**Socioeconomic Drivers of Vitamin A Biofortified Cassava Consumption Among Agricultural Professionals in Ondo State, Nigeria**

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ABSTRACT

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| **Aims:** This study examined the socioeconomic drivers influencing the consumption of vitamin A biofortified cassava among agricultural professionals in Ondo State, Nigeria, addressing persistent vitamin A deficiency  **Study design:** Cross sectional survey was used for the study  **Place and Duration of Study:** The study was carried out in Ondo State, Nigeria  **Methodology:** Using a stratified random sampling method, data were elicited from 80 academic staff from three tertiary institutions via structured questionnaires. Consumption frequency was measured on a four-point Likert-type scale. Data were presented using frequency tables, percentages and charts, while Chi-square and Spearman’s rank correlation coefficient (rho) were used to test the study’s hypotheses at the 0.05 level of significance.  **Results:** Correlation analysis revealed that monthly income negatively correlated with consumption of biofortified Vitamin A cassava food products (r = -0.28, p = 0.01), whereas years of awareness showed a strong positive association with its consumption (r = 0.43, p < 0.01). Furthermore, Chi-square analysis indicated that physical contact with the biofortified cassava significantly increased consumption (χ² = 45.81, p < 0.001).  **Conclusion:** The results highlight the critical role of experiential learning and physical contact with innovation in promoting the adoption of biofortified crops. Future research should explore additional contextual factors and develop targeted interventions—such as hands-on demonstrations—to further enhance dietary uptake and improve food security outcomes. |

*Keywords:* Vitamin A, Biofortification, Socioeconomics, Cassava, Consumption, Awareness, Experiential.

1. INTRODUCTION

Vitamin A deficiency remains a significant public health concern, particularly in regions where dietary diversity is limited (WHO, 2025). Biofortification, according to WHO (2023) is the process of enhancing the nutritional quality of staple crops through conventional breeding or modern biotechnology, offering a sustainable solution to this challenge (Hombali et al, 2019). Vitamin A biofortified cassava represents one such innovation, combining the resilience and adaptability of cassava with the nutritional benefits of increased vitamin A content. Biofortified crop has the potential not only to improve nutritional outcomes but also to influence agricultural practices and economic dynamics (Bindu et al, 2024; Rawal, 2024). Agricultural professionals serve as both custodians and disseminators of innovative farming techniques and play a critical role in adopting and promoting such nutritional interventions (Ranjan, 2024). Understanding the socioeconomic factors that drive their consumption behavior as knowledgeable persons is essential for tailoring effective dissemination strategies and ensuring the successful integration of biofortified crops into local food systems.

The initiative to develop vitamin A biofortified cassava began in the early 2000s. The International Institute of Tropical Agriculture (IITA) played a pivotal role, in collaboration with other research organizations such as the International Center for Tropical Agriculture (CIAT) (IITA, 2014). Their work was further supported by the HarvestPlus program, an initiative dedicated to biofortifying staple crops to combat micronutrient deficiencies (Harvest Plus, 2024). By the early 2010s, after extensive research, field trials, and participatory breeding efforts involving local farmers, biofortified cassava varieties were released for cultivation in regions like West Africa (IITA, 2014).

Vitamin A biofortified cassava, commonly known as "yellow cassava," is a nutritionally enhanced variety developed to combat widespread vitamin A deficiency in regions where cassava serves as a staple food (Ilona et al, 2017). Yellow cassava contains elevated levels of pro-vitamin A carotenoids—natural compounds that the body converts into vitamin A. This enhancement aims to improve the dietary intake of vitamin A in populations vulnerable to micronutrient deficiencies (Harvest Plus, 2024).

Despite the promising potential of vitamin A biofortified cassava to address micronutrient deficiencies, its adoption among households remains inconsistent (Samuel et al, 2023). Preliminary observations suggest that while awareness of the crop is increasing, actual consumption does not always correlate with the perceived benefits (Talsma, 2017; Oteh et al., 2023). Various socioeconomic factors—including income levels, educational background, access to markets, and risk perception—may significantly influence the decision-making processes of these professionals. This discrepancy raises critical questions: What are the key socioeconomic drivers that determine the consumption of vitamin A biofortified cassava among agricultural professionals? How do these factors interact to either facilitate or impede the consumption of this nutritionally enhanced crop? Addressing these questions is essential to bridge the gap between biofortification potential and practical, on-ground benefits, ensuring that innovative agricultural interventions translate into improved public health outcomes.

