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Assessment Of Compliance And Efficacy Of Food Safety Management Systems In Restaurants: A Case Study Of Katsina Metropolis

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ABSTRACT

This study assesses the compliance and efficacy of Food Safety Management Systems (FSMS) in restaurants within Katsina Metropolis, Nigeria, aiming to evaluate how well these establishments adhere to existing food safety standards and the effectiveness of their practices in minimizing foodborne illness risks. Food safety remains a critical public health issue globally, and this study investigates key elements, including hygiene practices, staff training, kitchen sanitation, food handling procedures, and adherence to Hazard Analysis and Critical Control Points (HACCP) standards. Data were collected through surveys, interviews, and on-site inspections across various types of restaurants, followed by logistic regression and ANOVA analyses to determine predictors of compliance and to compare food safety practices across establishments. Findings reveal a varied level of FSMS compliance among restaurants, with many establishments demonstrating adherence to food safety protocols, while others face challenges in areas such as staff training, regular monitoring, and hygiene practices. High Cronbach's Alpha reliability scores underscore consistency in food safety perceptions, while logistic regression highlights significant compliance predictors like restaurant type and years of operation. Despite general compliance, gaps in consistent monitoring and documentation were noted, suggesting a need for improvements in FSMS practices to fully protect public health. The study underscores the importance of enforcing food safety regulations and integrating comprehensive staff training to reduce foodborne illness risks, ultimately contributing to enhanced food safety and consumer trust in Katsina's restaurant industry.

Keywords: Food Safety, Management Systems, Restaurants

1.0 INTRODUCTION

In recent years, concerns regarding food safety have garnered significant attention worldwide, driven by an increasing number of foodborne illnesses and outbreaks. Among the various settings where food safety is paramount, restaurants stand out as critical nodes in the food supply chain, serving millions of meals

daily. The contamination of food with biological, chemical, and physical agents poses a significant threat to the health and economic stability of both developed and developing nations. The resulting foodborne diseases not only burden public health but also impact the economy (Akhtar, 2015; Yeager *et al.*, 2013). Hence, ensuring the safety of our food supply chain is of utmost importance. Factors such as the rise in foodborne disease occurrences, media coverage of food-related incidents eroding public trust, and concerns over the importation of contaminated food due to trade liberalization have heightened awareness about food safety.

To address these challenges, many countries have reinforced regulatory requirements and introduced new guidelines for food safety management, often based on Hazard Analysis Critical Control Points (HACCP) principles (Motarjemi, 2013). For instance, an evaluation of New York City's restaurant letter-grading program revealed significant improvements in compliance with specific requirements and sanitary conditions during inspections (Wong, 2015). Restaurants, in particular, have been linked to outbreaks of foodborne illnesses (Brown *et al.*, 2014; Smith *et al.*, 2012; Severi *et al.*, 2012; Petran *et al.*, 2012; Osei Tutu & Annison, 2017), prompting public health agencies to mandate food safety certification for both establishments and workers. Certification typically involves inspecting the food safety management systems implemented by restaurants. The significance of this research will lie in its potential to inform stakeholders, including restaurant operators, policymakers, and regulatory agencies, about the current state of FSMS implementation and its future impact on food safety outcomes. By comprehensively understanding the challenges and barriers that restaurants will face in complying with food safety regulations, targeted interventions can be developed to enhance the effectiveness of FSMS and mitigate foodborne risks in the future.

