

An Analysis of Consumption Frequency of Organic Vegetables in Chegutu, Zimbabwe: Reinforcing the Climate Mitigation Benefits of Organic Foods.

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Abstract

The study investigates factors affecting consumption frequency of organic vegetables in Chegutu, Zimbabwe in line with Sustainable development Goal 12 on responsible consumption and production. A mall-intercept survey gathered data from 200 respondents. Employing Zero-Inflated Negative Binomial (ZINB) model, the research finds that while price perception negatively influences consumption frequency, perceptions of nutritional value and longer periods of prior consumption have positive effects. These findings highlight the need for targeted policy interventions to make organic foods more affordable and accessible in order support climate mitigation and public health goals. The results reinforce the role of consumer behavior in promoting sustainable food systems and contribute to global discourses on climate change. The study proposes that reducing price barrier and promoting public awareness of the nutritional and environmental benefits of organic vegetables could help increase their consumption. Therefore, policymakers should consider producer subsidies, public education campaigns and improved market access to nurture sustainable dietary habits thereby contributing to climate change mitigation.

Keywords: Organic foods, Credence foods, Zero-Inflated Negative Binomial, Sustainable consumption and production, Chegutu

1.1 Introduction

While it is true that high-input, resource-intensive farming systems have led to tripling of global agricultural production and concomitant global economic growth between 1960 and 2015 (FAO, 2017)*, it is imperative to note that this has not occurred in an environmental vacuum. Heavy desertification, water shortages and erosion of biodiversity have accompanied the world food supply (FAO, 2018b)* hence the food systems are not sustainable. Globally, the agri-food system faces rising challenges from resource scarcity as well as everchanging consumer demand patterns. This has been exacerbated by the intensifying climate change impacts on food production. It is not unexpected that one of the clarion calls recently made is for economies to embrace sustainable production amid increased environmental degradation, climate change and public health concerns in line with Sustainable Development Goals (SDGs). While these

efforts need no disparagement, sustainable consumption is germane and should therefore take centre stage. Geiger, Fischer, and Schrader (2018)* note that while sustainability issues were perceived as mainly a responsibility of producers, research has reported that individual consumer behaviour is a key driver to the current patterns of unsustainable development.

At the turn of the new millennium, the Johannesburg Plan (2002) of the World Summit on Sustainable Development (WSSD) dedicated one of its chapters to “Changing Unsustainable Patterns of Consumption and Production” with all countries promoting sustainable consumption and production. Coming to Africa, in 2015 the Heads of State and Governments 2 set sustainable consumption and production as one of the African Union priority areas of the Agenda 2063 (Africa Union Commission, 2015).

SDG 12: Sustainable Consumption and Production, focuses on the role of both consumers and producers in achieving sustainable consumption and production. Most importantly, consumers must be advised to turn to nutritious and safe diets with low environmental consequences. Therefore, SDG 12 has an implication of substance to this study since it stresses the need to synchronise sustainable production with sustainable consumption so that food production is demand-driven. Through promoting organic production practices (Swenson & Conbere, 2021), adoption of sustainable dietary patterns including consumption of organic foods becomes critical for climate change mitigation. Manyere (2023) argue that consumer education forms the building block for increased consumer demand of organic foods. Vegetables constitute roughly 30% of household food-related emissions (Smith, Jones, & Brown, 2019, Abasolo & Zamora, 2016 and Lindenthal, Markut, Hortenhuber, Theurl, & Rudolph, 2010). Organic foods production avoids synthetic inputs, promotes ecological balance and offers significant environmental and health benefits. Recently, there has been an increasing number of studies examining the determinants of consumer demand for organic foods in the global South (Secer, 2023; Chowdhury, et al., 2021; Matibiri & Sandada, 2016 and Mhlophe, 2016). However, there is paucity of literature on consumption frequency of organic vegetables. Thus, this study examines factors influencing the frequency of organic vegetable consumption in Chegutu, Zimbabwe and explores the broader implications of sustainable foods systems on climate resilience.

