

## DETERMINANTS OF VEGETABLE CONSUMPTION AMONG HOUSEHOLDS IN RURAL PHILIPPINES

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### **Abstract**

*Despite the availability of vegetables, a large proportion of the Philippine population consumes an inadequate amount of vegetables. Low vegetable consumption is among the top risk factor contributing to several health problems. This study investigates the determinants of vegetable consumption particularly in Isabel, Leyte, Philippines using a cross-sectional data analysis. The descriptive analysis shows that the average daily vegetable consumption per capita is 48.2 grams lower than the recommended standard set by the World Health Organization (WHO) or Food and Nutritional Research Institute (FNRI). The regression analysis suggests that households who produce their own vegetables consume more vegetables. However, as income increases, vegetable consumption decreases because households opt to consume more meat products. Results of the study suggest that localization of vegetable supply is one of the feasible options that policymakers can consider in increasing vegetable consumption.*

**Key words:** food availability, vegetable intake, household characteristics, rural Philippines

### **INTRODUCTION**

Low fruit and vegetable intake is one of the main contributors of micronutrients deficiency in developing countries. According to the World Health Organization (WHO) an estimated 3.9 million deaths worldwide were attributable to inadequate fruit and vegetable consumption [28]. Fruit and vegetable consumption is undeniably an essential part of a healthy diet. A high vegetable intake decreases the risk for many chronic diseases such as cataract formation, chronic obstructive pulmonary disease, tuberculosis and hypertension [26]. The World Health Organization (WHO) recommended daily fruit and vegetable consumption for an adult is at least 400 grams per day [28].

People who eat more vegetables are likely to have a reduced risk of some chronic diseases. Vegetables are rich sources of vitamins, minerals and fiber. Consuming adequate and varied types of vegetables can provide essential nutrients. Vegetables are an essential component of a balanced diet. However, large proportion of adults in Asia consume an inadequate amount of fruits and vegetables [17]. Their results show that 63.5% of men

and 57.5% of women consume an inadequate amount of fruits and vegetables. Many developing nations reported having low consumption of fruits and vegetables [10].

In the Philippines, previous studies show that vegetable intake is inadequate. The daily vegetable intake among Filipino is only 110 grams and made up 13 % of the daily food intake [11]. This included green leafy vegetables at 30 grams per day and other vegetables at 80 grams per day. The most commonly eaten vegetables are squash, string beans, gourds, eggplant, spinach, sweet potato and moringa [11]. The Filipino's average daily vegetable consumption is way below the recommended consumption of 400 grams daily [6]. This is not unusual because low vegetable intake is prevalent in low and middle income countries [4]. The below-average vegetable consumption is one of the factors contributing to the inadequacy of micronutrient needs of Filipinos. The government must continually initiate programs to improve the nutritional status of the Philippine population.

There are previous researches that identify the factors associated with vegetable intake. Factors like age, sex, per capita household

income and education were positively associated with fruits and vegetable intake, whereas smoking habit showed a negative association with fruits and vegetable consumption [2]. Similarly another study found that age and sex were significant factors affecting fruit and vegetable consumption [18]. In addition, sex is related to fruit and vegetable consumption, with girls consuming more servings than boys [21]. Others found that participants increase in weight status as they age due to low fruit and vegetable consumption [12].

Low socioeconomic status is associated with less intake of vegetables. Dietary intake of vegetables is directly related to income [14]. Income is a significant determinant influencing vegetable consumption [14]. These findings were supported by previous studies showing that income has a positive or direct relationship toward fruits and vegetable intake [5] [8]. However, other studies found that there is no relationship between income and dietary intake. For example, a study suggested that parents' income was not significantly associated with a child's fruits and vegetable consumption [1]. Others reported that education, age, ethnicity, income, residence location, smoking status, and health condition were significant predictors of fruits and vegetable consumption [29]. The percentage of youth who consumed green vegetables and starchy vegetables decreased slightly with age [16].