The study of socioeconomic drivers behind the consumption of vitamin A biofortified cassava is both timely and crucial. First, by identifying the key determinants that influence consumption behaviors, policymakers and agricultural extension services can design targeted interventions that effectively promote the adoption of biofortified crops. Furthermore, understanding these socioeconomic dynamics can help in tailoring communication strategies that resonate with agricultural professionals and households in general, thereby enhancing the impact of public health nutrition programs. Ultimately, this research aims to bridge the gap between nutritional innovation and practical agricultural practice, fostering a sustainable model that benefits both producers and consumers in the long term. It was to this end that the study,

1. Examined socio-economic characteristics of the respondents
2. Determined the level of consumption of Vitamin A Bio-fortified Cassava among the respondents.

The study hypothesized that there is no significant relationship between socio-economic characteristics of the respondents and their level of consumption of Vitamin A Bio-fortified Cassava.

**1.1 Conceptual Framework**

The study is anchored in a framework that explores how various socio-economic characteristics influence the adoption and consumption of vitamin A biofortified cassava. At its core, the framework identifies key factors such as demographic variables (sex, marital status, and religion), awareness levels, and direct experiential factors (physical contact with the crop/food products). The framework posits that while background socio-demographic attributes provide a context for consumer behavior, experiential factors might play a more immediate role in shaping perceptions and, ultimately, consumption patterns. This multi-faceted approach allows the study to disentangle the relative contributions of different variables and to understand why certain factors (e.g., physical contact) significantly affect consumption, whereas others do not.

Theoretical Underpinnings of the study include Everett Rogers’ Diffusion of Innovations Theory (Halton, 2023). This offers a useful lens for interpreting the study’s findings. According to this theory, the adoption of new innovations—in this case, biofortified cassava—is influenced by factors such as perceived attributes, communication channels, time, and social systems. The theory suggests that firsthand experience (or physical contact) can reduce uncertainty and enhance the perceived relative advantage of an innovation, thus accelerating adoption/consumption. The Theory of Planned Behavior (TPB) according to Ajzen (1991) posits that an individual's behavior is driven by intentions which are influenced by attitudes, subjective norms, and perceived behavioral control. This theory helps to explain why awareness alone may not be sufficient to change consumption behavior unless it is complemented by personal experience. Behavioral Learning Theory emphasizes that learning and behavioral change occur through direct experiences and reinforcement. This experiential learning process reinforces the notion that behavior change in nutrition can be effectively driven by direct engagement rather than solely by information dissemination.

By integrating these theories into the conceptual framework, the study provides a good understanding of how socio-economic and experiential factors interact to influence the consumption of biofortified cassava. These theoretical perspectives reinforce the idea that behavior change in the agricultural and nutritional domain often requires more than just awareness; it demands an experiential component that makes the benefits tangible to the consumer. The conceptual framework and underpinning theories not only guide the study’s investigation into the relationships between socioeconomic characteristics and cassava consumption but also provide actionable insights for designing effective nutrition interventions.

2. methodology

The research was conducted in Ondo State, one of the six states in Southwest Nigeria. The state has an estimated population of approximately 5 million residents, encompasses a land area of about 15,500 square kilometers, and is geographically positioned at approximately 7º05'354"N latitude and 4º50'070"E longitude. Geopolitically, Ondo State is bordered by Edo and Delta States to the east, Ogun and Osun States to the west, Ekiti and Kogi States to the north, and the Bright of Benin as well as the Atlantic Ocean to the south (Ondo State Ministry of Economic Planning and Budget, 2025).