1.2 Background

Consumers’ increasing awareness of health and environmental benefits (Singh & Verma, 2017) have aligned organic food products with sustainable consumption and production. Statista (2020) reports that from 2000 to 2018, global organic food sales increased by US 77 billion dollars with nearly 70 million hectares of land put under organic agriculture globally. International sales of organic food reached US 112 billion dollars in 2019. For organic vegetables, global sales have risen up by up to 30% in some countries (FiBL & IFOAM- Organics International, 2022). Table 1 below shows the general global retail sales and per capita consumption by region. These statistics give a clear indication that organic agriculture is globally gaining popularity not only in terms of supply but also in terms of demand. Notwithstanding the steady growth in the global food market, actual consumption frequency remains low in many regions especially outside Europe and North America. A case in point is the United States of America, where organic foods make up 7.2% of the total food market. In contrast Denmark leads globally with 15.2% of its food market being organic followed by Austria (11.6%) and Luxembourg and Switzerland (11.5% and 10.4%) respectively. Most other countries including France (9.5%) and Germany (8.2%) remain below 10% (Organic Trade Association (OTA), 2025). In Africa, per capita consumption of organic foods is extremely low at €0.01 compared to €147.5 and €63.2 for Europe and North America respectively as

shown in Table 1. In Morocco, a recent study established that only 15% of participants cited lack of knowledge as a barrier while the majority pointed to high prices, poor assortment and limited availability as the main reasons for low consumption frequency (FiBL & IFOAM - Organics International, 2025)

A recent report estimates that for each US dollar spent on food, society has to pay two dollars in health, environmental and economic costs (Food and Agriculture Organisation of the United Nations, 2021). To address these concerns, there is urgent need to make food systems safe, inclusive, efficient and most importantly sustainable. While the past used to task and hold the production side responsible for these environmental and health deleterious consequences, it should be noted that sustainability issues are predominantly the responsibility of consumers. Several researchers have noted that consumers who prioritise food safety show intention to buy food products that are environmentally friendly (Chowdhury et al. 2021, Yormirzoev, Li and Teuber 2021 and Matibiri and Sandada 2016) and considered safe (Secer 2023, Chowdhury et al. 2021 and Alshammari, 2020). Promoting sustainable consumption through organic food purchase requires a deeper understanding of consumer behaviour vis-à-vis organics. A shift to more sustainable consumption patterns includes manipulation of the factors that influence consumption frequency of organic foods.

Table 1: Global market data: Retail sales and consumption per capita of organic foods by region.

Region	Retail Sales (Million Euros)	Per capita consumption (Euros)
Africa	16	0.01
Asia	12 540	2.70
Europe	52 000	63.2
Latin America	778	1.20
Northern America	53 717	147.5
Oceania	1 594	38.4
World	120 647	15.8

Source: The World of Organic Agriculture Statistics and Emerging Trends 2022

1.3 Organic Agriculture (OA) in Zimbabwe

Organic production in Zimbabwe is based on the Principles of Health, Ecology, Fairness and Care as enshrined in the Zimbabwe Organic Farming Handbook (ZOPPA Trust, Zimbabwe Organic Farming Handbook) and IFOAM Principles and Guidelines. In Zimbabwe, the production and consumption of organic foods have not yet been included in mainstream agriculture. In 2019, Zimbabwe had 848 hectares of land under organic agriculture up from 415 hectares in 2018 which is about 0.01% share of total agricultural land, an increase of 104.3%. However, the 10-year growth from 2009 to 2019 in agricultural land stands at -57.4%. The country boasts of only eight organic food processors and six organic food exporters (FiBL & IFOAM- Organics International, 2022). In terms of production and consumption of organic vegetables, an insignificant 15 hectares of vegetables and low per capita consumption were recorded in the same period.

1.4 Organic certification in Zimbabwe

Zimbabwe Organic Producers and Promoters Association (ZOPPA) Trust developed Zimbabwe's organic standards which were incorporated by the Standards Association of Zimbabwe (SAZ) and IFOAM in 2012 and 2014 respectively (McAllister, 2015)*. Certification increases consumer confidence in organic food products. ZOPPA Trust is the custodian of 'Zim Organic' and 'Zim Natural'. These two labels are registered with Africa Regional Intellectual Property Rights Organisation (ARIPO). The labels are in compliance with EU and US organic standards. The labels are accepted in 8 ARIPO member countries under the Banjul Protocol. These countries are Botswana, Lesotho, Malawi, Namibia, Swaziland, Tanzania, Uganda and Zimbabwe.

