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WILLINGNESS TO PAY FOR ORGANIC TOMATO AND BELL PEPPER IN KANO STATE, NIGERIA: A HECKMAN TWO-STEP ANALYSIS

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ABSTRACT
Background: Demand for organic vegetables is growing in Nigeria, but high prices and consumer uncertainty limit market growth. Objective: This study estimated consumers' willingness to pay (WTP) for organic tomato and bell pepper and examined the socioeconomic and perception factors driving WTP in Kano State. Methods: Primary data were collected from 288 consumers using structured questionnaires. The Heckman two-step model was used to correct for selection bias in WTP responses. Key Findings: On average, consumers were willing to pay a premium for organic tomato and organic bell pepper. Key drivers differed by crop. For tomato, age and freshness increased WTP, while higher education reduced the likelihood of paying. For bell pepper, age reduced WTP and household income reduced the probability of participation. Consumers rated freshness, taste and appearance highly, but rated chemical safety lowest, indicating low awareness of organic certification. The attitude scale showed low reliability, suggesting an attitude-behaviour gap. Conclusion: The results support crop-specific marketing strategies. Freshness-based messaging will work for tomato, while affordability and pesticide-free certification are critical for bell pepper. Improving consumer awareness of organic standards can help bridge the gap between positive attitudes and actual premium payments.

Keywords: Organic vegetables; Willingness to pay; Attitude-behaviour gap; Heckman model; Kano State
JEL Codes: Q13, D12, C24

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Introduction

Kano State is a major vegetable production and consumption hub in Northern Nigeria, with emerging demand for organic bell pepper (Capsicum annuum) and tomato (Solanum lycopersicum). However, market expansion is constrained by limited availability, price premiums, and information asymmetry regarding production methods. A critical challenge is product differentiation. The absence of certification, standardization, and quality grading prevents consumers from distinguishing organic from conventional produce. This information asymmetry creates a "market for lemons" where consumers cannot verify quality, thereby suppressing demand despite growing health and safety consciousness among urban consumers (Akerlof, 1970).

Willingness to pay (WTP) for credence attributes such as "organic" is grounded in Lancaster's (1966) characteristics theory and McFadden's (1974) random utility framework. Consumers derive utility from bundles of product attributes, and under imperfect information, organic status cannot be verified through search or experience. Global studies report significant WTP premiums for organic produce. Lusk and Hudson (2004) found 30% premiums in the United States, while Alphonce and Alfnes (2012) reported 31% for certified tomatoes in Tanzania. In West Africa, Owusu and Anifori (2013) documented 23% premiums for organic tomato in Ghana. In Nigeria, Yusuf et al. (2020) reported 18% higher WTP among female-headed households in the Southwest. Empirical evidence shows that income, education, age, and perceptions of freshness, taste, and chemical safety are key determinants of WTP. However, most Nigerian studies focus on Southern regions and use contingent valuation methods without correcting for sample selection bias.

Despite the growing demand for organic vegetables in Northern Nigeria, evidence on consumer WTP for organic tomato and bell pepper remains scarce. More importantly, the link between consumer attitudes and actual premium payments — the attitude-behaviour gap — has not been tested in this region. To address this gap, this study estimates WTP premiums for organic tomato and bell pepper among consumers in Kano State and identifies crop-specific socioeconomic and perception drivers using the Heckman two-step model to correct for sample selection bias. The findings will provide evidence to guide certification policy and crop-specific market segmentation in Northern Nigeria.

