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Importance of Purchasing Power and Education in the Food Security of Families in Rural Areas—Case Study: Chambo, Ecuador

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Abstract: Food security is a condition that allows people permanent access to food for a better quality of life; therefore, it is a priority for the economic development of countries. In this context, this research aims to determine the importance of purchasing power and education in the food security of families in rural environments using Chambo canton, Ecuador as a case study. Considering the deductive method, the research is descriptive correlational, with a qualitative and quantitative approach. For data collection, a questionnaire based on the Latin American and Caribbean Food Security Scale was applied to 230 households out of a total of 3585 households. The results showed that the variables of number of income earners and total family income have a high relationship with food security, unlike level of schooling. It was concluded that education does not represent a decisive factor for food security in rural environments, although its incorporation as a variable is important for improving quality of life.

Keywords: acquisitive capacity; family income; education; food security; Ecuador



Citation: Ayaviri-Nina, V.D.; Quispe-Fernández, G.M.; Vanegas, J.L.; Ortega-Mejía, V.; Cordero-Ahiman, O.V. Importance of Purchasing Power and Education in the Food Security of Families in Rural Areas—Case Study: Chambo, Ecuador. *Sustainability* **2022**, *14*, 6068. <https://doi.org/10.3390/su14106068>

Academic Editor: Hossein Azadi

Received: 18 April 2022

Accepted: 14 May 2022

Published: 17 May 2022

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1. Introduction

Since the seventies, food security has become a subject of interest, but at the same time, it is complex to approach given the multidimensional nature of the topic [1–5]. For an individual or household to enjoy full food security, they must have sufficient quantities of safe and nutritious food, have permanent physical and economic access to it, and be able to use and take advantage of it in an appropriate manner in order to cover physiological needs and lead a healthy and active life. Finally, the stability of these elements in time is important [6,7].

Various authors have oriented their research towards identifying the determinants of food security within the home, and through the application of different methodologies, they have come to the conclusion that there is a direct relationship between family income, which determines the level of food consumption in homes, and food security status [8–11]. The lower the income of a family, the lower its consumption capacity and the greater probability that it will find itself in a situation of food insecurity due to not being able to access food in adequate quantity and quality.

The main cause of food insecurity in Ecuador and in Latin America in general is not lack of food, but the limited economic resources to access it. In the region, the agricultural production capacity is greater than the existing population; that is, there is enough food to meet current and future demand. However, there are also significant poverty rates,

showing an unequal distribution of resources leading to difficulty acquiring food, although it is available on the market [12].

In Ecuador, the growth rate of agricultural production has averaged 8.31% in the last thirteen years, while the annual population growth has not exceeded 1.5%; that is, agricultural production is greater than the existing population [13]. On the other hand, poverty is a phenomenon that persists; according to the 2013–2018 Living Conditions Survey Report, 25.4% of the population experiences poverty and 5.7% experiences extreme poverty due to consumption. Likewise, 8.7% of households are not able to access a food basket that meets the minimum caloric requirements and almost three out of ten families have difficulties in paying food expenses [14]. This allows us to conclude that there is enough food in Ecuador, but limited economic resources to access it.

This situation is also observed in the Chambo canton, which is located in the Chimborazo Province of the Republic of Ecuador, is made up of 27 communities and 13 neighborhoods, and has a total population of 11,885 inhabitants, of which 52% are women and 48% men; 62% of its population is located in rural areas and the remaining 38% is in urban areas. Sixty percent of its population is between the range of 15 to 64 years of age; 87% of inhabitants identify themselves as mestizo and 9% as indigenous. The economically-active population reaches 46.8%, of which 62% are involved in activities related to agriculture and livestock. On the other hand, the malnutrition rate is approximately 63% [15]. This town is one of the largest agricultural producers in the country, but at the same time, it has highly significant malnutrition and poverty rates [13,14], as shown in Table 1 alongside other demographic and social data.

Table 1. Demographic and social indicators of the Chambo canton.

