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Article

Assessing Gender Differences in Consumer Perceptions and Attitudes Toward Post-harvest Losses of Fresh Produce in Anambra State, Nigeria

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Abstract: Post-harvest losses of fresh produce constitute a major but under-examined household-level problem in Nigeria, with limited empirical evidence on how consumer gender differences shape awareness, attitudes, behaviours, and loss-reduction strategies. This study addresses this gap by examining gender-based variations in consumer responses to post-harvest losses in Anambra State, Nigeria. Using a descriptive survey design, data were collected from 116 purposively selected consumers actively involved in the purchase, storage, and management of fresh produce across urban, semi-urban, and rural locations. A structured 4-point Likert-scale questionnaire was administered online via Google Forms. The instrument was validated by subject-matter experts and demonstrated strong reliability (Cronbach's alpha = 0.85). Descriptive statistics and Kruskal–Wallis tests were employed to examine gender differences in awareness, attitudes, behaviours, and household strategies at $p \leq .05$. Findings revealed clear gender-based patterns. Although females showed higher awareness of post-harvest losses than males, the difference was not statistically significant ($\chi^2 = 2.802$; $p = .094$). However, significant gender differences were observed in attitudes and household strategies, with females demonstrating more positive attitudes and stronger loss-reduction strategies than males ($\chi^2 = 11.902$; $p = .001$). Consumer behaviours did not differ significantly by gender, despite males recording slightly higher mean ranks ($\chi^2 = 1.910$; $p = .167$). The novelty of this study lies in its household-level, gender-disaggregated analysis of consumer responses to post-harvest losses, an area often overlooked in Nigerian food loss research that predominantly focuses on production and supply chains. The findings underscore the importance of gender-responsive consumer education and behavioural interventions. From a policy perspective, targeted awareness campaigns and household-focused loss-reduction programs, particularly those strengthening male engagement and reinforcing effective female-led strategies, could contribute meaningfully to reducing post-harvest losses and improving food security.

Keywords: Post-harvest losses, consumer perceptions, fresh produce, gender differences, Anambra State, Nigeria

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1. Introduction

Post-harvest losses (PHL) of fresh produce remain a persistent challenge within food systems, particularly at retail and household levels where consumer decisions directly shape outcomes. While much of the literature attributes PHL to technical, infrastructural, and economic factors, increasing evidence suggests that consumer awareness, perceptions, attitudes, and behaviours play a decisive role in determining losses between purchase and final consumption. However, consumer-level factors remain comparatively underexplored, especially within developing-country contexts [1][2][3].

PHL commonly manifest as physical spoilage, quality deterioration, and food wastage, much of which is influenced by how consumers perceive freshness, safety, and usability. Perception is central to these outcomes. Consumers often rely on visible quality

cues such as appearance, colour, firmness, and freshness when evaluating produce. Minor cosmetic defects, including bruises or irregular shapes, are frequently interpreted as indicators of poor quality or health risk, despite the produce remaining nutritionally adequate [4]. As a result, cosmetically imperfect fruits and vegetables are rejected by consumers and retailers, contributing significantly to waste during the post-harvest period [5].

Awareness and knowledge further influence consumer responses to post-harvest losses. Limited understanding of shelf life, appropriate storage practices, and actual food safety risks often leads to premature disposal of edible produce. Fear of foodborne illness, uncertainty about spoilage, and inadequate storage knowledge encourage risk-averse behaviours that accelerate household-level losses [6]. When food waste is perceived as a routine or unavoidable outcome of production, consumers disengage from responsibility, reflecting weak value orientation and behavioural discipline [7]. In contrast, studies show that informed consumers, particularly those aware of storage requirements, spoilage processes, and environmental impacts of food waste, are more likely to adopt loss-reducing practices [12].