1.5 Organic food production as a climate change mitigation strategy

OA focuses on food production by avoiding the use of chemo-synthetic solutions to nutrient and crop protection problems. According to FiBL & IFOAM (2025), achieving a 25% organic farmland share in the European Union reduces greenhouse gas emissions up to 25 million tonnes of carbon dioxide (CO_2) equivalent annually. This illustrates the power of consumption in shifting agri-food systems and climate benefits.

Based on life cycle assessment data, organic vegetables production emits approximately 33% less greenhouse gases (GHGs) per kg than conventional methods (Smith, Jones, & Brown, 2019). Another study by Lindenthal, Markut, Hortenhuber, Theurl and Rudolph (2010), showed that all organic products had lower GHG emissions per hectare and per kilogram of foodstuff compared to conventional products. Also, organic vegetables showed 10 to 35% lower carbon dioxide equivalent per kilogram of product.

Abasolo & Zamora (2016) quantified the material inputs, outputs and emissions in a defined boundary from land preparation to transport to the market for both conventional and organic vegetable production systems. They found out that conventional farming contributed 0.212kg CO_2 equivalent per kg of vegetable which was 43% higher than organic farming (0.141kg CO_2 equivalent per kg).

The different methodologies point to the supremacy of organic foods in reducing greenhouse emissions and thereby mitigating the impacts of climate change.

1.6 Literature Review

While the factors affecting purchase decisions have found some recent empirical applications especially in developed countries, consumption frequency of these credence foods is yet to receive sufficient attention. To date, a study by Kini, Pouw and Gupta (2020) in Burkina Faso determined the consumption frequency of organic vegetables. For full development of the organic foods industry, willingness to pay is a necessary but not sufficient condition hence consumption frequency should be a component of that equation. Sufficient nutritive, private and public benefits of consumption of organic foods can be realised if a more regular consumption interval is maintained. There is therefore urgent need to determine repeated purchases so as not to rely on one-time organic food purchases. It is on this backdrop that the research analysed factors affecting consumption frequency of organic vegetables in Chegutu urban, Zimbabwe. To organic vegetable marketers, this can help to develop strategies to increase consumption of organic vegetables for both private and public benefits to the consumers.

1.7 Methods

A structured digital questionnaire was administered to 200 primary grocery shoppers aged 18 and above in Chegutu's TM Pick'n Pay and OK supermarkets between July and September 2023. Participants were

approached using a mall-intercept technique, which has an ability to capture a diverse cross-section of consumers. Participants who were obtained through convenience sampling were screened to ensure they were responsible for household grocery decisions thus improving the relevance of their responses. Mall-intercept surveys are effective for accessing a representative sample of active consumers in urban settings, providing reliable data for consumer behavior studies (Bruwer & Haydam, 1996). Data were analysed using SPSS (version 27) and Stratgraphics (version 19).

1.8 Econometric estimation

The research measured consumption frequency as the number of meals in which a household consumes any type of organic vegetables (to cater for differences in tastes) per week. Sufficient benefits of consumption of organic vegetables are realised when consumption is repeated at regular intervals. Understanding the frequency of purchase is important in developing marketing strategies. A period of one week was considered sufficient period for analysing consumption frequency (Gido, Ayuya, Owuor, & Bokelmann, 2015). Count data models are therefore more appropriate for assessment of consumption frequency (Gujarati, 2004).

1.9 Choice of model

Four count data models were tested to model the determinants of purchase frequency of organic vegetables to choose the model that best fits the objectives of the study. To be precise, two standard count models in the case of Poisson and Negative Binomial Regression (NBR) count models were compared with the zero count models, Zero-Inflated Poisson (ZIP) and Zero-Inflated Negative Binomial (ZINB) using the Akaike Information Criterion. Stagraphics was used to compare the four models. Although the ZINB model cannot be fitted to compare it with the negative binomial, it can be concluded that the ZINB is the best model since the NBR was superior over the Poisson and the ZIP was in turn superior to the negative binomial (See Fig. 1 – Fig. 3).