Materials and Methods

The study was conducted in Kano State, Nigeria from 22 January to 3 February 2026. Kano was purposively selected as Northern Nigeria's largest vegetable consumption hub, with an estimated 4.9 million urban residents (NPC, 2006). A multi-stage sampling procedure was used: (1) purposive selection of nine LGAs — Nasarawa, Bebeji, Kumbotso, Danbatta, Kano Municipal, Dawakin Tofa, Tofa, Tarauni, and Fagge — based on market concentration; (2) identification of major urban markets within each LGA, with a total frame of 3,225 customers enumerated in January 2025; and (3) probability proportional to size allocation of 288 respondents. Respondents at each market were selected via systematic random sampling: $n_h = [N_h / 3{,}225] \times 288$, where N_h is the customer frame at market h. Primary data were collected from 288 respondents using structured questionnaires administered via Open Data Kit [ODK]. Because respondents were asked about both crops, the consumption patterns overlapped as follows: 110 respondents consumed tomato only, 72 consumed bell pepper only, and 106 consumed both crops. From the 288 respondents, two separate analysis datasets were constructed — one for tomato and one for bell pepper. Respondents who did not consume a given crop were excluded from that crop's analysis. After further dropping observations with missing data on WTP or covariates, the final usable samples were 179 respondents for tomato and 141 respondents for bell pepper.

For the Heckman analysis, the sample was further restricted to respondents who reported a positive willingness to pay [WTP>0] and had complete data on all covariates. This resulted in the estimation sample [e(sample)] of 179 tomato and 141 bell pepper respondents.
The sample breakdown is summarized below:
Total respondents interviewed: 288
Consumed tomato only: 110
Consumed bell pepper only: 72
Consumed both crops: 106
Final analysis sample - Tomato: 179
Final analysis sample - Bell pepper: 141
The questionnaire captured: (1) socioeconomic characteristics — age, gender [1=male], education [1=Primary, 2=Secondary, 3=Tertiary], household size, monthly income [₦]; (2) perception variables — freshness, taste, appearance, overall quality, and chemical safety, measured on 5-point Likert scales [1=very poor to 5=excellent]; and (3) WTP elicitation. Respondents were first asked if they would pay a premium for organic produce. Affirmative responses proceeded to a payment card with bids: ₦50, ₦100, ₦200, ₦300, ₦400 per kg above conventional prices.

The Heckman two-step model addressed potential sample selection bias from observing WTP amounts only for respondents with WTP>0. The selection equation was estimated via probit: $Pr[WTP>0] = \Phi[Z\gamma]$. The outcome equation estimated premium amount conditional on WTP>0: $WTP = X\beta + \lambda + \varepsilon$, where λ is the inverse Mills ratio. To ensure model identification, 'awareness of organic certification' was included in the selection equation but excluded from the outcome equation. This variable influences the decision to pay but is assumed not to directly affect the amount of premium paid. Models were estimated in STATA 14 using the `heckman, twostep` command. Conditional means were computed via `predict, ycond`. OLS was estimated on the same e(sample) for comparison. Descriptive statistics and perception-WTP correlations were computed using respondents with positive WTP and non-missing data [n=179 tomato; n=141 bell pepper]. Ethical clearance was obtained from the Bayero University, Kano Research Ethics Committee. Informed consent was secured from all respondents. Participation was voluntary, and respondents could withdraw at any time. No personally identifiable information was collected, and all data were anonymized.

Results and Discussion

1 Sample Flow and Descriptive Statistics

Table 1 presents descriptive statistics for respondents with positive willingness to pay [WTP>0] and complete data for organic tomato [n=179] and bell pepper [n=141]. This is the estimation sample [e(sample)] used for the Heckman outcome equation.

From the total of 288 respondents interviewed, 183 tomato consumers and 145 bell pepper consumers reported WTP>0. After listwise deletion of observations with missing covariates, the final Heckman sample was 179 for tomato and 141 for bell pepper. Five tomato respondents and 4 bell pepper respondents stated WTP>0 but did not provide a bid amount or had missing covariates and were therefore excluded from regression analysis.