The study targeted lecturers within the agricultural faculties of tertiary institutions in Ondo State. Ondo State is home to 18 tertiary institutions, including seven universities (with one federally owned, three state-owned, and three privately owned), five polytechnics (one federal, one state, and three privately owned), six accredited colleges of education, and one college of agriculture. Between 2015 and 2019, there was a collaborative activity between the International Institute of Tropical Agriculture (IITA), Harvest Plus, and the Federal College of Agriculture Akure that led to the introduction and dissemination of the cassava variety in Ondo state. These participants were purposively selected based on their proximity to the program intervention location and the premise that their specialized knowledge in agricultural sciences predisposes them to a greater understanding of the nutritional benefits associated with vitamin A biofortified crops, which may influence their consumption patterns.

A stratified random sampling approach was used to ensure representativeness across different types of institutions. Specifically, three tertiary institutions were randomly chosen, representing a university (Federal University of Technology Akure), a polytechnic (Rufus Giwa Polytechnic Owo), and a college of agriculture (Federal College of Agriculture Akure). Within each institution, 4% of the academic staff in the faculty of agriculture were randomly selected across the departments for participation.

Primary data were collected using a structured questionnaire, which was designed to capture comprehensive information on the consumption patterns vitamin A biofortified cassava. The questionnaire incorporated both closed and Likert-scale items to facilitate quantitative analysis. Consumption frequency was assessed on a four-point Likert scale, with responses coded as follows: "Most times" (4), "Once in a while" (3), "Rarely" (2), and "Never" (1).

Quantitative data analysis was performed using descriptive and inferential statistical techniques. Descriptive statistics, including means, percentages, and frequency distributions, were calculated to summarize the demographic characteristics and consumption patterns.

For hypothesis testing, the chi-square test was applied to variables measured at the nominal level to assess associations between categorical variables. For ordinal and interval level data, Spearman’s rank correlation coefficient (rho) was utilized to determine the strength and direction of the relationships among the study variables.

3. results and discussion

**3.1 Socio-economic Characteristics of Respondents**

**Sex**  
The gender distribution was skewed towards male respondents, who made up 70% of the sample, compared to 30% female respondents. The gender imbalance—with 70% male and 30% female—points to historical disparities in the agricultural academic field, it also highlights the potential to leverage female representation to promote nutritional awareness if inclusive policies are enacted.

**Age**  
The majority of respondents (38.8%) were between 41 and 50 years old, followed by those aged 51–60 (25%). Respondents aged 31–40 accounted for 20% of the sample, while those under 30 and above 60 comprised 7.5% and 8.7%, respectively. The age distribution, predominantly clustered in the 41–50 and 51–60 age groups, implies a mature and experienced workforce that has witnessed multiple agricultural innovations over the years.

**Educational Level**

Nearly all respondents (98.8%) held postgraduate qualifications, with only 1.3% reporting a Bachelor of Science (B.Sc.) as their highest degree. This indicates a highly educated sample of academic professionals. The demographic profile of the respondents provides important context for understanding the potential adoption and consumption of vitamin A biofortified cassava among agricultural professionals in Ondo State. Given that nearly all respondents hold postgraduate qualifications, it is reasonable to infer that this cohort is well-informed about contemporary agricultural practices and nutritional interventions. Their advanced education likely equips them with a solid understanding of the public health significance of vitamin A deficiency and the benefits of biofortified crops, suggesting that, at least in theory, they could be strong advocates for the adoption of vitamin A biofortified cassava.

The high educational attainment among respondents indicates a strong potential for effective knowledge transfer. Agricultural professionals can act as change agents, promoting the nutritional benefits of vitamin A biofortified cassava through research, teaching, and community outreach. The variation in income and experience levels suggests that tailored financial and educational interventions might be necessary to boost the adoption of biofortified crops. Policies that address affordability and market access could encourage wider consumption. Recognising the unique perspectives and capacities of different departments can facilitate the development of targeted strategies. For instance, crop management experts can focus on agronomic practices to optimize yield, while communication specialists can devise effective awareness campaigns.

**Marital Status**

A dominant proportion of the respondents (93.8%) were married, with the remaining 6.3% identified as single. The overwhelmingly married status of respondents (93.8%) might reflect a stable social environment, which can positively affect risk-taking and the adoption of innovative practices, including the consumption of biofortified foods.

