2 that about 91 percent of the farmers were sick for up to two times during the period of the survey. Respondents indicated that sicknesses affected their daily farming activities with about 30 percent losing between 12 and 17 days of farming activities due to sickness and also about 30 percent losing between 12 and 17 days of farming activities due to caring for sick household members.

**Table 2:**
Farmers' Health Status

| Variables | Frequency | Percentage |
|---|---|---|
| Source of water | | |
| Stagnant rain water | 160 | 34 |
| Stream/ River | 132 | 28.1 |
| Tap/ Public pipe | 29 | 6.2 |
| Well/ borehole | 149 | 31.7 |
| Source of medical treatment | | |
| Native | 267 | 56.8 |
| Hospital/ Health centre | 43 | 9.2 |
| Combination | 160 | 34.0 |
| Distance to refuse disposal | | |
| 6-10 metres | 353 | 75.1 |
| 11-15 metres | 117 | 24.9 |
| Mean 2.3 | SD 0.4 | Mode 2 |
| Toilet type | | |
| Open ditch | 218 | 46.4 |
| Latrine | 223 | 47.4 |
| Water closet | 29 | 6.2 |
| Days lost due to sick household member | 90 | 19.2 |
| 0-5 | 120 | 25.5 |
| 6-11 | 140 | 29.8 |
| 12-17 | 70 | 14.9 |
| 18-23 | 50 | 10.6 |
| 24-29 | | |
| Frequency of sickness | | |
| 0-2 | 426 | 90.6 |
| 3-5 | 37 | 7.9 |
| 6-8 | 7 | 1.5 |
| Days lost due to sickness | | |
| 0-5 | 62 | 13.2 |
| 6-11 | 115 | 24.5 |
| 12-17 | 139 | 29.6 |
| 18-23 | 120 | 25.5 |
| 24-29 | 34 | 7.2 |

*Source: Computed from Field Survey (2010)*

Mode of treatment while sick revealed that majority of the farmers (56.8%) used native or traditional medicine with herbs. Majority of the respondents lost 12-17 days of farm work due to sickness, accounting for 29.6% with a frequency of 0-2 times of sickness and 12-17 days lost due to the illness of a member of the household, accounting for 29.8% of farm work time. 75.1% of the farmers had a distance of six to ten metres of their house to the source of refuse disposal. Forty-seven percent (47.0%) of the respondents used the latrine system for disposal of excreta and 34% of the respondents depended on rain water as the source of water for drinking.

**The nutritional status of farmers in the study areas**

Table 3 and figure 1 show the body mass index of the respondents with a minimum value of 15, a maximum value of 38 and the average BMI of 24.73±5.26. The body mass index was further classified into categories according to the World Health Organization definition (WHO, 2010) and it was discovered that majority of the respondents (35.5%) were overweight when compared with the other groups of 17%, 29.1%, 15%, 3.2% being underweight, normal weight, obese 1 and obese 2 respectively.

Table 4 and figure 2 show the dietary diversity score for each respondent. Respondents with a score of seven food groups have the highest of 20.6% out of sixteen listed food groups with an average of 6.96±1.79. From a priori knowledge, a person with a lower BMI is supposed to have a low DDS. However, this supposition was not corroborated by this study probably because the people, being rural farmers, though may eat much, the food eaten lack the appropriate nutritional value or contents. Also, this may be as a result of their cultural beliefs and background. Most people in this part of Nigeria eat more of monotonous meals than diversified ones.