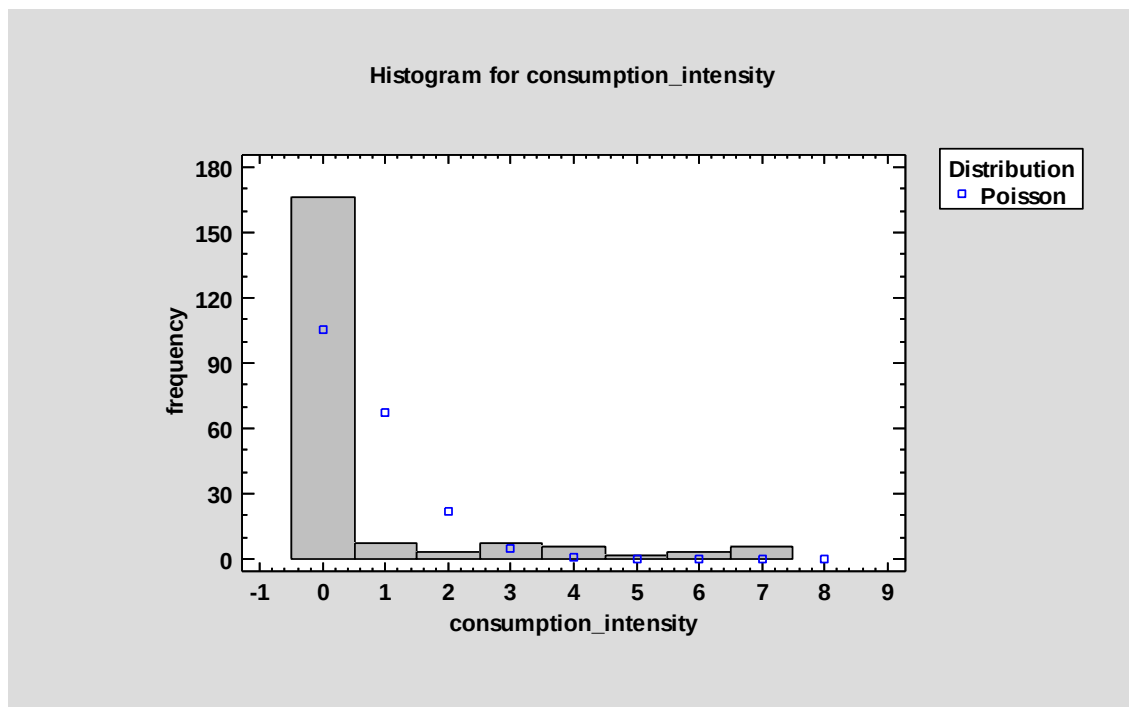


Figure 1: Poisson distribution of consumption of organic vegetables (Source: Authors' construction using Statgraphics 19)