1.1 Challenges and Evolution of Food Safety Culture in Nigeria and Developing Nations

Food safety remains a critical public health concern worldwide, particularly in emerging and developing countries (De Boeck *et al.*, 2009). It is also one of the most pressing social issues that requires attention in low- to middle-income countries, including Nigeria. To address food safety, the World Health Organization (WHO) introduced five key components: maintaining cleanliness, separating raw and cooked foods, thorough cooking, storing food at safe temperatures, and using safe water and raw materials (Fontannaz-Aujoulat *et al.*, 2009). Food safety culture refers to the collective attitudes, values, and beliefs that shape hygienic behaviors in food handling environments (Griffith *et al.*, 2010; Nwankwo & Agbasiere, 2021). Sharman *et al.* (2020) describe it as a deeply ingrained organizational paradigm that influences food safety performance. In recent years, assessments of food safety culture among consumers and food businesses have gained significant attention from both scientists and regulatory bodies (De Andrade *et al.*, 2020; Zanin *et al.*, 2021; Jespersen *et al.*, 2019). Despite advancements in food safety management systems (FSMSs), incidents of food poisoning and outbreaks persist as major public health concerns (Jespersen *et al.*, 2019; EFSA & ECDC, 2017; Griffith, 2006). This ongoing issue has led to a shift from a strictly technical approach to food safety management towards a more human-centered approach, emphasizing the importance of food safety culture (Nayak & Waterson, 2017; Powell *et al.*, 2011; Yiannas, 2008).

In Nigeria, over 200,000 people die annually from foodborne illnesses, with the economic impact estimated at around US\$ 3.6 billion per year (Ezirimwe, 2018). As in many developing countries, Nigeria struggles to meet WHO's five key requirements for food safety, largely due to a lack of basic infrastructure, such as running water and adequate sanitation (Fasoro *et al.*, 2016). These gaps along the entire food supply chain, from farm to table, exacerbate food safety challenges. Other contributing factors include Nigeria's growing population, income disparities, extended food supply chains, evolving demographics, limited education, poor food consumption habits, and weak food safety regulations (Fasoro *et al.*, 2016; Ortega, 2017). Many low-income households in Nigeria rely on staples produced by the informal sector, which exposes them to monotonous diets and increases food safety risks. Moreover, opportunistic practices like food fraud, adulteration, and information asymmetry further aggravate food safety issues in the country (Ezirimwe, 2018; Fasoro *et al.*, 2016; Amolegbe *et al.*, 2021).

1.2 Assessment of Food Safety Management Systems in Restaurants: Evaluating Compliance, Efficacy and Public Health Impact

Food safety remains a paramount concern globally, particularly within the restaurant industry where millions of meals are served daily. Ensuring the compliance and efficacy of Food Safety Management Systems (FSMS) in restaurants is essential to safeguard public health and maintain consumer trust. This research aims to comprehensively assess the status quo of FSMS implementation and its impact on food safety outcomes within restaurants. Amuquandoh, F. E. (2011), In a specific case, the Food and Drugs Authority (FDA) in Ghana conducted an assessment in 2008, revealing a lack of food safety management systems in the Greater Accra Region's hotel and restaurant industry. Subsequently, the FDA worked with the industry to implement HACCP-based systems. However, concerns persisted regarding food safety, as evidenced by a study among international tourists departing from Kotoka International Airport. In response, the FDA published a Code of Practice for food service establishments in 2010 and introduced an annual licensing scheme for the industry. Food and Drug Administration (FDA., 2011). Despite these measures, no documented performance assessment has been conducted for certified restaurants. Studies conducted in Ghana have identified restaurants as sources of foodborne diseases, highlighting the limited use of prerequisite measures and food safety management systems within these establishments (Ababio & Lovatt, 2015). Ensuring food safety in restaurants entails adhering to standardized practices within a regulated framework. Failure to comply with these practices can lead to foodborne illnesses. (Motarjemi, 2014). For example, in Nigeria, managers and head chefs of various restaurant types identified factors such as inadequate cleaning and sanitization, poor hand hygiene, and consumption of undercooked or raw food as potential causes of foodborne illnesses. (Osei Tutu & Annison, 2017). In recent decades, there has been increased awareness of the importance of food safety, driven by the need to mitigate the risks associated with foodborne diseases. This heightened awareness underscores the ongoing efforts to strengthen food safety measures and ensure the well-being of consumers worldwide.