**Table 3:**
Body Mass Index (BMI)

| BMI | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| <18.5 | 80 | 17.0 | 17.0 | 17.0 |
| 18.5-24.9 | 137 | 29.1 | 29.1 | 46.2 |
| 25.0-29.9 | 167 | 35.5 | 35.5 | 81.7 |
| 30.0-34.9 | 71 | 15.1 | 15.1 | 96.8 |
| 35.0-39.9 | 15 | 3.2 | 3.2 | 100 |

*Source: Computed from Field Survey (2010)*

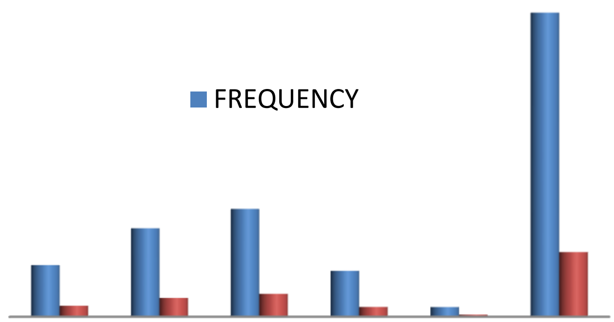


**Fig 1:**
Frequency Distribution of Body Mass Index
Source: Computed from Field Survey (2010)

**Table 4:**
Dietary Diversity Score (DDS)

| Food Groups | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| 4 | 37 | 7.9 | 7.9 | 7.9 |
| 5 | 73 | 15.5 | 15.5 | 23.4 |
| 6 | 90 | 19.1 | 19.1 | 42.6 |
| 7 | 97 | 20.6 | 20.6 | 63.2 |
| 8 | 77 | 16.4 | 16.4 | 79.6 |
| 9 | 50 | 10.6 | 10.6 | 90.2 |
| 10 | 33 | 7.0 | 7.0 | 97.2 |
| 11 | 13 | 2.8 | 2.8 | 100.0 |
| Total | 470 | 100.0 | 100.0 | |

*Source: Computed from Field Survey (2010)*

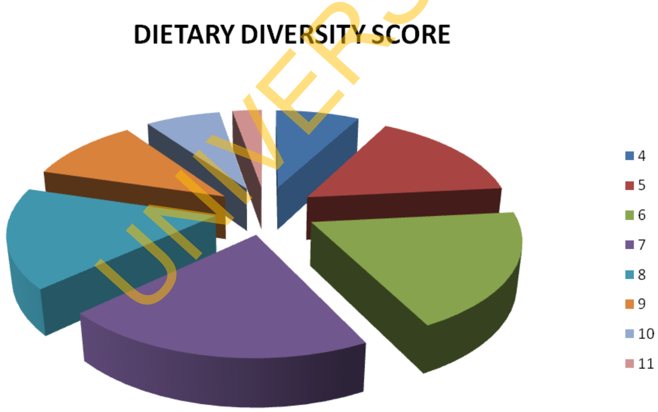


**Fig 2:**
Frequency Distribution of the Dietary Diversity Score
Source: Computed from Field Survey (2010)

**Determinants of the effect of nutritional status of farmers on their health status**

The determinants of the effect of nutritional status of farmers on their health status were identified using the Tobit model. The estimates of the Tobit model are presented in Table 5. Eight out of fifteen variables considered in the model were significant at five percent level of significance and two at ten percent level of significance. The following variables were found to have statistically significant influence on the frequency of sickness: age, distance of house to the source of refuse disposal, rain as source of drinking water, latrine as a means of excreta disposal, body mass index, dietary diversity score, years of education, self-medication, and traditional means of treatment such as herbs and a combination of traditional and self-medication. The results showed that as there is an increase in the frequency of sickness, there is also an increase in the use of traditional medicine and self-medication with herbs for treatment of various sicknesses. This conforms to *a priori* knowledge which implies that the farmers tend to use more of traditional medicine and self-medication instead of orthodox medication when sick. In like manner, the nearness of the site of refuse disposal to peoples' residence, the higher the frequency of occurrence of sickness. This is in conformity with *a priori* knowledge.

Body mass index (BMI) was found to have a negative significant influence on the frequency of sickness; implying that the higher the BMI, the lower the rate of occurrence of sickness and the lower the BMI, the higher the rate of sickness. In other words, people with a lower BMI may be more prone to sickness since they may be underweight. Similarly, the dietary diversity score (DDS) has an influence on the frequency of sickness. Contrary to *a priori* expectation, it was discovered that there is an increase in the occurrence of sickness alongside an increase in the number of food groups consumed by the farmers. This situation may be due to farmers' lack of knowledge on the type of food that can improve their health status and also the environment promotes monotonous types of food than diversified ones.