In the Southern Philippines, low vegetable yields combined with distance to market have made vegetable unaffordable and inaccessible to many threatening household food security [13]. To address this problem, there have been innovations to intensity vegetable productions [3], [13], [24]. However, despite these local efforts, vegetable consumption appears to be low.

In the Philippines particularly in Leyte island, few studies investigate the determinants affecting vegetable consumption. Hence, it is essential to document information that will explain what factors contribute to vegetable consumption. Results of the study could provide valuable information to implement

public health policies and dietary recommendations. A healthy diet is vital in a developing country like the Philippines, where the poverty level remains high [7], [20], [23]. Poor nutrition and lack of food access are among the most abject manifestations of poverty [27]. To add more information to the literature related to determinants of vegetable consumption, this study will examine factors affecting vegetable intake, particularly in the municipality of Isabel located in Leyte island, Philippines. It is necessary to investigate not only the current level of vegetable consumption but also the factors associated with vegetable intake. Results of the study will encourage the implementation of public policies for increasing fruit and vegetable intake.

## MATERIALS AND METHODS

### Study site

The selected study site is in the municipality of Isabel, located in the northern portion of Leyte, Philippines. The municipal center of Isabel is situated at approximately 10° 56' North, 124° 26' East with an estimated elevation of 4.1 meters above mean sea level [19]. It is a coastal town with a land area of around 64.01 square kilometers with an estimated population of 46,915 [19]. Isabel is comprised of 24 villages or barangays. From these 24 villages, we selected two villages to serve as the sample of the study. Figure 1 shows the location of the study site in Isabel, Leyte.

### Data Collection

Primary data was collected through face-to-face interviews with the household head or representative. This was done to explain questions that were difficult to answer and obtain the exact information needed for the study. The household survey was prepared with a structured questionnaire to investigate demographic, socioeconomic, family and lifestyle characteristics. Food intake was measured with a one-week dietary recall. A one-week dietary recall was used in reporting the total food consumed by the respondent. Simple random sampling was used to select

the respondents included in the study. The total respondents of the study were 153 households.



Map 1. Location of the study site in Isabel, Leyte, Philippines  
 Source: [9], [15].

### Data Analysis

Descriptive statistics were used to summarize the socio-demographic status of the respondents. Ordinary least square regression analysis was used to investigate the determinants of vegetable consumption. This is a common method for estimating the association of variables in linear model. The goal is to minimize the sum of the squares of the differences between the observed responses in the given dataset and those predicted by a linear function of a set of explanatory variables. The smaller the differences, the better the model fits the data. The regression model used in the study is specified as follows:

$$\begin{aligned} \text{vegconsump}_i = & \beta_0 + \beta_1 \text{female}_i + \beta_2 \text{age}_i + \\ & \beta_3 \text{hhinc}_i + \beta_4 \text{hhsz}_i + \beta_5 \text{employ}_i + \\ & \beta_6 \text{educ}_i + \beta_7 \text{location}_i + \beta_8 \text{married}_i + \\ & \beta_9 \text{health}_i + \beta_{10} \text{catholic}_i + \beta_{11} \text{foodavail}_i + \\ & \beta_{12} \text{foodexp}_i + \beta_{13} \text{houseown}_i + \\ & \beta_{14} \text{homeprod}_i + e_i \end{aligned}$$

where:

$\text{vegconsump}_i$  = is the estimated daily vegetable consumption measured in kilograms per capita

$\text{female}_i$  = the sex of the household head, 1 if the head is female and 0 otherwise

$\text{age}_i$  = age of the head in years

$\text{hhinc}_i$  = is the average household monthly income measured in Philippine pesos categorized as low, middle and high income

$\text{hhsz}_i$  = household size

$\text{employ}_i$  = is a dummy variable for the employment status (1 if employed, 0 otherwise)

$\text{educ}_i$  = level of educational attainment measured in years

$\text{location}_i$  = location of household (1 if upland area, 0 otherwise)

$\text{married}_i$  = dummy variable for marital status (1 if married, 0 otherwise)

$\text{health}_i$  = reflects the perceived health status of the respondents (1 if they consider healthy, 0 otherwise)