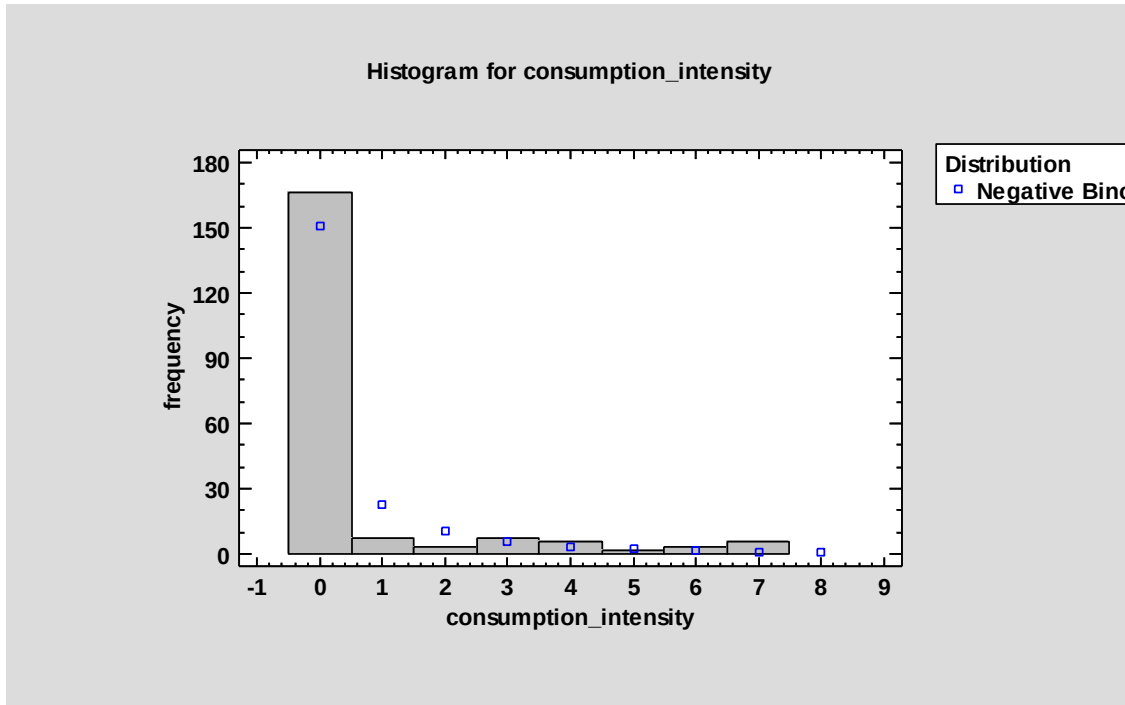


Figure 2: Negative Binomial distribution of consumption frequency of organic vegetables using Statgraphics 19)

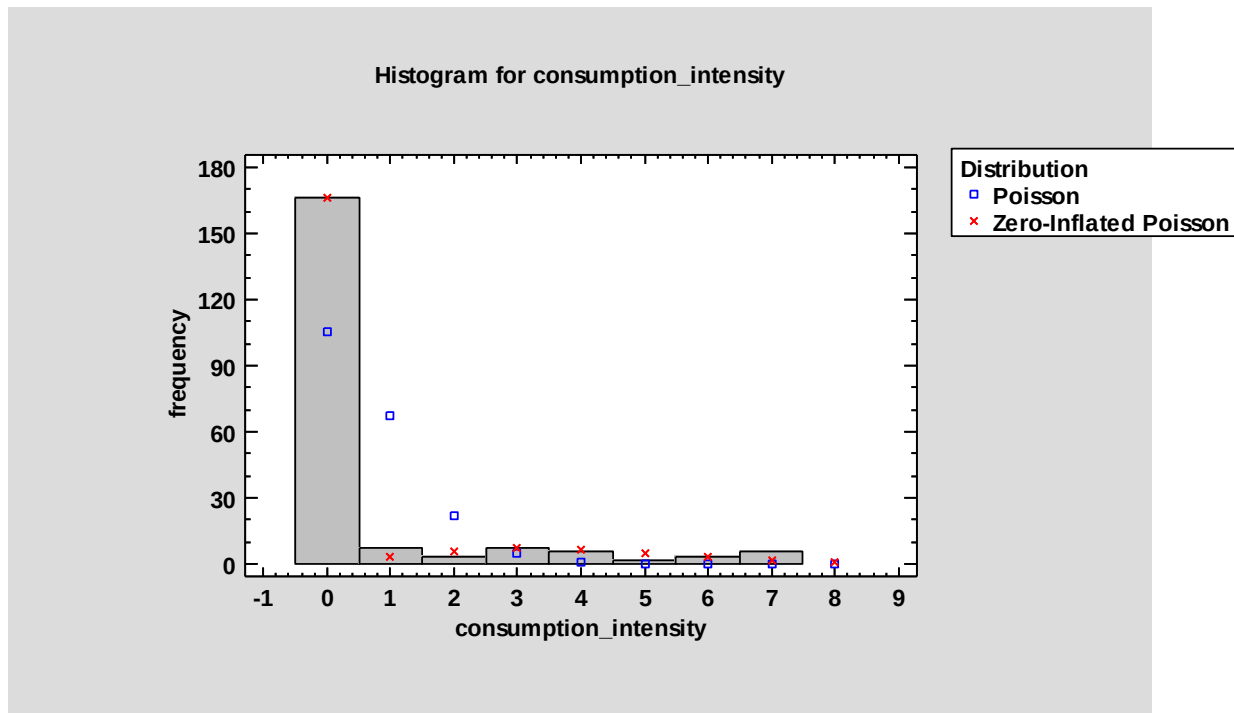


Figure 3: Comparison of Poisson and Zero-Inflated Poisson models in estimating consumption frequency organic vegetables (Source: Authors' construction using Statgraphics 19)