Considering the type and/or means of excreta disposal, the latrine and water closet have negative significant influence on the frequency of sickness. This shows that when farmers and their households resort to the use of latrine / WC for their excreta disposal, this will lead to a reduction in the occurrence of sicknesses or number of days of illnesses. Similarly, as farmers grow older and are exposed to better knowledge on waste management or disposal, this will help reduce disease occurrence.

**Table 5:**
Tobit estimates, marginal effects and elasticities of the effect of nutritional status of farmers on their health status.

| Variables | Coefficient | t-value | dy/dx | z-value |
|---|---|---|---|---|
| Age | -0.003 (0.001) | -2.41** | -0.003 (0.001) | -2.41** |
| Educ | 0.007 (0.003) | 1.99** | 0.007 (0.003) | 1.99* |
| Rain | -0.042 (0.022) | -1.91* | -0.042 (0.022) | -1.91* |
| River | 0.027 (0.023) | 1.19 | 0.027 (0.023) | 1.19 |
| Latrine | -0.100 (0.021) | -4.73*** | -0.100 (0.021) | -4.73*** |
| Water closet | -0.025 (0.043) | -0.59 | -0.025 (0.043) | -0.59 |
| Refuse distance | -0.031 (0.005) | -6.92*** | -0.031 (0.005) | -6.92*** |
| Trad medicine | 0.185 (0.040) | 4.56*** | 0.185 (0.040) | 4.56*** |
| Tradselfhosp | 0.027 (0.023) | 1.16 | 0.027 (0.023) | 1.16 |
| Tradhosp | 0.056 (0.043) | 1.31 | 0.056 (0.043) | 1.31 |
| Selfmed | 0.125 (0.046) | 2.69** | 0.125 (0.046) | 2.69* |
| Hospself | 0.063 (0.042) | 1.49 | 0.063 (0.042) | 1.49 |
| Tradself | 0.069 (0.040) | 1.73* | 0.070 (0.040) | 1.73* |
| BMI | -0.009 (0.002) | -4.40*** | -0.009 (0.002) | -4.40*** |
| DDS | 0.018 (0.006) | 3.10*** | 0.018 (0.006) | 3.10*** |
| Constant | 0.596 (0.181) | 3.30*** | | |
| Log likelihood | 47.875 | | | |
| LR chi2 | 165.55 | | | |
| Prob>chi2 | 0.0000 | | | |

Source: Computed from Field Survey (2010)
Dependent variable
**SL**: Proportion of number of workdays lost by the farmers due to sickness e.g. if sick for 4 days out of 30 days then SL is 4/30 or 0.1333.
y = Linear prediction (predict) = 0.504
(*) dy/dx is for discrete change of dummy variable from 0 to 1
***Significant at 1% **Significant at 5% *Significant at 10%
Number of observations = 470 Values in parentheses are standard error
Note: Educ= level of education in years, tradselfhosp= combination of traditional, self and hospital as a source of treatment; traditional and hospital; self-medication; hospital and self-medication; traditional and self-medication. BMI= Body Mass Index; DDS= Dietary Diversity Score.