Indicators	Amount	Percentage
Total population	11,885	100%
Urban economically-active population	2111	37.98%
Rural economically-active population	3447	6.02%
Economically-active population	5558	46.80%
Employed economically-active population	5472	98.45%
Total households	3099	100%
Urban households	1161	37.46%
Rural households	1938	62.54%
% overcrowded homes	369	11.91%
Households with physical inadequacies	604	19.50%
Households that have telephone service	1088	35.10%
Poverty due to unsatisfied basic needs		69.58%
% homes with excreta disposal system		67%
Homes with drinking water		56.60%
Homes with access to electricity		95.20%
Homes with sewage availability		55%
Homes with access to a dump truck		81.10%
Chronic malnutrition from 0 to 59 months		24.57%
Chronic malnutrition from 0 to 23 months		24.40%
Primary attendance rate		93.09%
Head of household education		7.13%
Illiteracy rate		11.70%
Average schooling level		7.41%
Acute malnutrition from 0 to 59 months		1.30%
Acute malnutrition from 0 to 23 months		1.88%

Source: Prepared by the authors based on data from the Territorial Development and Planning Plan (2020–2030).

The Chambo Territorial Development and Planning Plan (PDOT 2014–2019), indicates that poverty due to consumption has a prevalence of 60% and poverty due to unsatisfied basic needs borders on 74%, thus demonstrating that in this canton, the problems of food insecurity lie in the lack of economic resources, which results in a lack of access to food. With the exposed antecedents, the research asks: To what extent are purchasing power and

education relevant factors for the food security of families in the rural environment of the Chambo canton, Ecuador?

This approach considers the access to food as opposed to food consumption and availability, understanding that access to food depends on a large number of factors related to food markets and with the ability of consumers to pay [16], with supply, income, production, and employment standing out. However, another important element for food security from a development capacity perspective is education [17], since education allows the improvement of living conditions. In this context, the research aims to determine the importance of purchasing power and education in the food security of families in rural environments, using Chambo canton, Ecuador as a case study.

2. Theoretical Aspects

There are several theoretical and empirical studies that support the relationship between purchasing power and food security, which uses as a measure the inability of households to access food and the incidence of extreme poverty due to consumption. These studies obtained the result that the lower the family income, the more likely it is that they are in a food insecurity situation [18–21]. The risk increases in large households with a high proportion of dependent members [22–24]. The Latin American and Caribbean Scale of Food Security (ELCSA) it is used as the main tool to measure food security. These studies conclude that due to the lack of economic resources, households reduce the amount of food they consume, and include in their diet a greater quantity of foods deficient in micronutrients, which in some circumstances are cheaper or at least perceived to be by families, increasing the risk of falling into food insecurity [10].

Poverty is the root cause of food insecurity, since unemployment or insufficient income do not allow the acquisition of the necessary food. Most individuals who suffer from food insecurity live in countries with low incomes and high rates of poverty and inequality. Other authors agree with the idea that hunger is not the product of lack of food, but of low purchasing power, such as [11,24,25], who affirm that income conditions the ability to purchase food, either because prices are very high or because family income per capita is very low. Although food physically exists is inaccessible for those with low incomes [26,27], and the remuneration or income of households is closely related to the level of food security that can be reached by members of a family [6]. Therefore, raising the income of families is equivalent to improving their ability to access a balanced and diversified diet. Taking into account the fact that poor people spend most of their income on food, an increase or decrease in = income can have immediate effects on household food security [19,28].

Studies developed by international organizations have reached similar conclusions; one in nine people cannot access the minimum food to lead a healthy and active life because they do not have enough resources to acquire it. Studies also state that most people who suffer from food insecurity live in rural areas and do not have an academic education or stable employment [2,3,29]. Poverty and food security are closely related social phenomena; chronic malnutrition mainly affects the marginalized and is more or less serious depending on the level of wealth and the area of residence [24,30]. There is a direct relationship between nutrition and the incidence of extreme poverty, with research results showing that countries with higher levels of malnutrition also have higher levels of poverty [31–35].

The statements made by these authors allow us to conclude that there is a direct relationship between purchasing power and food security; there may be plenty of food in the market and but there is a lack of income in households to access it. A higher level of income increases consumption capacity, allowing families to access a greater amount of food and better nutritional value [36–39].

3. Materials and Methods

The research assumes a quantitative and descriptive correlational approach. The phenomenon is described from the perspective of food security in households in the Chambo canton, and seeks to correlate the study variables to identify which of them are

most related to food security. The method is deductive because it addresses the problem from the general to the particular, for which secondary sources have been used, such as documents and reports from the municipal government of the Chambo canton, National Institute of Statistics and Census, development plans of the canton, specialized literature; as well as a primary source consisting of a survey to 230 households out of a total of 3585. It should be noted that the qualitative component is introduced in the case analysis of food security in the rural context and the prioritization of qualitative variables, mainly education, based on other studies [40].