1.3 Developing Diagnostic Tools for Assessing Food Safety Management Systems in Fresh Produce Chains

Despite the importance of food safety management systems (FSMS), there remains limited information regarding the core control and assurance activities and their effectiveness in fresh produce supply chains. Consequently, there is a need for a better understanding of the status of FSMS in fresh produce that operates independently of existing legislation and quality assurance standards. A diagnostic tool has been previously developed to assess microbial FSMS in the manufacturing sector for animal-derived products, such as meat processing and dairy industries (Jacxsens et al., 2010; Luning, Bango, Kussaga, Rovira, & Marcelis, 2008; Luning et al., 2009). However, this tool is not fully suitable for the fresh produce industry because it does not account for specific activities involved in the production and processing of fresh produce, such as washing and the use of irrigation water. Moreover, it overlooks critical chemical hazards unique to fresh produce, such as pesticides and mycotoxins.

The objective of this study was to gain assessment of compliance and efficacy of food safety management systems in restaurants: a case study of Katsina metropolis and microbial safety within FSMS for fresh produce. An international discussion forum held in January 2011 helped identify the most concerning risks within the fresh produce chain (Van Boxtael et al., 2013). Another goal was to develop a diagnostic tool to assess FSMS across the supply chain for companies dealing with fresh produce and its derivatives.

1.4 Challenges and Evolution of Food Safety Culture in Nigeria's Rural and Urban Sectors

In Nigeria, there is a severe lack of basic infrastructure and adequate awareness regarding the importance of food safety culture, particularly in rural and suburban areas (Oranusi, 2004; Egbule et al., 2021; Ifiora, 2020; Anyogu et al., 2021). Several factors have been identified as contributing to foodborne outbreaks in the country, including cooking methods, inadequate food safety practices such as insufficient refrigeration, extended handling, improper reheating of cooked food, and contamination by both commercial and household food handlers (Hedberg, 2006). Moreover, the landscape of food safety management in Nigeria is evolving, as the sale of ready-to-eat street foods in the informal sector continues to gain prominence, largely driven by the country's economic challenges (Ezirigwe, 2018; Fasoro et al., 2016). Jespersen et al. (2019) suggest that by assessing food safety maturity through a

validated triangulation method, food handling organizations can estimate the proportion of their sales lost due to poor-quality items. This approach could lead to the design of targeted interventions necessary for strengthening food safety management and improving control measures within organizations (EFSA & ECDC, 2017). In light of the looming global food crisis, the ongoing COVID-19 pandemic, and Nigeria's growing population (Onyeaka *et al.*, 2021; Ekwebelem *et al.*, 2020), food safety has become a critical topic. This paper seeks to review food safety practices in Nigeria, assess both consumer and producer behavior, and highlight the factors influencing fundamental food safety. At the advanced level, assurance activities in food safety management systems (FSMS) are proactive and incorporate feedback from the system itself, utilize specific data sources, conduct self-performed tests and trials, engage independent assessments, and provide extensive documentation. Key indicators for evaluating preventive measures in the fresh produce supply chain include the hygienic design of equipment and facilities, maintenance and calibration programs, sanitation protocols, incoming material control, and personal hygiene standards. Studies in the fruit and vegetable sector emphasize the importance of hygienic equipment design and sanitation practices (Lehto *et al.*, 2011; Rapanello *et al.*, 2009; Todd *et al.*, 2010), as well as the critical role of personal and hand hygiene among workers (Fonseca, 2006; Michaels & Todd, 2005; Todd *et al.*, 2010). Additionally, proper maintenance of equipment like sprayers and packaging, along with controlling inputs such as planting materials, fertilizers, and pesticides, are vital for preventing microbial and chemical contamination in fresh produce (Abhilash & Singh, 2009; Garrett, 2009; Froder *et al.*, 2007; Leifert *et al.*, 2008). These indicators have thus been incorporated into the assessment tool to evaluate FSMS activities effectively (Luning *et al.*, 2008).