**Monthly Income**

The income distribution revealed that 36.2% of respondents earned between ₦310,000 and ₦400,000 monthly. Those in the ₦100,000–₦200,000 bracket accounted for 32.5%, 21.3% earned between ₦210,000 and ₦300,000, and 10% received between ₦410,000 and ₦500,000. Income levels among respondents, particularly the concentration in the ₦310,000–₦400,000 range, indicate moderate economic status. This income bracket might influence consumption decisions, as affordability is a key factor in the adoption of new food products (Oteh et al., 2020). Despite their high educational level, financial considerations could affect the extent to which these professionals incorporate vitamin A biofortified cassava into their personal and professional dietary practices. For example, if the cost of these biofortified crops is perceived as high, even well-informed individuals might hesitate to adopt them fully, highlighting a potential area for policy intervention or subsidies.

**Awareness and Contact with Vit A Biofortified Casaava**

The data on Figure 1 indicate that awareness of vitamin A biofortified cassava among respondents is extremely high, with 98.8% reporting that they are aware of the crop. In addition, 90% of respondents have come into physical contact with the biofortified cassava, suggesting that the vast majority not only know about the crop but have also been exposed to it directly. The high levels of awareness (98.8%) and physical contact (90%) with vitamin A biofortified cassava among the respondents point to effective dissemination efforts and robust outreach initiatives within the agricultural community. This widespread awareness can be seen as a critical first step in the adoption process (Meher et al.,2020), as knowledge about the nutritional benefits and agronomic potential of biofortified cassava is essential for driving its consumption.

Furthermore, the fact that 90% of respondents have had physical contact with vitamin A biofortified cassava suggests that the crop is present in local markets and accessible to the target demographic. This physical exposure, however, does not automatically translate into frequent consumption, which may be moderated by factors such as taste preferences, cultural acceptance, or concerns regarding agronomic performance and yield stability.

**Fig. 1 Distribution of respondents according to Awareness and Contact with Vit A Biofortified cassava**

The results in Figure 2 show that the majority of respondents (75.9%) have been aware of vitamin A biofortified cassava for 5–10 years, with smaller proportions having been aware for less than 5 years (21.5%) and more than 10 years (2.6%).The predominance of respondents with 5–10 years of awareness indicates that awareness campaigns and extension activities regarding vitamin A biofortified cassava have been notably effective within the recent past. This sustained period of awareness is a positive indicator, as it suggests that the crop has been consistently promoted, allowing sufficient time for the diffusion of information among the target population.

The implication of this is that a longer duration of awareness, as seen in the 5–10 year group, often correlates with increased familiarity and confidence in the crop. However, awareness alone does not guarantee consumption. Socioeconomic drivers, such as income level, market accessibility, and perceived cost-effectiveness, can still mediate actual consumption. For instance, if the crop is perceived as less economically competitive or if it fails to meet taste or yield expectations, even well-informed respondents may hesitate to adopt it into their regular diets. Also, the very small proportion of respondents with over 10 years of awareness (2.6%) might indicate that earlier efforts were not sustained or that newer methods of dissemination have become more effective. Nonetheless, these long-term aware individuals could serve as early adopters and champions, whose positive experiences and testimonials might further drive acceptance among their peers.

**Fig. 2 Distribution of respondents according to Years of Awareness of Vit A Biofortified cassava**

**Departmental Affiliation**

Respondents were distributed across various departments (Fig 3). The largest group (23.8%) came from the Crop, Soil, and Pest Management department. Other notable departments included Agricultural Extension and Communication Technology (18.8%), Animal Production and Health (15%), Food Science and Technology (10%), and Agricultural Resources and Economics (11.3%). Smaller proportions were drawn from departments such as Ecotourism and Wildlife Management (7.5%), Fisheries and Aquaculture Technology (5%), Forestry, Wood Products and Bio-Technology (7.5%), and Agricultural and Bio-environmental Engineering (1.3%).