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Table 1: Socioeconomic and Perception Factors of Consumers Willing to Pay Premiums for Organic Tomato and Bell Pepper in Kano State, Nigeria

Variable	Tomato (n=179)	Bell Pepper (n=141)
	Mean [SD]	Mean [SD]
Socioeconomic		
Income (₦/month)	233,854.7	221,666.7
	(79,022.8)	(78,786.9)
Age (years)	35.78	34.89
	(8.69)	(8.41)
Education [1-3]	2.85	2.89
	(0.59)	(0.38)
Household size	4.90	4.55
	(1.66)	(1.54)
Perception scores (1-5)		
Overall quality	4.42	4.38
	(0.71)	(0.72)
Freshness	4.40	4.32
	(0.67)	(0.75)
Taste	4.35	4.27
	(0.63)	(0.67)
Appearance	4.50	4.40
	(0.59)	(0.60)
Chemical safety	4.12	3.95
	(0.92)	(1.03)

Source: Field Survey, 2026

Notes: Standard deviations in square brackets. Sample = respondents with positive WTP and complete data for all regression variables [Heckman e(sample): n=179 tomato, n=141 bell pepper]. Income reported in Nigerian Naira per month. Education: 1=Primary or less, 2=Secondary, 3=Tertiary. Perception measured on 5-point Likert scale: 1=Very poor, 5=Excellent.

Table 1 presents descriptive statistics for consumers with positive willingness to pay for organic tomato [n=179] and bell pepper [n=141] in Kano State.

For tomato consumers, average monthly income was ₦233,855 with notable variation. Mean age was 35.8 years and education corresponded to tertiary level. Perception scores were high across attributes, with appearance rated highest at 4.50, followed by overall quality, freshness, taste, and chemical safety at 4.12.

Bell pepper consumers reported slightly lower income of ₦221,667 and were marginally younger at 34.9 years. Perception scores followed a similar pattern but were lower overall. Across both crops, chemical safety received the lowest scores despite being a core organic attribute, suggesting information gaps regarding certification and chemical-free guarantees.

Table 2a: Descriptive Statistics and Correlations of Attitude Items [Full Sample, N = 288]

Variable	Mean	SD	1	2	3
1. Importance of Organic Vegetable	2.57	1.40	1.00		
2. Organic is healthier	2.30	1.39	0.125*	1.00	
3. Confidence in Organic Label	2.57	1.15	0.138*	0.247***	1.00

Source: Field Survey, 2026.

Note: Likert scale 1 = Strongly disagree to 5 = Strongly agree. *p < 0.10, **p < 0.05, ***p < 0.01
Table 2a shows that in the full sample, perceptions of organic vegetables are positively correlated. Importance is weakly associated with belief that organic is healthier (r = 0.125, p < 0.10) and with confidence in the organic label (r = 0.138, p < 0.10). Belief that organic is healthier is also positively correlated with label confidence (r = 0.247, p < 0.01).

Table 2b. Willingness to Pay and Reliability of Attitude Scale: WTP = Yes Subsample

Crop	N	WTP Mean	WTP SD	Cronbach's α	Corr: Importance	Corr: Healthier	Corr: Confidence
Organic Tomato	179	203.28	100.77	0.310^a	0.018	0.071	0.100
Organic Bell Pepper	141	152.48	93.03	0.418^a	0.081	0.152*	-0.055

Source: Field Survey, 2026.
Notes: Sample includes only respondents with WTP>0 and complete data for regression [Heckman e(sample)].
Five tomato and 4 bell pepper respondents with WTP>0 were dropped due to missing bid amount or covariates. ^a Cronbach's α measures internal consistency of the 3-item scale. *p < 0.10.
Table 2b reports WTP amounts for the subsample with positive WTP. Mean WTP for tomato is ₦203.28 (SD = 100.77, N = 179) and for bell pepper is ₦152.48 (SD = 93.03, N = 141). Correlations between WTP and attitude items are generally weak and inconsistent. For bell pepper, only the relationship between WTP and "organic is healthier" is significant at the 10% level (r = 0.152). Internal consistency for the 3-item attitude scale in the WTP subsample was low: α = 0.310 for tomato and α = 0.418 for bell pepper. Following DeVellis (2017) and Nunnally and Bernstein (1994), α < 0.70 indicates the items do not reliably measure a single latent construct. Due to this low reliability, the composite attitude score was not included as a regressor in the Heckman model. Instead, item-level correlations are reported in Table 2b. Correlations between WTP and attitude items were generally weak and inconsistent. For bell pepper, only "organic is healthier" was significant at the 10% level [r = 0.152].