Socio-economic and cultural factors also shape consumer attitudes and behaviours toward PHL. In low-income settings, price sensitivity may encourage the purchase of near-expiry or cosmetically flawed produce, which can reduce losses at the point of sale [13][14]. However, inadequate household storage infrastructure, unreliable electricity supply, and limited refrigeration often shift losses from markets to households rather than eliminating them [15][16]. Conversely, higher-income consumers tend to prioritise convenience, abundance, and aesthetic quality, leading to bulk purchasing and frequent replacement of produce even when still edible [17][18]. Cultural norms related to hygiene, status, and risk avoidance further reinforce the association between visual freshness and safety, shaping disposal practices [19][20].

Environmental and ethical considerations have also begun to influence consumer attitudes toward post-harvest losses. Growing concern about climate change, resource depletion, and food insecurity has encouraged some consumers to perceive food waste as a moral and environmental issue rather than solely an economic one [4]. These attitudes have led to support for imperfect-produce initiatives and waste-reduction campaigns. However, the translation of positive attitudes into consistent behaviour remains constrained by habits, convenience, and structural limitations within food systems [23][24].

Despite these insights, existing literature continues to prioritise supply-side explanations of PHL, with limited empirical emphasis on consumer behaviour, particularly in developing economies. Consumer attitudes toward cosmetically imperfect or near-expiry produce, as well as the roles of awareness, risk perception, and socio-cultural norms, remain insufficiently examined [4][6]. This gap weakens the applicability of existing policy and intervention models, which often overlook household-level behavioural dynamics. Addressing this gap through consumer-focused research is essential for designing complementary behavioural and educational interventions that strengthen acceptance of quality-diverse produce and ultimately reduce post-harvest losses in fresh produce systems [22].

Research Questions

Guided by prior evidence on consumer awareness, attitudes, and gendered household practices in post-harvest loss management, this study addresses the following questions:

1. What difference exists between male and female consumers in their level of awareness of post-harvest losses of fresh produce?
2. How do consumers' attitude toward the impact of post-harvest losses on food security and environmental sustainability differ by gender?
3. What gender-based differences exist in the factors influencing consumer behavior in the purchasing and disposal of fresh produce?

4. What differences exist between male- and female-headed households in the strategies adopted to reduce post-harvest losses of fresh produce?

Hypotheses

Drawing directly from the literature that suggests gendered variations in awareness, attitudes, and household food management practices, the following null hypotheses were tested:

H01: There is no significant gender difference in consumers' awareness of post-harvest losses of fresh produce.

H02: There is no significant gender difference in consumers' attitude toward the impact of post-harvest losses on food security and environmental sustainability.

H03: There is no significant gender difference in the factors influencing consumer behavior in the purchasing and disposal of fresh produce.

H04: There is no significant gender difference in household-level strategies for reducing post-harvest losses of fresh produce.

2. Materials and Methods

The study adopted a descriptive survey research design, appropriate for generating quantitative data and examining gender-based differences in awareness, attitudes, behaviours, and household strategies related to post-harvest losses of fresh produce. The research was conducted in Anambra State, Nigeria, a context characterised by active production, trade, and consumption of fresh fruits and vegetables across urban, semi-urban, and rural settings. The state's socio-economic and demographic diversity makes it suitable for examining variations in consumer behaviour and household-level post-harvest loss management practices.

The target population comprised male and female consumers of fresh produce in Anambra State, including both male- and female-headed households actively involved in the purchase, storage, and disposal of fruits and vegetables. A total of 116 respondents participated in the study. Purposive sampling was employed to ensure that respondents had direct and regular engagement with fresh produce handling and household food management. This approach enhanced the relevance and representativeness of the data by excluding peripheral consumers with limited involvement in post-harvest decision-making, thereby reducing response bias related to uninformed reporting. To further minimise selection bias, respondents were drawn from diverse residential settings (urban, semi-urban, and rural) and included both genders.

Data were collected using a structured questionnaire administered online via Google Forms. The questionnaire was developed based on relevant literature on post-harvest losses, consumer behaviour, and food waste management, with items adapted to reflect the local context of fresh produce handling and consumption. The instrument comprised five sections covering socio-demographic characteristics, awareness of post-harvest losses, attitudes toward the implications of post-harvest losses for food security and environmental sustainability, consumer behaviours related to purchasing and disposal of fresh produce, and household-level strategies for minimising post-harvest losses. All scale items were measured using a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree).