The varied departmental affiliations suggest that perspectives on agricultural innovation and nutritional benefits might differ across specializations. Departments such as Crop, Soil, and Pest Management and Agricultural Extension and Communication Technology, which form a significant part of the sample, are likely to be directly involved in field-level crop management and dissemination of agricultural innovations. Their positive reception of vitamin A biofortified cassava could have a cascading effect on farmers and local communities, thereby enhancing overall consumption. Conversely, departments with less direct involvement in crop production might require tailored strategies to understand and advocate for the nutritional benefits of biofortified crops

**Fig. 3 Distribution of respondents according to Agricultural Specialisations**

**Years of Working Experience**

A plurality of respondents (47.5%) had between 1 and 10 years of working experience, while 36.3% had 11–20 years, 15% had 21–30 years, and only 1.2% had more than 30 years of experience as academics. The nearly half of the respondents with only 1–10 years of working experience could represent a more dynamic subset of the academic community that may be more receptive to novel interventions like biofortified cassava. This blend of experience and openness could facilitate the integration of nutritional innovations into academic curricula and extension services, thereby influencing wider agricultural practices (Oteh et al., 2023).

**Table 1: Distribution of Respondents according to Socio-economic characteristics.**

|  |  |  |
| --- | --- | --- |
| Characteristics | Frequency  N = 80 | Percentage |
| **Age of Respondents** |  |  |
| Less than 30 | 6 | 7.5 |
| 31 – 40 | 16 | 20 |
| 41 – 50 | 31 | 38.8 |
| 51 – 60 | 20 | 25 |
| 61 – 70 | 7 | 8.7 |
| Educational Level |  |  |
| BSc | 1 | 1.3 |
| Postgraduate | 79 | 98.8 |
| Total | 80 | 100 |
| **Marital Status** |  |  |
| Married | 75 | 93.8 |
| Single | 5 | 6.3 |
| **Sex** |  |  |
| Female | 24 | 30 |
| Male | 56 | 70 |
| **Monthly Income** |  |  |
| 100,000 – 200,00 | 26 | 32.5 |
| 210,000 – 300,000 | 17 | 21.3 |
| 310,000 – 400,000 | 29 | 36.2 |
| 410,000 – 500,000 | 8 | 10 |
| **Years of Working Experience** |  |  |
| 1 – 10 | 38 | 47.5 |
| 11 – 20 | 29 | 36.3 |
| 21 – 30 | 12 | 15.0 |
| >30 | 1 | 1.2 |

**3.2 Frequency of Consumption of vitamin A biofortified cassava**

Analysis of the frequency of consumption for vitamin A biofortified cassava among the study respondents as shown on Table 2, revealed the following distribution: only 10.0% of respondents reported consuming it "most" times, 36.3% indicated they consume it "once in a while," 37.5% stated that they "rarely" consume it, and 16.3% reported "never" consuming it. On a four-point Likert scale (where 4 represents "most" and 1 represents "never"), the overall mean consumption score was 2.40. This score indicates a generally low-to-moderate frequency of consumption among the sample**.**

The consumption pattern of vitamin A biofortified cassava among agricultural professionals in Ondo State, indicated by the mean score of 2.40, suggests that the crop is not being integrated into the diet as frequently as expected given its nutritional benefits (Akinsola et al., 2022). This may imply that although the respondents are highly educated and possess extensive knowledge of agricultural practices and nutritional interventions, the relatively low frequency of consumption may signal gaps in awareness or perceived benefits of vitamin A biofortified cassava. The academic community may recognize the potential of the crop, yet personal dietary habits and institutional practices do not strongly endorse its regular consumption. The infrequent consumption pattern—where a combined 53.8% of respondents consume the crop only "rarely" or "once in a while"—might also be linked to factors such as market availability, pricing, or logistical issues in obtaining the biofortified cassava (Oteh et al., 2020). These external barriers could hinder the regular use of the crop, despite its recognized benefits.

The low mean consumption score signals a need for targeted interventions that go beyond simply disseminating information. Given the influential role of agricultural professionals as both educators and opinion leaders, enhancing their personal consumption of vitamin A biofortified cassava could catalyze broader adoption in the communities they serve. Strategies such as incentivizing regular use through pilot programs, integrating the crop into institutional meal plans, or showcasing successful case studies might help shift consumption patterns. With a highly qualified respondent group, there is significant potential for incorporating practical modules on the benefits and usage of biofortified crops into academic curricula. This could not only increase personal consumption among educators but also enhance their capability to advocate effectively for these nutritional innovations among future agricultural professionals.