The low reliability likely reflects multidimensionality: WTP respondents may be motivated by distinct factors such as health, environment, or food safety that do not co-vary Ajzen (2002). These α values are comparable to those reported in developing-country organic studies Nasir and Nuseir, (2018). Therefore, perception coefficients should be interpreted as exploratory, Bollen (1989).

Table 3: Determinants of WTP Decision and Amount of Organic Bell Pepper and Tomato

Variable	Bell Pepper		Tomato	
	Heckman β (se)	OLS β (se)	Heckman β (se)	OLS β (se)
Outcome Equation WTP Amount (₦)				
Income	0.00046	0.00046	0.00022	0.00028*
	(0.00037)	(0.00037)	(0.0002)	(0.0001)
Age	-5.290*	-5.290*	3.472**	2.838**
	(2.858)	(2.858)	(1.593)	(1.373)
Gender	-1.462	-1.420	-4.818	-13.164
	(21.247)	(21.247)	(17.596)	(14.756)
Education	-14.909	-15.118	3.896	-9.999
	(16.857)	(16.857)	(18.703)	(12.748)
Household	-0.489	-0.419	-7.790	-4.764
Size	(8.144)	(8.144)	(7.727)	(6.649)
Overall	16.191	15.438	-1.452	-6.750
Quality	(21.179)	(21.179)	(14.607)	(12.847)
Freshness	-26.120	-26.441	30.476*	22.693
	(26.540)	(26.540)	(16.652)	(14.193)
Taste	11.184	11.456	12.398	9.541
	(21.353)	(21.353)	(16.014)	(14.594)
Appearance	1.672	1.609	-29.576*	-25.599*
	(19.424)	(19.424)	(15.478)	(14.024)
Chemical	2.412	2.336	-4.702	-2.416
safety	(12.401)	(12.401)	(8.799)	(7.929)
_cons	301.294*	304.651*	48.587	108.692
	(158.671)	(158.671)	(94.556)	(70.721)
Selection WTP Decision				
Income	-0.00001**		0.00000	
	(0.00000)		(0.00000)	
Age	0.009		-0.018	
	(0.029)		(0.020)	
Gender	0.137		-0.376	
	(0.299)		(0.263)	
Education	-0.085		-0.761***	
	(0.272)		(0.233)	
Household	-0.044		0.142	
Size	(0.127)		(0.121)	
Overall	0.197		-0.198	
quality	(0.283)		(0.221)	
Freshness	-0.108		-0.271	
	(0.322)		(0.237)	

Taste	-0.073		-0.198	
	(0.311)		(0.246)	
Appearance	0.020		0.095	
	(0.288)		(0.226)	
Chemical	0.027		0.084	
safety	(0.166)		(0.133)	
_cons	-0.580		5.682***	
	(1.986)		(1.711)	
Model Stats				
Lambda	-105.205		-98.229	
	(162.062)		(81.857)	
N Total	176		215	
N Uncensored	141		179	
Wald χ^2/F	13.62	1.45	32.93***	3.12***
Prob> χ^2/F	0.191	0.170	0.000	0.002

Source: Field survey, 2026. Notes: Standard errors in parentheses. *** p < 0.01, ** p<0.05, * p<0.10. Heckman two-step estimates reported. Lambda = inverse Mills ratio; not statistically significant for bell pepper and tomato indicating no sample selection bias, indicating the tomato model has good explanatory power while the bell pepper model does not. OLS models restricted to e[sample] from Heckman. Gender: 1=Male, 0=Female. Education: 1=Primary or less, 2=Secondary, 3=Tertiary. Perception: 1=Very poor, 5=Excellent.