1.5 Challenges in Food Safety Management Systems for Fresh Produce

Over the past decade, food safety management in Europe has largely focused on animals and animal-based products (Alemanno, 2010; Caduff & Bernauer, 2006). Simultaneously, there has been a significant increase in the trade and consumption of fruits and vegetables (EC, 2007). This rise has been accompanied by an apparent uptick in foodborne outbreaks, many of which are now linked to produce and its derived products (Lynch, Tauxe, & Hedberg, 2009; Sivapalasingam *et al.*, 2004; Tauxe *et al.*, 2010). Since fruits and vegetables are frequently consumed raw, fresh-cut, or minimally processed, the removal of contamination is either impossible or highly constrained. The production, processing, and trading of these items occur in diverse climates and regulatory environments across the globe, involving a mix of traditional, structured, or industrial food systems. Supply chain actors range from small-scale operators to large corporations (McCullough, Prabhu, & Kostas, 2008). Each player in these supply chains is encouraged to implement a specific Food Safety Management System (FSMS) (CAC, 2003), which is built on relevant quality assurance standards and guidelines, such as Codex Alimentarius, hygiene legislation, and certifications like GLOBALGAP, BRC, and IFS. At the primary production level, FSMS focuses on implementing good agricultural and hygienic practices. In processing and trading stages, it incorporates good manufacturing practices and HACCP-based principles. These systems consist of equipment, procedures, programs, tools, organizational measures, and personnel dedicated to ensuring the chemical and microbial safety of fresh produce. However, translating these broad requirements into company-specific systems poses a challenge. This is because the guidelines are often general, not tailored to specific production types, vary by region, or lack a solid scientific foundation. As a result, food business operators frequently struggle to adapt these guidelines into their own FSMS (Hatanaka, Bain, & Busch, 2005; Pachepsky *et al.*, 2011; Steele & Odumeru, 2004; Tyrrel, Knox, & Weatherhead, 2006). Several studies have already highlighted deficiencies in currently implemented FSMSs in fresh produce supply chains, pointing to inadequate sanitation, poor hygiene practices, and suboptimal production methods (Ilic, Odumeru, & LeJeune, 2008; Ilic *et al.*, 2012; Johnston *et al.*, 2006; Lehto *et al.*, 2011; Little & Gillespie, 2008).

1.6 Consumer Perceptions and Food Safety Challenges in Nigeria's Informal Food Sector

Two notable phenomena related to consumer perceptions of food safety and quality have been observed (Iyadi, 2015). Firstly, there is a widespread belief that ready-made meals (prepackaged meals requiring minimal or no preparation beyond heating) are more dangerous than home-cooked meals, with the perceived risk heightened when new technologies are involved. Secondly, consumers tend to view

familiar risks as less severe compared to unfamiliar ones (Iyadi, 2015). In Nigeria, the latter phenomenon takes precedence over the former (Iyadi, 2015).