The questionnaire was developed based on the indicators related to the availability of food from the Food Security Survey of Latin America and the Caribbean, and through quantitative and qualitative questions related to demographic variables, perception, income (purchasing power), and education. The selection of the respondents was through simple random sampling based on a list of families living in the Chambo locality, with information provided by the municipality. Data collection was carried out in the first semester of 2021. For data analysis, the statistical software SPSS was used, which allowed the testing of the hypothesis through a binary logistic regression model.

4. Results

This section presents the descriptive statistics related to the study variables, which allow an approximation and understanding of them.

Schooling level: 45.7% of those surveyed stated that they completed secondary education, 33% primary education, 14.8% higher education, and 5.2% do not have a level of schooling, with an average schooling between primary and secondary. The level of schooling influences household income; the higher the academic training of a person, the greater the possibility of accessing a better paid job and consequently improving the living conditions of their home.

Members in a household: 32.2% affirm that their household is made up of four people while a similar percentage reports households made up of five members; 13.5% of households have three members, and 6.1% state that their household is made up of two people. Finally, 16.1% indicate that their family is made up of more than five people. Thus, the average number of members per household is four people, with a variation between two to three people. Households with a greater number of members are more likely to suffer from food insecurity, since they have more needs and therefore require more income.

Paid economic activity: 58.7% of the households surveyed indicated that two people carry out a paid economic activity, while 17.4% of households stated that only one person contributes financially to the maintenance of the family. The same proportion stated that three people carry out paid activities, while in 4.8% of households, four people carried out paid activities. The mean of this variable is two people, with a standard deviation of two to three people. This variable influences the level of family income, since the greater the number of people who receive remuneration per household, the greater the family income.

Income level: 47.8% of households have a monthly income between 300 and 600 USD (in the range of the national minimum wage); then, there are households with a monthly income of less than 300 USD, which represent 26.1%. Households with a monthly income between 601 and 900 USD represent 21.3%, while 3.5% receive an income between 901 and 1200 USD. The mean household monthly income is 300 to 600 USD, with a standard deviation of 601 to 900 USD. Most households earn less than 600 USD and only a small percentage earn more than 1000, demonstrating the notable inequality gaps within the canton.

According to the results obtained from the ECLSA a priori, it can be stated that in the households surveyed in the Chambo canton, there are problems of food insecurity, mostly at a moderate level. That is to say that the lack of family income affects the quality of food. However, there is also a significant group of households that have to reduce the number of daily meals, eat less than they need, and sometimes even not eat.

4.1. Estimation of the Model

To determine the relationship between purchasing power in households and food security, a binary logistic regression model was developed, which is used with a dichotomous dependent variable (an attribute whose absence or presence has been scored with the values zero and one, respectively) and a set of predictor or independent variables, which can be quantitative (called covariates or covariates) or categorical. It is distinguished from a multiple linear regression model because in the logistic regression, the variables are not necessarily quantitative, nor must they fulfill normality assumptions (heteroscedasticity may exist), nor is it necessary to have a linear relationship between the dependent variable and the independent variables [17]. This type of model has two purposes: to quantify the importance of the existing relationship between each of the predictor variables and the dependent variable, that is, determine which variables weigh more to increase or decrease the probability that the event in question will happen to someone; and to classify individuals within the categories of the dependent variable, according to the probability them belonging to one of the categories given the presence of certain independent variables. The binary logistic regression model has the following elements: a dependent variable or dichotomous Y_i response, which takes the value (1) when the household has food security and takes the value (0) when the household does not have food security; that is, when it is in a situation of food insecurity; and some independent or return variables X_1, X_2, X_k that help explain the dependent variable.