Table 3 presents Heckman two-step and OLS estimates of willingness-to-pay decision and amount for organically produced vegetables. The inverse Mills ratio is not statistically significant for bell pepper [β=-105.21, p>0.10] or tomato [β=-98.23, p>0.10], indicating no sample selection bias. Consequently, OLS estimates are consistent and preferred for interpretation. For the Bell Pepper consumers: Age negatively influences WTP amount, implying that older consumers may be less willing to pay premiums with each additional year reducing WTP by ₦5.29 [p<0.10]. In the selection equation, income has a negative but economically negligible effect on WTP participation probability [β=-0.00001, p<0.05]. Perception variables are insignificant for bell pepper, suggesting consumers are less responsive to intrinsic quality cues.

Unlike the bell pepper consumers, for tomato consumers: Age positively influences WTP amount, with additional years increasing WTP modestly. Freshness increases WTP amount while appearance reduces WTP in the Heckman model, as consumers may think "too perfect" equals chemical use. Education negatively affects WTP participation, indicating more educated respondents are less likely to express WTP for tomato. The OLS model shows income has a positive marginal effect on WTP amount.

Model fit: The Wald chi-square test is significant for tomato [χ^2=32.93, p<0.001] _** but not for bell pepper [χ^2=13.62, p=0.191], indicating the tomato model explains variation in WTP better than the bell pepper model.

Key findings include:

1. Socioeconomic factors diverged by crop. Age negatively influenced WTP amount for bell pepper but positively affected tomato. This suggests older consumers discount premium prices for bell pepper while valuing tomato attributes associated with health. This aligns with Owusu and Anifori (2013), but contrasts with Alphonce, Temu, and Almli (2015), where younger consumers showed higher preference for food quality attributes.

2. Perception variables dominated for tomato, not bell pepper. Freshness increased tomato premiums while appearance reduced them, indicating Kano consumers equate organic with fresh, natural produce rather than cosmetic perfection. For bell pepper, no perception variable reached significance, suggesting a lack of clear organic quality cues for this crop. This supports Alphonce, Temu, and Almli (2015), who documented quality attributes as key drivers.
3. Education reduced WTP participation for tomato but not the amount, implying educated consumers are skeptical of organic claims yet willing to pay once convinced. This mirrors Oparinde, Banerji, Birol, and Ilona (2016) in Nigeria, where information and trust affected consumer WTP for biofortified products.
4. Chemical safety perception was not significant for either crop. Despite Nigeria's 2019 organic agriculture policy, consumers do not associate organic with reduced chemical risk. Extension services should prioritize awareness campaigns linking organic certification to pesticide-free guarantees, particularly for bell pepper where no perception variable predicted premiums.

Therefore, market segmentation is warranted: target older, higher-income consumers for tomato with freshness-based messaging, while bell pepper requires broader price interventions or subsidies to stimulate demand.

Conclusion and Policy Implications

This study provides the first evidence on willingness to pay for organic tomato and bell pepper in Northern Nigeria, using data from 179 tomato and 141 bell pepper consumers in Kano State. By applying the Heckman model to address sample selection, the study addresses a key methodological gap in prior Nigerian studies that relied on contingent valuation alone.

Three main contributions emerge. First, we document a clear attitude-behavior gap (Ajzen, 2002): consumers rate organic attributes highly but these perceptions do not strongly translate into premium payments. Second, we show that WTP drivers are crop-specific. Tomato premiums are linked to freshness cues, while bell pepper demand appears more sensitive to demographic factors than to perceptions. Third, the absence of significant sample selection bias suggests that factors influencing the decision to pay and the amount paid are similar in this context.

These findings have direct implications for market development in Northern Nigeria. Given low consumer confidence in organic labels and the weak attitude-behavior link, policy should prioritize institutional solutions over price premiums. Specifically:

1. Establish credible third-party certification: Without verifiable organic standards, health and safety claims cannot be trusted and premiums will not materialize.
2. Use crop-specific messaging and targeting: Campaigns for tomato should emphasize freshness and safety, while interventions for bell pepper may need to address affordability constraints, particularly among older consumers.
3. Invest in consumer education before premium extraction: Building trust in what "organic" means is a prerequisite for a functioning premium market.

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