Moreover, there is a stark difference between how consumers and manufacturers perceive food safety. Consumers prioritize packaging, taste, and nutritional richness as key indicators of food quality, while manufacturers focus on product design, performance, and form as critical components of food safety (Iyadi, 2015). As Nigeria continues to evolve socially and economically, an increasing number of consumers are allocating their income in ways that deviate from conventional spending patterns. Notably, a significant portion of the population, particularly low-income earners, places a higher emphasis on saving money and convenience rather than food safety, quality, and hygiene (Isaac A., 2021; Kundu *et al.*, 2020). For many low-income workers, travelers, and school children, street food vendors are the preferred source of meals, with hunger satisfaction being the main concern, often at the expense of food safety or nutritional quality (Kundu *et al.*, 2020; Okojie *et al.*, 2019). Unfortunately, unhygienic practices are widespread among informal food vendors. Food is often prepared, baked, or processed in unsanitary environments. Although some consumers and food businesses are eager to improve food safety practices, essential infrastructure for safe food handling remains inadequate. Many communities and food businesses lack facilities for hygienic washing and drying of utensils, properly designed lavatories, adequate storage for food, ingredients, and chemicals, and sufficient drainage and waste disposal systems (Gali *et al.*, 2020). Compounding these issues is the unreliable power supply, which severely limits the proper storage of agricultural products and processed foods. Even in areas with some basic facilities, poor maintenance culture remains a significant issue. Street food is commonly sold from carts, wheelbarrows, or specially-designed bicycles, allowing vendors to move from one location to another (Onyeneho & Hedberg, 2013). Others operate out of small stalls or carry food on their heads (Ezrigwe, 2018). Studies have revealed that most street food vendors store their cooking utensils in open baskets, cupboards, or even on the floor (Okojie *et al.*, 2019). However, another study in a rural community found that most respondents claimed they consistently practiced good hygiene, including handwashing before cooking and after using the toilet, and cleaning cooking utensils before and after use (Fasoro *et al.*, 2016). While these findings appear positive, they may be subject to bias, as respondents could have provided socially desirable responses. Perceptions of food safety and quality among Nigerian farmers present a different challenge. Food processing remains underdeveloped due to the lack of modern equipment, and poor transportation infrastructure often leads to food spoilage (Ayeni *et al.*, 2021). For instance, consumers perceive Abakaliki rice from the southeastern region as unsafe due to the presence of stones, dirt, and low nutritional content (Nwali & Maureen, 2019). However, improvements in destoning and polishing technologies have enhanced consumer satisfaction. Additionally, vitamin- and iron-rich fruits such as plantain, mango, guava, and banana are often considered unsafe due to the alleged use of harmful chemicals like calcium carbide to induce ripening (David & Adepoju, 2021). These consumer perceptions and food safety challenges highlight the need for more robust infrastructure and education to improve food safety practices across Nigeria's informal food sector.

Onyeaka *et al.* (2021) study the Improving Food Safety Culture in Nigeria, as Nigeria has enormous challenges connected with food safety culture. To produce and provide safe, secure and nutritious food, consumers and food businesses must abide by a set of shared values known as food safety culture. This research aims to investigate the current state of FSMS implementation in restaurants situated in Katsina Metropolis of Katsina state, evaluate their compliance with established food safety regulations and standards, and assess the effectiveness of these systems in preventing foodborne illnesses. By addressing these issues, this study seeks to provide insights and recommendations for enhancing food safety practices in the restaurant industry.

1.7 Objectives of the Study

The aim of this research is to investigate the current state of food safety practices within restaurant environments in Katsina metropolis and evaluate the effectiveness of existing food safety management systems.

The objectives of the research include:

1. To assess the level of compliance of restaurants with established food safety regulations and standards.

2. To evaluate the efficacy of food safety management systems in preventing foodborne illnesses and ensuring food safety.
3. To identify strengths and weaknesses in the implementation of food safety practices within restaurants.
4. To provide recommendations for improving food safety practices, training programs, and technological solutions in restaurant environments.

2. RESEARCH METHOD

2.1 Study Area

The research was conducted in Katsina metropolis, located in the Katsina Local Government Area of Katsina State, Nigeria. Katsina, formerly a city-state, serves as the capital of Katsina State. Situated approximately 160 miles east of Sokoto and 84 miles northwest of Kano, the city lies near the border with Niger. Katsina is a hub for agriculture, known for producing groundnuts, cotton, hides, millet, and guinea corn, and it hosts mills for processing peanut oil and steel. Predominantly Muslim, the city's population is primarily composed of the Fulani and Hausa ethnic groups.

2.2 Data collection

The data used for the research was gathered from restaurant owners, managers, chefs, and staff responsible for food safety. The sample was selected from different restaurants in the metropolitan area of Katsina (fast food, casual dining, fine dining, etc.). Questionnaire was Distributed to these individuals to feel and interview was administered to them in-person to gather responses. Sampling Technique was Used in selecting restaurants of various sizes and types.