The zero-inflated negative binomial (ZINB) regression model (Minami, Lennert-Cody, Gao, & Roman-Verdeseto, 2007) overcomes the assumption of equi-dispersion existing between the variance and the mean (Greene 2002 and Gujarati, 2004) in the Poisson regression model and overdispersion experienced in the negative binomial regression (NBR) and zero-inflated poisson (ZIP) models. Overdispersion occurs when variance is greater than the conditional mean while excess zeros are a result of non-consumption of organic foods. The binary logit regression identifies zero outcomes associated with count data and while the NBR models the count process. The probability distribution function for the ZINB model follows Minami, Lennert-Cody, Gao, & Roman-Verdeseto (2007) as shown:

$$f(y_i/B_i, G_i, \gamma, \theta) = \begin{cases} P_i + (1 - P_i)q(0/\mu_i, \theta) & \text{for } y_i = 0 \\ (1 - P_i)q(y_i/\mu_i, \theta) & \text{for } y_i = 1, 2, 3 \dots \end{cases}$$

B and G are row vectors of covariate values for the i^{th} observation in imperfect and perfect regimes or states respectively. β and γ are parameter estimates for imperfect and perfect states respectively. θ is the precision or size parameter and μ_i is the conditional mean for the count data which is defined as $\mu_i = e^{X_i' \beta}$. The binary logit model is given as:

$$\text{Logit}(P_i) = \ln\left(\frac{P_i}{1 - P_i}\right) = G_i' \gamma$$

while truncated NBR for the imperfect state follows:

$$q(y_i/\mu_i, \theta) = \frac{\Gamma(\theta + y_i)}{\Gamma(\theta)\Gamma(y_i + 1)} \left(\frac{\theta}{\theta + \mu_i}\right)^\theta \left(\frac{\mu_i}{\theta + \mu_i}\right)^{y_i} \quad \text{for } y_i = 0, 1, 2, 3 \dots$$

in which $\Gamma(\cdot)$ is a gamma distribution function and the log-likelihood functions of x_i are given as $\ln \mu_i = B_i' \beta$. For the generation of the β , γ and θ estimates, a log-likelihood function for the ZINB regression is optimised using

$$L(\beta, \gamma, \theta/Y, B, G) = \sum_{i=1}^n \ln f(Y_i/B_i, G_i, \beta, \gamma, \theta)$$

This is the maximum likelihood function.

1.10 Results and discussion

1.10.1 Descriptive statistics

Consumption frequency of organic vegetables was generally low, with a mean of 0.64 days per week (see Figure 1). Most respondents consumed organic vegetables rarely and leafy vegetables (such as cabbage and rape) were the most popular followed by herbs and spices.

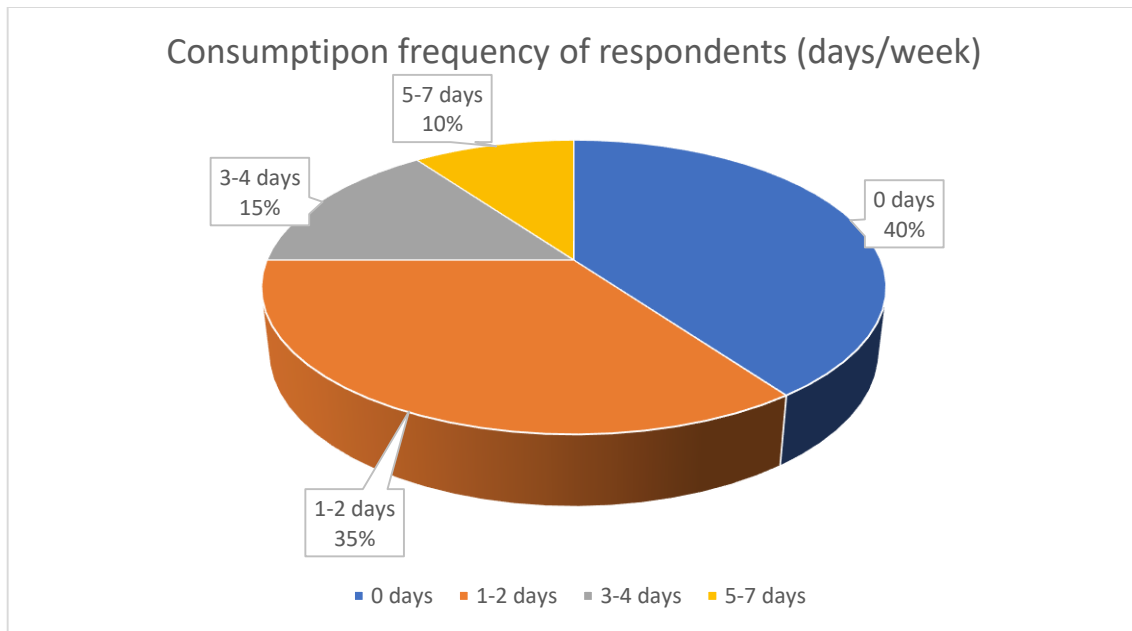


Figure 4: Consumption frequency of organic vegetables [day/week] (Source: Author)