$\text{catholic}_i$  = dummy variable for religion (1 for Catholic, 0 otherwise)

$\text{foodavail}_i$  = availability of food in the house measured as 1 food is always available and 0 otherwise

$\text{foodexp}_i$  = estimated weekly expenditure on food consumption

$\text{houseown}_i$  = dummy variable for household ownership (1 owned the house, 0 otherwise)

$\text{homeprod}_i$  = produce their own vegetable at backyard (1 if they produce, 0 otherwise)

$e_i$  = remaining error term

The subscript  $i$  represents the surveyed respondents. Diagnostic tests were conducted including test for multicollinearity, normality of the residuals and heteroskedasticity.

## RESULTS AND DISCUSSIONS

### Socio-demographic profile of the respondents

Table 1 presents the socio-demographic characteristics of the respondents. More than half of the respondents were female, the rest were male. The age of the respondents ranged from 20 to 65 and the average age of the respondents was 44 years old. Close to 40% of the respondents have ages ranging from 36 to 45. Only 7% of the respondents are aged more than 65 years old. Most of the respondents were married (73%).

In terms of educational attainment, most of the respondents were able to reach primary

level (38%) and secondary level (37%) (Table 1). Only 16% of the respondents indicated to have at least tertiary level of education but only 4% were able to graduate college (Table 1). More than half of the respondents were not able to attend college.

Table 1. Socio-demographic profile of the farmer respondents.

Profile of the Respondents	n	Percentage
Sex		
Male	42	27
Female	111	73
Total	153	100
Age		
20 - 35 years old	44	28
36 - 50 years old	59	39
51 – 65 years old	39	26
66 years old and above	11	7
Total	153	100
Average age (44 years old)		
Civil Status		
Single	12	8
Married	112	73
Separated	3	2
Widowed	11	6
Cohabitation	15	10
Total	153	100
Educational Attainment		
Primary Level	58	38
Secondary Level	56	37
Vocational	8	5
Tertiary Level	24	16
College Graduate	7	4
Total	153	100

Source: Authors' own calculation and analysis (2021).

Table 2 shows the household size and number of children at school. Close to half of the respondents (45%) have a household size ranging from 3 to 4 members. The average household size is composed of 5 members. For the number of children at school, results show that respondents have number of kids at school ranging from 1 child to 7 children. On average, two children are reported to be at school. More than half of the respondents have 1 – 2 kids at school.

Table 3 shows the monthly household income of the respondents. Sixty – three percent of the total household monthly income is below 5,000 pesos (USD 104.2). This is followed by income ranges from PHP 5,001 to PHP 15,000 (USD 104.2 - 312.5). The average

monthly income of households is PHP 6,830 (USD 142.3).

This income level is relatively below the poverty line in the region according to the Philippine Statistics Authority (PSA, 2020).

Table 2. Household size and number of children at school.

Profile of the Respondents	n	Percentage
Household size		
1-2 members	23	15
3-4	68	45
5-6	34	22
7-8	17	11
9 or more	11	7
Total	153	100
Average 5 members		
Number of children at school		
None	32	21
1 – 2	78	52
3 – 4	31	19%
5 - 6	10	7
7 or more	2	1
Total	153	100
Average 2 kids at school		

Source: Authors' own calculation and analysis (2021).

Table 3. Estimated monthly income of households

Monthly Income (PHP)	n	Percentage
Below 5,000	96	62.7
5,001 – 15,000	37	24.2
15,001 – 25,000	13	8.4
Above 25,000	7	4.6
Total	153	100
Average monthly income = PHP 6,830 (USD 142.3)		

Note: 1 USD = 48 Philippine Peso (PHP)

Source: Authors' own calculation and analysis (2021).