Content validity was established through expert review by specialists in Agricultural Economics and Food Security, who assessed the relevance, clarity, and contextual appropriateness of the items. A pilot test involving 15 respondents outside the main study area was conducted to assess reliability, yielding a Cronbach's alpha coefficient of 0.85, indicating high internal consistency. Composite scores for awareness, attitude, consumer behaviour, and household strategies were constructed by computing the mean scores of items within each construct. Higher composite scores indicated stronger awareness, more positive attitudes, more responsible consumer behaviours, or greater adoption of loss-reduction strategies.

Ethical considerations were fully observed. Participation was voluntary, and informed consent was obtained from all respondents prior to data collection. Respondents were assured of anonymity and confidentiality, and no personally identifiable information was collected. Data were used strictly for research purposes. Google Forms was used to automatically record completed responses, which were subsequently exported for analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed. Tests of normality using Kolmogorov–Smirnov and Shapiro–Wilk indicated non-normal data distributions ($p < .05$), justifying the use of non-parametric statistical techniques. Accordingly, Kruskal–Wallis tests were employed to assess gender differences in awareness, attitudes, consumer behaviour, and household strategies related to post-harvest losses. Statistical significance was evaluated at $p \leq .05$, with higher mean ranks indicating stronger levels of the measured constructs.

3. Results and Discussion

Results

Table 1. Socio-Demographic Characteristics of Respondents (n = 116)

S/N	Variable	Category	Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Age						
1	Age	Below 20 years	34	29.3	29.3	29.3
2		21–30 years	52	44.8	44.8	74.1
3		31–40 years	8	6.9	6.9	81.0
4		41–50 years	10	8.6	8.6	89.7
5		51 years and above	12	10.3	10.3	100.0
Gender						
6	Gender	Male	42	36.2	36.2	36.2
7		Female	74	63.8	63.8	100.0
Educational Level						
8	Educational Level	No formal education	32	27.6	27.6	27.6
9		Primary education	34	29.3	29.3	56.9
10		Secondary education	32	27.6	27.6	84.5
11		Tertiary education	18	15.5	15.5	100.0
Monthly Income Level						
12	Monthly Income	Below ₦50,000	14	12.1	12.1	12.1
13		₦50,000–₦100,000	46	39.7	39.7	51.7
14		₦101,000–₦200,000	38	32.8	32.8	84.5

S/N	Variable	Category	Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
15		Above ₦200,000	18	15.5	15.5	100.0
Geographic Location						
16	Location	Urban	26	22.4	22.4	22.4
17		Semi-urban	62	53.4	53.4	75.9
18		Rural	28	24.1	24.1	100.0

Table 1 summarises respondents' socio-demographic characteristics. The sample was predominantly young, with those aged 21–30 years forming the largest group (44.8%). Females constituted a higher proportion of respondents (63.8%) than males (36.2%). Educational attainment was generally low, as respondents with primary education (29.3%), no formal education (27.6%), and secondary education (27.6%) dominated the sample, while only 15.5% had tertiary education. Most respondents earned ₦50,000–₦100,000 monthly (39.7%) and resided in semi-urban areas (53.4%).

Research Question 1: What difference exists between male and female consumers in their level of awareness of post-harvest losses of fresh produce?

Table 2. Gender Differences in Consumers' Level of Awareness of Post-Harvest Losses of Fresh Produce

	Gender	N	Mean	Std. Deviation	Std. Error Mean
I am aware of what post-harvest loss of fresh produce means.	Male	42	3.33	.477	.074
	Female	74	3.68	.471	.055
Improper storage contributes significantly to the spoilage of fresh fruits and vegetables.	Male	42	3.05	.962	.148
	Female	74	3.30	.460	.053
Post-harvest losses occur mostly at the household level rather than farms alone.	Male	42	2.86	1.372	.212
	Female	74	3.89	.313	.036
Poor handling during transportation increases post-harvest losses.	Male	42	3.86	.354	.055
	Female	74	3.51	.503	.058
Reducing post-harvest losses can help improve food availability.	Male	42	3.57	1.063	.164
	Female	74	3.51	.503	.058