Assuming households maintain their total vegetable intake but shift consumption from conventional to organic vegetables, this dietary shift could reduce vegetable-related emissions by about one-third (following Smith, Jones, & Brown, 2019). Also, given that vegetables constitute roughly 30% of household food-related emissions as noted by Smith, Jones, & Brown (2019), Abasolo & Zamora (2016) and Lindenthal, Markut, Hortenhuber, Theurl, & Rudolph (2010), increasing organic vegetable consumption from current average of 0.64 days per week to 3 days per week could lower overall household food-related GHG emissions by approximately 10-15% directly mitigating climate change impacts.

1.10.2 ZINB Results

The upper part of Table 2 shows the NBR component which is the count model component (imperfect state). For price, the coefficient is negative with an odds ratio of 0.7906. This suggests that a unit increase in the price of organic vegetables negatively influences their consumption intensity. The variable 'nutrients' has coefficient estimate of 0.419 and a calculated odds ratio of 1.5204. The results seem to suggest that a high perception of nutrients availability in organic foods increases the probability of increasing consumption intensity of organic vegetables. Lastly, the coefficient estimate of 0.004 and odds ratio of 1.004 indicates that due to the distance to the market, the probability of increasing consumption is equal to the probability of decreasing consumption intensity (50-50 chance).

The bottom part shows the logistic regression for zero inflation (perfect state). Period of consumption is statistically significant. The coefficient of -1.388 (odds ratio of 0.2496) indicates that an increase in the period or years of consumption of organic foods is less likely lead to zero inflation with regards to consumption frequency of organic vegetables. Therefore, an increase in the period of consumption of organic vegetables has a positive impact on consumption intensity of organic vegetables.

Table 2: Zero-Inflated Negative Binomial regression output of consumption intensity of organic vegetables

Variable	Coefficient	Std Error	z-value	Exp (B)	p-value
NEGATIVE BINOMIAL COUNT MODEL COEFFICIENTS					
Price_per	-0.235**	0.096	-2.450	0.7906	0.014
Nutrients	0.419**	0.172	2.436	1.5204	0.015

Market_dist	0.004**	0.001	3.028	1.0040	0.002
ZERO INFLATION MODEL COEFFICIENTS					
Yr_consum	-1.388**	0.317	-4.375	0.2496	<0.001

** indicates significance at 5%

*1.10.3 Implications of low consumption frequency

The low average frequency suggests that organic vegetables are not yet integrated into regular diets in Chegutu. This limits the potential of health and environmental benefits and indicates a need for interventions to make organic foods more accessible and appealing.

1.11 Conclusion and recommendation for further studies

The study reveals that organic vegetables offer significant health and environmental benefits. However, their consumption frequency remains low in Chegutu primarily due to price barriers. Policy interventions to address affordability such as subsidising organic foods and public awareness campaigns are critical in fostering more sustainable dietary patterns. This supports both climate resilience and public health. Expanding research to include other organic foods and broader geographic samples will further inform strategies to mainstream organic consumption in Zimbabwe.