In Eastern Visayas, Philippines where Leyte island is located, the estimated poverty threshold is PHP 10,408 per month (USD 216.83) [20]. This finding is similar to what was reported by other studies [22], [25]. This suggests that the respondents of the survey are living below the poverty line. Table 4 presents the average household food expenditure by income. The main food category is divided into three: vegetable, meat and rice. The beverages and other food items were excluded in the analysis. The results show that households whose income is below PHP 5,000 tend to spend an average of 79 pesos on vegetables, 226 pesos on meat and 407 pesos

on rice. Household income below 5,000 usually produces vegetables at their backyard. Hence, their expenditure on vegetable is relatively low but their consumption is at par with other income groups. The average vegetable expenditure for households within the income range of PHP 5,001 – 15,000 is 130 pesos, 332 pesos for meat and 476 pesos for rice. Households whose income is above PHP 15,000 have relatively lower vegetable expenditure compared to household with monthly income of PHP 5,001 – 15,000.

Table 4. Estimated monthly income of households

Income range (PHP)	n	Weekly Food Expenditure (PHP)		
		Vegetable	Meat	Rice
Below 5,000	96	79	226	407
5,001 – 15,000	37	130	332	476
15,001 – 25,000	13	87	350	334
Above 25,000	7	88	660	540
Average		93	278	423

Source: Authors' own calculation and analysis (2021).

Table 4 also shows that as vegetable expenditure decreases, meat expenditure increases. This implies that households tend to consume more meat as income increases. However, there is no clear trend for rice consumption. It fluctuates with changes in income level. On average, household vegetable expenditure is around 93 pesos. The average meat expenditure is 278 pesos and the weekly average rice expenditure is 423 pesos.

#### Commonly eaten vegetables and estimated vegetable consumption

Table 5 presents the most common type of vegetables consumed by households. The results indicate that most respondents prefer to consume moringa (75.8%) and squash or pumpkins (73.2%). Moringa or locally known as *malunggay* is commonly planted in the backyard. It is a popular vegetable among households in Isabel, Leyte, Philippines. For respondents who indicated they have no moringa plant mentioned that they usually ask for moringa leaves from their neighbour. Next to moringa, the most preferred vegetable is

squash. The majority of the household respondents indicated that they eat squash every week as part of their weekly vegetable consumption. The next commonly eaten vegetable following moringa and squash include basella, eggplant, mixed vegetables, okra, carrots and cabbage. The mixed vegetables are locally known as *sari-sari* or assorted vegetables already cut and ready for cooking. Some households prefer to buy and consume mixed vegetables since this is composed of several types of vegetables. This is mostly composed of squash, cabbage, vegetable pear (locally known as *sayote*), carrots and string beans (Table 5).

Table 5. Common type of vegetables preferred by the respondents.

Type of Vegetable	n	Percentage
Moringa	116	75.8
Squash	112	73.2
Basella	40	26.1
Eggplant	33	21.6
Mixed vegetable	32	20.9
Okra	27	17.6
Carrots	23	15.0
Cabbage	23	15.0
String beans	17	11.1
Cucumber	11	7.2
Sweet potato	11	7.2
Yautia and other rootcrops	9	5.9
Sponge gourd	8	5.2
Spinach (kankong)	7	4.6
Vegetable pear	6	3.9
Banana's heart	4	2.6
Bitter gourd	4	2.6
Bottle gourd	3	2.0
Mung bean	2	1.3
Winged bean	1	0.6
Fern	1	0.6
Jackfruit	1	0.6

Note: \* multiple response

Source: Authors' own calculation and analysis (2021).

Table 6 presents the average daily vegetable intake of households or per capita disaggregated by income level. The results show that lower income household is associated with lower vegetable consumption. The average daily vegetable consumption of household is around 241 grams translating to around 48.2 grams per capita. This consumption is below the daily recommended

intake of 5 to 6 serving (75grams per serving) or 400 grams of vegetables per person [28].

Table 6. Estimated daily vegetable consumption of households.

Monthly Income	n	Estimated Daily Vegetable Consumption	
		Household (grams)	Per Capita (grams)
Under 5,000	96	228	45.6
5,001 – 15,000	37	271	54.2
15,001 – 25,000	13	262	52.4
Above 25,000	7	197	39.4
Total		241	48.2

Source: Authors' own calculation and analysis (2021).