For the dichotomous variable Y_i , the probability that the household is in a food security situation, the logistic regression model would be:

$$\Pr(\text{Food security}) = \Pr(Y_i = 1) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_{1i} + \dots + \beta_k X_{ki})}} \quad (1)$$

Replacing the data in the above equation, we obtain the study model:

$$\Pr(\text{Food security}) = \Pr(Y_i = 1) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5)}} \quad (2)$$

where:

Y_i = food security, measured through the ECLSA and categorized as (1) for food security and (0) for food insecurity;

X_1 = total monthly family income, measured as all entries in cash or in kind received by members of the household over a month;

X_2 = level of education, which refers to the educational level reached by each of the individuals;

X_3 = number of household members, measured as the number of habitual residents who live permanently in the home;

X_4 = number of recipients of income, measured as the number of people receiving income from any source or origin, whether from work, income, transfers, or other benefits;

X_5 = amount of money destined to the purchase of food, measured as the monthly monetary value used for the acquisition of food and non-alcoholic beverages;

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ = the regression parameters to be estimated;

e = Euler number or Napier constant, meaning the natural logarithm with a constant value of 2.718.

4.2. Analysis of the Results of the Econometric Model

Firstly, the Wald method was used to see the proportion of the binomial distribution and identify the values of the coefficients for the model, the results of which showed a sigma of 0.00; therefore, the null hypothesis is rejected and it is concluded that the model is statistically significant as a whole and fulfills its prediction function. On the other hand, the Hosmer–Lemeshow test was also used, which is another test used to evaluate the goodness of fit of a logistic regression model. It starts from the idea that if the fit is good,

a high value of the predicted probability (p) will be associated with category 1 of the dependent binomial variable, while a low value of p (close to zero) will be associated with the category 0 of the dependent binomial variable. A Chi square of 1.02 and a sigma of 0.032 were obtained, which implies that what is observed is sufficiently adjusted to what is expected in the model and is considered acceptable. Next, the variables of the equation are presented (see Table 2).

Table 2. Variables in the equation.

	B	Standard Error	Wald	Gf	Sig.	Exp(B)	95% C.I. for Exp(B)	
							Lower	Higher
Step 1 ^a								
Monthly income	1.545	0.312	24.511	1	0	4.696	2.542	8.637
Constant	−4.44	0.658	45.521	1	0	0.012		
Step 2 ^b								
Monthly income	1.017	0.264	14.864	1	0	2.764	1.648	4.634
Food money	1.439	0.311	21.462	1	0	4.218	2.294	7.755
Constant	−7.211	1.058	46.484	1	0	0.001		
Step 3 ^c								
Monthly income	0.959	0.268	12.841	1	0	2.608	1.544	4.406
Food money	−0.518	0.193	7.179	1	0.007	0.595	0.408	0.87
Scholarship	1.669	0.339	24.189	1	0	5.309	2.724	10.326
Constant	−5.824	1.14	26.092	1	0	0.03		
Step 4 ^d								
Monthly income	0.982	0.273	12.925	1	0	2.671	1.563	4.563
Food money	−0.702	0.214	10.725	1	0.001	0.496	0.326	0.754
Scholarship	0.601	0.262	5.246	1	0.022	1.824	1.091	3.05
Perceivers	1.582	0.343	21.255	1	0	4.862	2.482	9.525
Constant	−6.474	1.195	29.373	1	0	0.002		

Note: ^a—variable specified in step 1: Food money; ^b—variable specified in step 2: Scholarship; ^c—variable specified in step 3: Members; ^d—variable specified in step 4: Perceivers.

The table allows the formulation of the logistic model, considering the Wald statistic and the Hosmer–Lemeshow test, where the degrees of freedom, the significance, the exponentials of the estimators, and the confidence intervals suggest an estimator of 95%. The iterative process allows us to observe the individual variables that are significant (<0.05); they are monthly income, followed by amount of money allocated to food, level of schooling, and number of income earners within the household. Table 3 presents the variables that are not in the equation.

It can be seen how number of members is not part of the estimate, because its significance is >0.05. Although it is significant in a bivariate way, it is not multivariate, so it is excluded from the model.

The new regression model would be defined as follows:

$$\Pr(\text{Food Security}) = \Pr(Y_i = 1) = \frac{1}{1 + e^{-(6.474 + 0.982X_1 + 0.601X_2 + 1.582X_4 - 0.702X_5)}} \quad (3)$$

$$\Pr(\text{Food security}) = \Pr(Y_i = 1) = \frac{1}{1 + e^{(6.474 - 0.982X_1 - 0.601X_2 - 1.582X_4 + 0.702X_5)}} \quad (4)$$

The equation allows shows, given the individual characteristics of any household belonging to that population, what would be its probability of experiencing food security.