**Marginal Effects and Elasticities of Tobit coefficients**

Table 5 also shows the marginal effects after tobit. Result from the table reveals that age of farmers (p<0.05), distance of refuse dumps from living houses (p<0.01), rain as a source of water for drinking (p<0.10), latrine for disposal of excreta (p<0.01), BMI (p<0.01), DDS (p<0.01), Education (p<0.10), Traditional medicine for treatment when sick (P<0.01 ), self-medication (p<0.10), combination of traditional and self-medication (p<0.10) were all significant at between 1 percent (p<0.01) and 10 percent (p<0.10) levels of significance. The computed marginal coefficient of age is 0.003 implying that a one percent or unit increase in age will reduce the number of workdays lost by the farmers due to sickness by 0.003 days that is, as age increases, the farmers tend to have additional knowledge on how to take care of their bodies to avoid certain illnesses. Also, a one percent or unit increase in the distance to the source of refuse disposal will reduce work days lost due to sickness by 0.031 days which is in conformity with a priori expectation that is, the farther the distance, the lesser the occurrence of sickness. Rain as a source of drinking water had a value of 0.042 implying that a unit or one percent increase in the use of rain water for drinking will lead to a reduction in the workdays lost due to sickness by 0.042. This may be so because rain water may be a better source of water than flowing streams or rivers that might have been contaminated in the rural areas. Latrine as a means of excreta disposal has a coefficient of 0.100 and found to be significant as this seems to be a better means of disposal, a one percent increase in the use of latrine gives a 0.100 reduction in the workdays lost due to sickness. Years of schooling was found to have a value of 0.007 implying that a one percent increase in the level of education will increase work days lost due to sickness by 0.007. This is contrary to a priori expectation since it is expected that the higher the level of education, the higher the knowledge on health and nutrition that may help reduce occurrence of sicknesses and diseases. The use of traditional medicine, self-medication in form of herbs and the combination of the two were found to have

0.185, 0.125 and 0.069 values respectively implying that a one percent increase in the use of traditional medicine, self-medication and the combination of the two will increase workdays lost due to sickness by these values. This may be due to the fact that orthodox medicine or the use of health centres may be better sources of treatment as some of the constituents of the herbs being used may also have adverse effects on their health status since they are not mostly quantifiable. Body Mass Index (BMI) was found to have a value of 0.009 implying that a one percent increase in BMI gives rise to a reduction in the work days lost due to sickness by 0.009. This may be due to the fact that BMI does not distinguish between muscularity and adiposity. Dietary Diversity Score (DDS) had a value 0f 0.018 implying that a unit increase in DDS will increase workdays lost due to sickness by 0.018. This is contrary to a priori expectation as one will expect that an increase in the number of food groups consumed will give rise to a reduction in the number of workdays lost due to sickness but this result may be due to the fact that the farmers may consumed more food that are monotonous considering the location or areas of the study as people in these areas tend to eat more of monotonous food.

## DISCUSSION

The study investigated the effect of the nutritional status of farmers on their health. It was revealed that nutrition and health impact on farmers' productivity or work output. The reason, as the study revealed, is that nutrition, health and productivity are mutually interdependent. There are indications that inadequacy in farmers' diets makes them susceptible to sicknesses or diseases which affected their productivity. Consumption of unsafe food and water is one of the major causes of preventable illness, which can eventually lead to death. A farmer and his household's productivity depend on its health. In addition to the loss of household labour, health problems lower productivity in several ways. Illness impairs the farmer's ability to innovate, experiment, and implement technical changes. Healthcare expenses may consume resources that otherwise might be used to purchase improved seed, fertilizer, equipment, or other inputs. Also, households with sick family members are less able to adopt labour-intensive techniques. The long-term household impacts of ill health include loss of farming knowledge, reduction of land under cultivation, planting of less labour-intensive crops, and reduction of variety of crops planted. Furthermore, debilitating effects of malnutrition and sickness on farm labour and its reducing effects on farmers' efficiency level cause low productivity in the study areas. Thus, the health and nutrition of rural farmers determine, to a large extent, their productivity and, ultimately, affect the agricultural sector as a whole. Based on the findings of the study, should be enlightenment programmes on how to improve living conditions, particularly in rural communities; refuse dumps should be kept far from houses to reduce the incidence of disease; there is need for nutritional programmes that will help educate farmers on appropriate food intake for good health and maximum productivity; rural development policies should be backed by health policies that place greater emphasis on preventive health care rather than curative health services. Farmers should be enlightened and encouraged on the necessity of balanced diets as this will promote good health and enhance their productive capacity. Farmers should also be encouraged and given the needed assistance to diversify the production of food crops as this will help meet the nutritional requirements for their labourious work. There is need for more effort to exploit the synergies among agriculture, nutrition, and health which is still in its infancy, because this effort offers real potential for improving the lives of millions of people worldwide.

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