### Determinants of vegetable consumption

To investigate the factors that influence vegetable consumption, Table 7 shows the results of regression analysis. The R-squared value of the estimation is at 0.456 suggesting that the model explains 45.6% of the variation in vegetable consumption. Robust standard errors were used because of the presence of heteroskedasticity. Results show that age, age-squared, general health, middle income, household living in upland, production, food expenditure, and vegetable availability significantly affect vegetable consumption. The results show that there is a negative relationship between age and vegetable consumption. This is similar to what was reported by Martin et al. (2011) [12]. However, there is nonlinearity involved. Results show that initially, vegetable consumption decreases as respondents get aged, however, there is a turning point showing that later on, as respondents become more health-conscious due to old age and health problems, then vegetable consumption starts to increase. Perceived health status has a significant positive relationship with vegetable consumption. This suggests that a person whose general health is in good condition consumes more vegetables. Estimates also revealed that a healthy person increases their vegetable intake by 0.774 grams compared to a person who rated themselves as not healthy. Meanwhile, middle income and high income households consume less vegetables than low income households. This is because most of the middle income households and high income households

prefer to consume more meat than vegetables compared to low income households. This plausible because low income households are constrained with income and meat is expensive. Hence, low income household prefer to eat more vegetables. On the other hand, food expenditure is associated with an increase in vegetable consumption. Estimates revealed that a one-unit increase in food expenditure shows 0.001 grams increase in vegetable intake. Households from the upland location tend to produce vegetables in their backyard. This reflects the significant association of vegetable consumption and upland location. While households in the lowland area close to the municipality center tend not to produce vegetables because of limited space. In addition, vegetables in upland areas are cheaper compared to vegetables sold in the town market of Isabel, Leyte. Households who produce their own vegetable increase their vegetable consumption by 0.640. Households who indicated that food is readily available is positively associated with vegetable consumption.

Table 7. Determinants of vegetable consumption

Variables	Coefficient	Robust Std. Error
Female	0.0193	0.267
Age	-0.136***	0.0498
Age square	0.00125***	0.000473
Middle income	-0.518*	0.311
High income	-0.610	0.409
Household size	-0.000766	0.0749
Employed	-0.291	0.315
Secondary educ	0.137	0.260
Tertiary educ	0.319	0.402
College graduate	0.0176	0.680
Vocational	-0.0908	0.435
Upland	1.343***	0.326
Married	0.0729	0.264
General health	0.774***	0.243
Roman Catholic	-0.155	0.340
Food availability	0.761***	0.256
Food expenditure	0.00121***	0.000373
Own house	-0.279	0.535
Produce vegetable	0.640**	0.253
Constant	3.025**	1.219
Observations	153	
R-squared	0.456	

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Authors' own calculation and analysis (2021).

## CONCLUSIONS

This study aims to investigate the determinants of vegetable consumption in Isabel, Leyte, Philippines. Results show that the average daily consumption per capita is 48.2 grams. This is below than the recommended intake of 400 grams by the World Health Organization (WHO). Results suggest that the selected respondents in Isabel, Leyte did not consume an adequate amount vegetable. Across income level, the estimated vegetable consumption is below the recommended standard. The regression results show that age, age-square, general health, income level, location, food expenditure, vegetable home production, employment status and food availability significantly affect vegetable consumption in Isabel, Leyte.

The results of the study suggest that promotion and localization of vegetable supply through backyard gardening could be one of the feasible approaches in influencing increasing vegetable consumption. Local government units may start a program on teaching households on small container gardening or cultivating vegetables with limited area. By producing vegetables in the backyard will increase the availability of the vegetables in their household. As reflected in the regression results, households who produce vegetables in their backyard tend to consume more vegetables. In addition, educational campaigns through seminars and capacity building activities designed to change behaviours are possible options to encourage people to consume more vegetables. This would motivate consumers to build a healthier lifestyle by consuming more vegetables. The policy makers may also improve vegetable consumption through the improvements of agricultural and food systems.

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