**Table 2: Frequency of Consumption of Vit A Bio-fortified Cassava**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Frequency of Consumption** | **Most**  **F(%)** | **Once in a while**  **F(%)** | **Rarely**  **F(%)** | **Never**  **F(%)** | **Mean**  **F(%)** |
| **Cassava** | 8(10.0) | 29(36.3) | 30(37.5) | 13(16.3) | 2.40 |

**3.3 Hypothesis Testing**

A Spearman’s rho correlation analysis was conducted to test the hypothesis that there is no significant relationship between selected socio-economic characteristics of the respondents and their level of consumption of vitamin A biofortified cassava. The results are presented in Table 3. The correlation coefficient of the variables revealed only Monthly income and Years of awareness were the only significant characteristics of the respondents. The correlation coefficient for monthly income (-0.278) was significant at the 0.05 level (p=0.014), indicating a negative relationship between income and cassava consumption frequency.The correlation coefficient for years of awareness of cassava (0.428) was significant at the 0.01 level (p=0.000), demonstrating a positive relationship between awareness duration and cassava consumption frequency.

The significant negative correlation between monthly income and cassava consumption frequency suggests that individuals with higher income levels may consume cassava less frequently. This could be attributed to greater dietary diversity among higher earners, who might opt for alternative staples or more expensive protein sources, indicating “Garri” to be an inferior good among this category of consumers (Kenton, 2024). Such a trend highlights the need for targeted promotion strategies that address potential misconceptions about cassava’s nutritional value or status as an affordable staple. In contrast, members of the population with lower income may be more predisposed to consumption of the product.

The strong positive correlation between years of awareness and cassava consumption frequency underscores the importance of knowledge and exposure in shaping dietary behavior (Oteh et al, 2023). The longer individuals have been aware of vitamin A biofortified cassava, the more likely they are to incorporate it into their diets. This finding highlights the value of sustained extension services and educational campaigns that emphasize both the nutritional and agronomic benefits of biofortified varieties.

The non-significant relationships with age, household size, and years of working experience imply that these factors do not substantially affect cassava consumption among the sampled agricultural professionals. Consequently, efforts to enhance adoption rates should focus more on improving awareness and addressing economic considerations, such as cost and availability, rather than solely targeting demographic attributes. By strengthening information dissemination and making vitamin A biofortified cassava more accessible, stakeholders can potentially boost its regular consumption and thereby improve overall dietary quality. This point is buttressed by the significant finding for “physical contact with Vit-A Cassava” which suggests that direct exposure or handling of vitamin A biofortified cassava is associated with a different pattern of consumption among respondents (Felip et al, 2023). This might imply that physical contact with the crop, which could include activities such as handling during market transactions, cultivation, or processing may enhance familiarity, reduce apprehension, or increase trust in the nutritional benefits of the biofortified variety. Consequently, this factor appears to positively influence consumption behavior.

In contrast, variables such as sex, marital status, religion, awareness, and agricultural specialisation did not have statistically significant associations with consumption levels. These findings support the possibility that mere demographic or background characteristics and even general awareness are not strong enough drivers to affect consumption patterns. Instead, hands-on experience with the product (physical contact) seems to be a more critical determinant.It therefore implies that targeted interventions and programs aimed at increasing the consumption of vitamin A biofortified cassava might be more effective if they include practical demonstrations, field days, or hands-on activities. This can help potential consumers become familiar with the product, thereby fostering a higher acceptance rate. This also underscores the importance of experiential learning and direct exposure in influencing dietary behaviors (Varman et al, 2021). Policymakers and extension workers could integrate such practical approaches into nutrition interventions.

Furthermore, while awareness campaigns are important, integrating tangible experiences with the crop may be necessary to shift consumption patterns. This could involve community-based activities that encourage physical interaction with the crop, thereby reinforcing the benefits and reducing skepticism. Given that most socio-economic variables did not show significant associations, further research might focus on understanding the mechanisms by which physical contact influences consumption. It would also be useful to explore if other contextual or cultural factors play a role when individuals have direct exposure to biofortified cassava.