Table 2 demonstrates the differences between genders, in terms of awareness about post-harvest losses of fresh produce. Women expressed more awareness than men on a majority of the questions, especially understanding the meaning of post-harvest loss (female mean = 3.68; male mean = 3.33) and the fact that the basis of losses are usually at the household level (female mean = 3.89; male mean = 2.86). There was also a higher awareness of the importance of improper storage in spoilage by females (female mean 3.30; male mean 3.05). On the other hand, males had marginally higher awareness in regards to transportation-related losses (male mean 3.86; female mean 3.51).

Research Question 2: How do consumers' attitude toward the impact of post-harvest losses on food security and environmental sustainability differ by gender?

Table 3. Gender Differences in Consumers' Attitude toward the Impact of Post-Harvest Losses on Food Security and Environmental Sustainability

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Post-harvest losses of fresh produce are a serious problem in Nigeria.	Male	42	3.86	.354	.055
	Female	74	3.51	.503	.058
Household food waste negatively affects national food security.	Male	42	2.86	1.372	.212
	Female	74	3.89	.313	.036
Wasting fresh produce contributes to environmental problems.	Male	42	3.86	.354	.055
	Female	74	3.51	.503	.058
Consumers have a responsibility to reduce post-harvest losses.	Male	42	3.57	1.063	.164
	Female	74	3.51	.503	.058
Reducing food waste at home can save money and resources.	Male	42	2.33	.954	.147
	Female	74	3.46	.502	.058

Table 3 outlines the gender-based differences among the attitude of consumers with respect to the implications of post-harvest losses to food security and environmental sustainability. Male respondents showed a significantly higher level of concurrence that post-harvest losses are a serious concern in Nigeria (male mean = 3.86; female mean = 3.51) and that wastage of fresh produce is a greater concern in relation to the environmental problems (male mean = 3.86; female mean = 3.51). Conversely, the female respondents indicated a higher level of concern about the role of household food waste in national food security (female mean = 3.89; male mean = 2.86) and rated higher the economic benefits of minimizing food waste in the household (female mean = 3.46; male mean = 2.33).

Research Question 3: What gender-based differences exist in the factors influencing consumer behavior in the purchasing and disposal of fresh produce?

Table 4. Gender-Based Differences in Factors Influencing Consumer Behavior in the Purchasing and Disposal of Fresh Produce

	Gender	N	Mean	Std. Deviation	Std. Error Mean
I often buy more fresh produce than my household needs.	Male	42	3.86	.354	.055
	Female	74	3.89	.313	.036
I check the freshness of produce before purchasing it.	Male	42	3.86	.354	.055
	Female	74	3.51	.503	.058
I store fresh produce properly to prolong its shelf life.	Male	42	2.57	1.516	.234
	Female	74	3.30	.806	.094
	Male	42	3.86	.354	.055

	Gender	N	Mean	Std. Deviation	Std. Error Mean
I dispose of fresh produce once it begins to spoil, even if some parts are still usable.	Female	74	3.68	.471	.055
I plan meals to reduce spoilage of fruits and vegetables.	Male	42	3.52	.505	.078
	Female	74	3.38	.488	.057

Table 4 sheds light to gender-based differences in determinants that influence consumer behaviour in comparison to purchasing and discarding of fresh produce. Both men and women exhibited similar, high propensities of obtaining fresher product than the households needed (male mean = 3.86; female mean = 3.89). The males indicated a better degree of concurrence to the practice of checking the freshness of produce before making a purchase (male mean = 3.86; female mean = 3.51). On the other hand, the female supported better storage behavior that would prolong the shelf life (female mean = 3.30; male mean = 2.57). There was a slight difference, however, in disposal behaviour: male mean = 3.86; female mean = 3.68). The measurement of meal-planning behaviours aimed at reducing food spoilage showed quite an equal distribution between genders, with a slight male advantage (male mean = 3.52; female mean = 3.38).

Research Question 4: What differences exist between male- and female-headed households in the strategies adopted to reduce post-harvest losses of fresh produce?