References

1. Abasolo, A. O., & Zamora, O. B. (2016). Agro-environmental Sustainability of Conventional and Organic Vegetable Production Systems in Tayabas, queson, Philippines. *Journal of Environmental Science and management*, 19 (1), 10.47125/jesam/2016_1/07, 58-71.
2. Alshammari, E. (2020). Factors Influencing Organic Food Purchase Intention in an Emergent Market: An Empirical Investigation of Saudi Arabia. *European Journal of Business and Management Research*, 5(6)., DOI:<http://dx.doi.org/10.24018/ejbmr.2020.5.6.633>, 1-8.
3. Bruwer, J., & Haydam, N. E. (1996). Reducing bias in shopping mall-intercept surveys: the time-based systematic sampling method. . *South African Journal of Business Management*, 27(1/2), 9-16.
4. Chowdhury, S., Meero, A., Rahman, A. A., Islam, K. M., Zayed, N. M., & Hasan, R. K. (2021). An empirical study on the factors affecting organic food purchasing behaviour in Bangladesh: Analysing a few factors. *Academy of Strategic Management Journal*, 20(4), 1-12.
5. FAO. (2017). *The Future of Food and Agriculture: Trends and Challenges*. Rome: Food and Agriculture Organisation.
6. FAO. (2017). *The Future of Food and Agriculture: Trends and Challenges*. Rome: Food and Agriculture Organisation.
7. FiBL & IFOAM . (2020). *Organics International*. Frick and Bonn.
8. FiBL & IFOAM - Organics International. (2025). *Global Organic Continues to Grow*. Frick and Bonn: FiBL & IFOAM.
9. FiBL & IFOAM- Organics International . (2022). *The World of Organic Agriculture*. Frick and Bonn.
10. Food and Agriculture Organisation of the United Nations . (2021). *Organic Foods. Are they safe?* Bangkok: Food and Agriculture Organisation of the United Nations .

11. Gido, E., Ayuya, O. I., Owuor, G., & Bokelmann, W. (2015). Consumption intensity of leafy African indigenous vegetables: towards enhancing nutritional security in rural and urban dwellers in Kenya. *Agricultural and Food Economics*, 5(14), 1-16.
12. Greene, W. (2002). *Econometric Analysis*, 6th edition. New York: Prentice Hall.
13. Kini, J., Pouw, N., & Gupta, J. (2020). Organic vegetables demand in urban area using a count outcome model: case study of Burkina Faso. *Agricultural and Food Economics*, 8(22), <https://doi.org/10.1186/s40100-020-00166-0>, 1-16.
14. Lindenthal, T., Markut, T., Hortenhuber, S., Theurl, M., & Rudolph, G. (2010). Greenhouse Gas Emissions of Organic and Conventional Foodstuffs in Austria. Vienna: FiBL Austria.
15. Manyere, S. H. (2023). A Systematic Review of Organic Farming and Organic Foods in Southern Africa: Towards Organics 3.0. In B. Nyagadza, & Rukasha, T., *Sustainable Agricultural Marketing and Agribusiness Development: An African Perspective* (pp. 16-27). CAB International, DOI: 10.1079/9781800622548.0003.
16. Matibiri, G., & Sandada, M. (2016). An Assessment for the Motivation of Purchase of Organic Foods In Harare. *STUDIA UBB PYSCHOL.-PAED.*, LXI, 2., 83-98.
17. Mhlophe, B. (2016). Consumer Purchase Intentions Towards Organic Food: Insights from South Africa, 1(1). *Business and Social Sciences Journal*, 1-32.
18. Minami, M., Lennert-Cody, C. E., Gao, W., & Roman-Verdeseto, M. (2007). Modelling shark by catch: the zero-inflated negative. *Fish Res*, 84(2), 210-221.
19. Organic Trade Association (OTA). (2025). Growth of U.S. Organic Marketplace Accelerated in 2024. Washington D.C: Organic Trade Association (OTA).
20. Secer, A. (2023). Factors Affecting Organic Food Consumption: Insights on Consumer Awareness and Behavioural Drivers. *Journal of Agricultural Sciences Technology*, 25(4), 803-815.
21. Smith, L., Jones, M., & Brown, T. (2019). Comparative life cycle assessment of organic and conventional farming systems: Emissions and land use trade-offs in crop production. *Journal of Cleaner Production*, 235, 1234-1245. <https://doi.org/10.1016/j.jclepro.2019.06.123>.
22. Swenson, D. X., & Conbere, J. P. (2021). Stakeholder management in organization development. *Organic Development Review*, 53, 15-22.
23. Yormirzoev, M., Li, T., & Teuber, R. (2021). Consumers' willingness to pay for organic versus all-natural milk-Does certification make a difference? *International Journal of Consumer Studies*, 45. <https://doi.org/10.1111/ijcs.12622>, 1020-1029.
24. Zhang, B., & Kim, J. H. (2013). Luxury fashion consumption in China: Factors affecting attitude and purchase intent. *Journal of Retail Consumer Service*, 68-79.