**Table 3: Results of Spearman Rho Correlation of Socio-economic characteristics and Frequency of consumption of Biofortified Vitamin A Cassava**

|  |  |  |
| --- | --- | --- |
| Socio-economic Characteristics | r-value | p –value |
| Years of awareness | 0.43\*\* | 0.00 |
| Age | -0.20 | 0.07 |
| Household size | -0.09 | 0.43 |
| Monthly income | -0.28\* | 0.01 |
| Working experience | -0.17 | 0.14 |

From the chi-square results on Table 4, only the variable “Physical Contact with Vit-A Cassava” returned a statistically significant chi-square value (p = 0.00), indicating a significant association with the level of consumption. All other socio-economic characteristics did not show statistically significant relationships (p-values > 0.05).

**Table 4: Results of Chi-square Analysis of Socio-economic characteristics and Frequency of consumption of Biofortified Vitamin A Cassava**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Socio-Economic Characteristics | Chi-Square Value | Contingency Coefficient | df | p-value | Decision |
| Sex | 6.43 | 0.27 | 3 | 0.09 | Not Significant |
| Marital Status | 6.22 | 0.27 | 3 | 0.10 | Not Significant |
| Religion | 2.67 | 0.18 | 3 | 0.45 | Not Significant |
| Awareness | 5.22 | 0.25 | 3 | 0.16 | Not Significant |
| Physical contact with Vit-A cassva | 45.81 | 0.60 | 3 | 0.00 | Significant |
| Agricultural specialisation | 21.92 | 0.46 | 24 | 0.58 | Not Significant |

4. Conclusion

The socio-economic characteristics of agricultural professionals in Ondo State underscore both opportunities and challenges in the promotion of vitamin A biofortified cassava. The findings imply that while there is considerable potential for advocacy given the respondents' advanced education and professional experience, additional measures addressing economic constraints and departmental-specific perspectives are essential to enhance consumption and broader adoption of this nutritional innovation.

Though there is some degree of engagement with vitamin A biofortified cassava, its consumption is not yet robust in contrast to the hype about the crop. Addressing barriers related to awareness, accessibility, and perceived value through targeted policy interventions and educational strategies is crucial for promoting regular consumption. Such efforts could ultimately strengthen the role of agricultural professionals as champions of biofortification, thereby facilitating a broader public health impact

In essence, while the data demonstrate that awareness and physical contact with vitamin A biofortified cassava are not major barriers, additional socio-economic drivers—particularly income and market dynamics—likely play a crucial role in influencing the actual consumption behavior. To enhance the regular intake of this nutritionally beneficial crop, interventions should not only continue to promote awareness but also address economic and perceptual barriers. Such strategies might include pricing incentives, quality assurance, and further integration of biofortified crops into institutional programs to ensure that high awareness is effectively translated into consistent consumption patterns.

In summary, while the overall hypothesis of no significant relationship holds for most socio-economic characteristics, the exception of physical contact highlights a key area where consumer behavior can be influenced through direct engagement with the product.

Consent:

All authors declare that verbal informed consent was obtained from the respondents before the interview.

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2. It was used during the editing to fine tune the write up and correct grammatical errors
3. Input prompts include: rephrase this write up and outline implications of this data

References

Ajzen, Icek. (1991). The Theory of Planned Behavior. Organizational Behavior and Human Decision Processes. 50. 179-211. 10.1016/0749-5978(91)90020-T.

Akinsola, G.O., Adewumi, M.O., Olalere, I.T., Bello, M.A, Osungade, A.A. & Ayoola, R.O. (2022) Consumption pattern of biofortified vitamin A cassava products in Oyo state, South-West Nigeria. <https://journals.sta.uwi.edu/ojs/index.php/ta/article/download/8371/7014/12483>

Bindu, N., Kumar, V., Rizwanuddin, S., Mishra, S., Kumar, V., Saris, P. E. J., Khanduri, N., Kumar, A., Pandey, P., Gupta, A. K., Khan, J. M., & Rustagi, S. (2024). Biofortification as a solution for addressing nutrient deficiencies and malnutrition. *Heliyon*, *10*(9), e30595. <https://doi.org/10.1016/j.heliyon.2024.e30595>

Felip, F., Galán, J., Contero, M., & García-García, C. (2023). Touch Matters: The Impact of Physical Contact on Haptic Product Perception in Virtual Reality. Applied Sciences, 13(4), 2649. <https://doi.org/10.3390/app13042649>

Halton C. (2023) Diffusion of Innovations Theory: Definition and Examples. <https://www.investopedia.com/terms/d/diffusion-of-innovations-theory.asp>

Harvest Plus (2024) Vitamin A Cassava. <https://www.harvestplus.org/crop/vitamin-a-cassava/>

Hombali, A.S., Solon, J., Venkatesh, B.T., Nair, N., & Peña-Rosas, J.(2019) Cochrane Database of Systematic Reviews. 2019; Issue 5. Art. No.: CD010068.