Table 5. Gender Differences in Strategies Adopted by Households to Reduce Post-Harvest Losses of Fresh Produce

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Improved storage methods can significantly reduce post-harvest losses at home.	Male	42	3.57	1.063	.164
	Female	74	3.51	.503	.058
Consumer education can help reduce waste of fresh produce.	Male	42	2.86	1.372	.212
	Female	74	3.46	.831	.097
Buying smaller quantities of fresh produce reduces spoilage.	Male	42	3.57	1.063	.164
	Female	74	3.73	.447	.052
Proper food preservation techniques can reduce household food waste.	Male	42	2.33	.954	.147
	Female	74	3.46	.502	.058
Awareness campaigns can change consumer behavior toward fresh produce management.	Male	42	3.86	.354	.055
	Female	74	3.89	.313	.036

Table 5 focuses on the variations between male and female headed households on the strategies used to reduce post-harvest losses of fresh produce. Male and female agreed on the fact that better storage measures would reduce losses in a household (male mean =

3.57; female mean = 3.51). Women respondents said they agreed to a higher level that consumer education helps reduce waste (female mean = 3.46; male mean = 2.86) and that using appropriate food-preservation methods is effective (female mean = 3.46; male mean = 2.33). Another area where females indicated a slightly higher level of support was buying less to minimize spoilage (female mean = 3.73; male mean = 3.57). Both cohorts rated awareness campaigns high, although with female being slightly higher (female mean = 3.89; male mean = 3.86).

Table 6. Tests of Normality for Knowledge, Attitude, Consumer Behavior, and Strategies on Post-Harvest Losses

	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Knowledge Assessment on Post-Harvest Losses	.291	116	.000	.786	116	.000
Attitude toward Post-Harvest Losses	.278	116	.000	.865	116	.000
Consumer Behavior and Practices	.231	116	.000	.835	116	.000
Strategies for Reducing Post-Harvest Losses	.256	116	.000	.846	116	.000
a. Lilliefors Significance Correction						

The results of the Kolmogorov-Smirnov and Shapiro-Wilk normality tests on the main variables of the study are shown in Table 6. The results indicate that the knowledge level measurement of post-harvest losses, post-harvest loss attitude, consumer behaviour and practices, and loss reduction strategies all produced statistically significant results ($p < .05$) in both tests. In particular, the ShapiroWilk values of all variables were (.000), the Kolmogorov Smirnov values were also significant (.000). These findings support the fact that the data of the variables of all variables are not normally distributed. Therefore, the assumption of normality is not met, which proves the claim in favor of the use of non-parametric statistical tests in the further analysis. In this regard, hypothesis testing is conducted through a non-parametric Kruskal-Wallis test.

Hypothesis 1: There is no significant gender difference in consumers' awareness of post-harvest losses of fresh produce.

Table 7. Kruskal–Wallis Test of Gender Difference in Consumers' Awareness of Post-Harvest Losses of Fresh Produce

	Gender	**N**	**Mean Rank**
Knowledge Assessment on Post-Harvest Losses	Male	42	51.88
	Female	74	62.26
	Total	116	

Chi-Square=2.802, df =1, Asymp. Sig.=.094

Table 7 shows that female consumers had a higher mean rank (62.26) than males (51.88) in awareness of post-harvest losses. However, the difference was not statistically significant ($\chi^2 = 2.802$; df = 1; $p = .094$). Therefore, the null hypothesis is accepted.

Hypothesis 2: There is no significant gender difference in consumers' attitude toward the impact of post-harvest losses on food security and environmental sustainability.

Table 8. Kruskal–Wallis Test of Gender Difference in Consumers' Attitude toward the Impact of Post-Harvest Losses on Food Security and Environmental Sustainability

	Gender	**N**	**Mean Rank**
Attitude toward Post-Harvest Losses	Male	42	44.55
	Female	74	66.42
	Total	116	

Chi-Square=11.902, df=1, Asymp. Sig.=.001

Table 8 indicates that female consumers had a higher mean rank (66.42) than males (44.55) in attitude toward post-harvest losses. The difference was statistically significant ($\chi^2 = 11.902$; df = 1; p = .001). Therefore, the null hypothesis is rejected.