Table 3. Variables that are not in the equation.

	Punctuation	GI	Sig.
Step 1 Variables			
Food money	16.352	1	0
Scholarship	0.084	1	0.453
Members	10.172	1	0.001
Perceivers	12.026	1	0
Global statistics	29.392	4	0
Step 2 Variables			
Scholarship	15.636	1	0
Members	7.53	1	0.006
Perceivers	1.245	1	0.264
Global statistics	13.377	3	0.004
Step 3 Variables			
Members	0.385	1	0.535
Perceivers	5.495	1	0.019
Global statistics	6.53	2	0.038
Step 4 Variables			
Members	1.091	1	0.296
Global statistics	1.091	1	0.296

Source: Own based on data.

4.3. Interpretation of the Parameters Obtained

Regarding the interpretation of the parameters estimated in the model, their sign indicates the direction in which the probability moves when the explanatory variable increases. The effect on the dependent variable can be known through the sign of the coefficient; in this sense, the coefficients with negative signs reduce the probability of experiencing food security, while the coefficients with a positive sign increase the probability of reaching a state of food safety. The variables total monthly family income, educational level, and number of income recipients have a positive sign; therefore they increase the probability that a household achieves food security. The variable amount of money allocated to the purchase of food has a negative sign; that is, it reduces the probability of enjoying food security in a household.

The $\text{Exp}(\beta)$ indicates the strength of the relationship between the dependent variable and the explanatory variables; the further it is from 1, the stronger the relationship. To compare the exponentials of β with each other, those that are less than 1 must be transformed into their inverse or reciprocal, dividing by 1 for the $\text{Exp}(\beta)$. This occurs in the case of amount of money allocated to the purchase of food ($1/0.496 = 2.016$).

Once this transformation has been carried out, it is concluded that there is a strong relationship between food security and number of income earners within the household, followed by total monthly family income, while the weakest relationship is with level of schooling.

4.4. Practical Application of the Model

A practical case is presented below, which will allow the validity of the model to be verified: A household in the Chambo canton presents a monthly income of 1000.00 USD and is made up of four members, of which three carry out a paid economic activity. Monthly, it allocates 250.00 USD to the purchase of food, which represents 25% of its total income. The head of household has higher education.

X_1 = total monthly family income = 1000 USD;

X_2 = level of education = 3 (0 = none, 1 = primary, 2 = secondary, 3 = third level, 4 = graduate);

X_3 = number of household members = 4;

X_4 = number of income earners = 3;

X_5 = amount of money destined to purchase food = \$250.

$$\Pr(\text{Food security}) = \Pr(Y_i = 1) = \frac{1}{1 + e^{(6.474 - 0.982(1000) - 0.601(3) - 1.582(3) + 0.702(250))}} \quad (5)$$

$$\Pr(\text{Food security}) = \Pr(Y_i = 1) = \frac{1}{1 + e^{(-806.575)}} \quad (6)$$

$$\Pr(\text{Food security}) = \Pr(Y_i = 1) = 1 \quad (7)$$

The probability is equal to 1, that is >0.05 ; therefore, a household with these characteristics is classified within the group that enjoys food security. This is consistent with what is proposed in theory: individuals with high incomes, higher academic education, a significant number of income earners at the household level, and who spend a small part of their income on food purchases are associated with access to food and enjoy food security.

5. Discussion

Food security is an important element for human and economic development because it ensures survival in the face of scarcity and is related to the availability, access, and consumption of healthy and safe food; from this perspective, countries must address food security problems, increasing production in order to reduce risks of scarcity and food insecurity [29,30,41]. Food security is threatened by four elements: firstly, the internal conditions of the economic policy that generate insufficient agricultural supply to satisfy the internal demand for food; secondly, the recurring economic crises that deteriorate income levels, severely restricting access to food for large groups of the population; thirdly, external factors where the strongest economic agents implement strategies to manipulate agricultural markets, with which they are likely to deplete local markets and influence the generation of risks; and, finally, a possible scenario of abrupt slowdown of the economy together with a growing decomposition of the agricultural productive base that translates into internal food insufficiency [2,15].