IITA (2014) Nigeria releases more cassava with higher pro-vitamin A to fight micronutrient deficiency. <https://www.iita.org/news-item/nigeria-releases-cassava-higher-pro-vitamin-fight-micronutrient-deficiency/>.

Ilona, P., Bouis, H. E., Palenberg, M., Moursi, M., & Oparinde, A. (2017). Vitamin A cassava in Nigeria: Crop development and delivery. African Journal of Food, Agriculture, Nutrition and Development, 17. <https://doi.org/10.18697/ajfand.78.HarvestPlus09>

Kenton, W. (2024) Inferior Good: Definition, Examples, and Role of Consumer Behavior. <https://www.investopedia.com/terms/i/inferior-good.asp>

Meher, M., Panigrahi, S. P., & Nayak, D. (2020). Adoption Behavior of Farmers in Khordha District of Odisha, India. Asian Journal of Agricultural Extension, Economics & Sociology, 38(12), 102–106. https://doi.org/10.9734/ajaees/2020/v38i1230493

Ondo State Ministry of Economic Planning and Budget (2025) Ondo State Profile. https://www.mepbondostate.org/meet-us/ondo-state-profile/#:~:text=Ondo%20State%2C%20made%20up%20of,lies%20entirely%20in%20the%20tropics.

Oteh O.U., Hefferon, K., Agwu, N.M. (2020) Moving Biofortified Cassava Products Closer to Market in Nigeria. *Frontiers in Sustainable Food Syst*. 4. <https://doi.org/10.3389/fsufs.2020.589424>

Oteh, O., Mbanasor, J., Agwu, N., Hefferon, K., Onwusiribe, C., & Steur, H. (2023). Understanding the biofortified cassava market in Nigeria: Determinants of consumer demand and farmer supply. Cogent Food & Agriculture, 9, 2263972. https://doi.org/10.1080/23311932.2023.2263972Ranjan, A., Ghosh, B., Barman, B., Quader, S., Fatheen, P. N., Tiwari, S., Saurav, S., & Bishnoi, S. (2024). Role of agricultural extension in addressing food security. European Journal of Nutrition & Food Safety, 16, 67–85. https://doi.org/10.9734/ejnfs/2024/v16i91527

Rawal, J., Gurung, L., Rc, P., Joshi, G., & Awasthi, R. (2024). Biofortification: Enhancing nutritional value in crops. Tropical Agroecosystems, 5, 26–33. https://doi.org/10.26480/taec.02.2024.26.33Samuel, L., de Barcellos, M. D., Watabaji, M. D., & De Steur, H. (2023). Factors affecting farmers’ acceptance and adoption of biofortified crops: A systematic review. Outlook on Agriculture, 53(1), 15-29. https://doi.org/10.1177/00307270231212924 (Original work published 2024)

Talsma E.F., Melse-Boonstra A., & Brouwer, I.D. (2017) Acceptance and adoption of biofortified crops in low- and middle-income countries: a systematic review. *Nutr Rev*. 75 (10): 798-829. doi: 10.1093/nutrit/nux037. PMID: 29028269; PMCID: PMC5914320.

Varman, S., Cliff, D., Jones, R., Hammersley, M., Zhang, Z., Charlton, K., & Kelly, B. (2021). Experiential learning interventions and healthy eating outcomes in children: A systematic literature review. International Journal of Environmental Research and Public Health, 18(20), 10824. https://doi.org/10.3390/ijerph182010824WHO (2023) Biofortifcation of Staple foods <https://www.who.int/tools/elena/interventions/biofortification>

WHO (2025) Vitamin A Deficiency <https://www.who.int/data/nutrition/nlis/info/vitamin-a-deficiency>