Hypothesis 3: There is no significant gender difference in the factors influencing consumer behavior in the purchasing and disposal of fresh produce.

Table 9. Kruskal–Wallis Test of Gender Difference in Factors Influencing Consumer Behavior in Purchasing and Disposal of Fresh Produce

	Gender	**N**	**Mean Rank**
Consumer Behavior and Practices	Male	42	64.07
	Female	74	55.34
	Total	116	

Chi-Square=1.910, df=1, Asymp. Sig.=.167

Table 9 shows that male consumers had a higher mean rank (64.07) than females (55.34) in factors influencing purchasing and disposal behavior. However, the difference was not statistically significant ($\chi^2 = 1.910$; df = 1; p = .167). Therefore, the null hypothesis is accepted.

Hypothesis 4: There is no significant gender difference in household-level strategies for reducing post-harvest losses of fresh produce.

Table 10. Kruskal–Wallis Test of Gender Difference in Household-Level Strategies for Reducing Post-Harvest Losses of Fresh Produce

	Gender	**N**	**Mean Rank**
Strategies for Reducing Post-Harvest Losses	Male	42	44.55
	Female	74	66.42
	Total	116	

Chi-Square=11.902, df=1, Asymp. Sig.=.001

Table 10 shows that female-headed households had a higher mean rank (66.42) than male-headed households (44.55) in strategies for reducing post-harvest losses. The difference was statistically significant ($\chi^2 = 11.902$; df = 1; p = .001). Therefore, the null hypothesis is rejected.

Discussion

The study revealed gender-based differences in awareness, attitudes, consumer behaviour, and strategies regarding post-harvest losses (PHL) of fresh produce. Female respondents showed higher awareness, particularly regarding the definition of PHL and household-level occurrences. This aligns with evidence that women's frequent engagement in post-harvest tasks and household food decisions enhances their knowledge [25]. Gender differences may also reflect differential access to information, responsibilities, and resource control, consistent with findings that context shapes awareness [26].

Attitudinal patterns were nuanced. Males emphasized environmental impacts and the seriousness of waste, while females were more concerned with household food security and economic outcomes. This divergence aligns with consumer behaviour theory, which suggests attitudes are mediated by perceived roles, responsibilities, and personal

relevance. Similar patterns have been observed internationally, where women often prioritize social and household dimensions of food waste, and men emphasize external or systemic concerns [27][28].

Regarding consumer behaviour, both genders tended to over-purchase, reflecting general behavioural tendencies contributing to household food loss [29]. Males focused more on checking freshness, whereas females demonstrated stronger storage practices, reflecting gendered division of household responsibilities and the application of behavioural routines learned through daily food management [24]. In terms of PHL-reduction strategies, females were more proactive in consumer education, food preservation, and purchasing smaller quantities, supporting calls for gender-sensitive interventions in post-harvest management [25].

These findings highlight the need to integrate behavioural insights into PHL interventions. Women's higher engagement suggests they may be key agents for promoting adoption of waste-reducing practices, while strategies targeting men could focus on environmental and systemic consequences of losses. Limitations include the purposive sampling, reliance on self-reported measures, and online survey administration, which may introduce selection and response biases. Nonetheless, the study contributes to both local and international discourse by linking gendered consumer behaviour to practical outcomes in post-harvest management, reinforcing the relevance of behavioural theory in understanding food loss across contexts.

4. Conclusions

The study indicates that gender influences consumer awareness, attitudes, and household strategies regarding post-harvest losses of fresh produce in Anambra State, with women demonstrating stronger engagement in loss-reduction practices. These findings underscore the need for targeted interventions, including consumer education campaigns, household training on storage and preservation, and retail policies that encourage acceptance of cosmetically imperfect produce. Policymakers and development agencies should leverage women's central role in household food management to promote sustainable consumption. Future research could examine behavioural interventions across diverse socio-economic settings to further optimise post-harvest loss reduction strategies.

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