On the other hand, there are variables that explain food security. One of them is related to social welfare, because with an increase in a population's welfare, security levels increase by at least fifty percent; thus, food security influences the well-being of a population [42]. Another variable is poverty, considered as an indicator of food insecurity, since low income and production deficits affect a country's ability to achieve food security. For example, in the case of Mexico, the poor spend 40 to 50% of their income on food consumption; that is, to acquire a family basket they need twice as much, placing themselves at the threshold of food insecurity. This may be related to insufficient food supply that fails to cover a growing demand, insufficient economic growth and formal employment, low income levels, high increases in food prices, poverty, and health, among other factors [43].

However, food security can be related to other variables such as choice, consumption habits, tradition, profit-oriented producers, and education. Considering the last variable, humans are associated with the development of capabilities in order to have access to quality food [4,39]. Thus, this research analyzes food security considering the variables of income and education, (measured by the level of schooling). The results of this research show that there is a strong relationship between food security and income and a weak relationship between food security and education. In the case of the income variable, it is corroborated that the inability to access food is related to economic capacity, which directly or indirectly affects dietary consumption in households and their members; these results correspond to an urban area of the city of Colombia [44]. A study carried out in Mexico determined that the schooling variable is related to well-being, since an adequate level of schooling allows greater possibilities of well-being [43]. On the other hand, the lack of education and the condition of displacement leads to worse working conditions and this

leads to unemployment and reduced income, since the level of education is a key factor for adequate growth, development, and avoiding malnutrition [45].

Thus, this research corroborates the importance of family income for food security; however, despite the fact that the results show a reduced significance of education in food security, this factor may be a conditioning factor in the rural context, to improving income levels with a higher level of education and thus have greater possibilities of access to the labor market, consequently improving the quality of life of the population.

Finally, it is important to mention that the availability of food is very important in food security because not only are the type, quantity and availability of food important, but also the nutritional values of the products offered and consumed. In this context, studies show that nutritional information in visible biofortified foods reduces negative impacts on purchase intentions [46].

On the other hand, it can be mentioned that the research, in addition to verifying the income variable that explains food security from a food availability approach, also corroborates the education variable with a human development approach.

6. Conclusions

The results of the logistic regression model are highly reliable according to the significance and goodness-of-fit tests. There is therefore statistical evidence to infer that household purchasing power, measured through monthly family income, positively influences food security; households with higher incomes are more likely to be food secure, while households with lower incomes are at greater risk of food insecurity.

The research incorporates other variables that increase the probability of reaching a state of food security; these are level of schooling and number of income recipients. On the contrary, the amount of money that is used to purchase food reduces the probability of achieving food security.

The contribution of the study focuses on the application of the logistic regression model to the issue of food security in a rural context, and incorporates other variables such as the level of schooling and income recipients. These are new contributions in their approach and treatment of the food security construct, which present a separate analysis and reflection that can promote future research in rural contexts in Ecuador and other countries.

One of the limitations of the research is that it does not include all the elements and variables that define food security, due to the fact that the subject is relatively new in Ecuador and in the rural context. It would be helpful to develop a study integrating food access and consumption.

Author Contributions: Conceptualization, V.D.A.-N. and G.M.Q.-F.; theoretical aspects, V.D.A.-N. and G.M.Q.-F.; methodology, V.D.A.-N., G.M.Q.-F. and J.L.V.; resources, V.D.A.-N., G.M.Q.-F., V.O.-M. and O.V.C.-A.; data curation, G.M.Q.-F., J.L.V. and V.O.-M.; data analysis, V.D.A.-N., G.M.Q.-F., J.L.V., V.O.-M. and O.V.C.-A.; writing—original draft preparation, V.D.A.-N., G.M.Q.-F., J.L.V., V.O.-M. and O.V.C.-A.; writing—review and editing, V.D.A.-N. and G.M.Q.-F. All authors have read and agreed to the published version of the manuscript.

Funding: The article is part of a research project on the issue of food security in Ecuador. It did not receive funding, but the researchers contributed their research hours at the Universidad Nacional de Chimborazo and Universidad de Cuenca.

Acknowledgments: A special thanks to the National University of Chimborazo for supporting the research processes and the dissemination of this article. Thanks to Verónica Ortega, who was in charge of supervising the development of the survey.

Conflicts of Interest: The authors declare no conflict of interest.

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