2.3 Data Analysis Process:

Logistic Regression Analysis was used to Identify significant predictors of non-compliance or violations (e.g., inadequate training, lack of proper facilities). And ANOVA Analysis was also used to Compare the means of food safety practices and management system effectiveness across different restaurant types. By conducting the survey and analysis, we are able to assess not only the current compliance but also the effectiveness of food safety systems in place. The results from logistic regression and ANOVA can guide targeted recommendations for specific types of restaurants.

The research demonstrated that while some restaurants in Katsina Metropolis comply with food safety regulations, there are significant breaches in FSMS implementation across many establishments. These breaches, particularly in staff training, kitchen hygiene and food handling practices, pose potential risks to public health. The findings suggest that stricter enforcement of food safety regulations, alongside enhanced training programs, could substantially improve the efficacy of FSMS in restaurants. Overall, the study highlights the critical need for continuous monitoring and improvement of food safety systems to safeguard consumers and maintain high industry standards.

3. RESULT AND DISCUSSION

This section gives a detailed descriptive statistics that provide insight into the various dimensions of food safety compliance observed within the sample. Through Cronbach's Alpha, we validate the reliability of the items used to gauge the restaurants' adherence to essential safety standards.

Next, logistic regression analysis is employed to identify key predictors of compliance status, enabling an understanding of how specific characteristics, such as years of operation and types of restaurants, influence the likelihood of meeting food safety requirements. This statistical approach allows for an examination of the relationships between these factors and compliance, identifying significant patterns that may inform better practices and policies in the restaurant industry. By interpreting these results, the chapter aims to provide a comprehensive view of compliance levels within the sampled restaurants, highlighting strengths, potential areas for improvement, and implications for maintaining effective food safety management systems.

Table 1: Reliability study for food safety management using Cronbach's Alpha

Case Processing Summary			
		N	%
Cases	Valid	250	100.0
	Excluded ^a	0	.0
	Total	250	100.0

a. Listwise deletion based on all variables in the procedure.

To assess the internal consistency of the survey instrument used in measuring compliance and efficacy of food safety management systems in restaurants, a reliability analysis was conducted using Cronbach's Alpha. Cronbach's Alpha value of .871 indicates high reliability, confirming that the 16-item scale is consistent and suitable for capturing responses across various dimensions of food safety management. The item statistics reveal the mean scores and standard deviations for each statement, providing insights into the respondents' agreement levels.

Reliability Statistics

Cronbach's Alpha	N of Items
.871	16

Case Processing Summary

Out of a total of 250 cases, 100% were valid, meaning no cases were excluded, which enhances the validity of the reliability results.

Table 2: Item Statistics respondents' agreement with food safety regulations, and the overall efficacy of food safety management systems

	Mean	Std. Deviation	N
The restaurant consistently follows all required food safety regulations.	4.64	.739	250
There is regular inspection and auditing to ensure food safety compliance.	4.31	.859	250
Employees are well-trained and knowledgeable about food safety standards.	4.21	1.052	250
The restaurant has a clearly documented food safety management system.	4.16	1.178	250
The food safety management system in the restaurant effectively prevents foodborne illnesses.	4.48	.936	250
The restaurant has not experienced any incidents of food contamination or illness in the past year.	4.46	.683	250
All safety protocols (temperature control, cleanliness, etc.) are consistently followed.	4.21	.835	250
The food safety management system covers all critical points of food handling and storage.	4.32	.861	250

The restaurant excels in maintaining cleanliness in food preparation areas.	4.32	1.123	250
There is room for improvement in the regular monitoring of food safety practices.	4.11	.965	250
The restaurant's pest control measures are highly effective.	4.26	.712	250
Employees strictly follow proper food handling procedures at all times.	3.95	1.312	250
Ongoing food safety training is necessary for staff.	4.74	.546	250
Implementing technological solutions (e.g., temperature monitoring devices) would improve food safety.	4.21	.692	250
Improved documentation and tracking of food safety practices would enhance the system.	4.16	.809	250
Regularly updating the food safety management system would lead to better compliance.	4.41	.827	250

The mean scores for each item demonstrate respondents' general agreement with statements regarding compliance with food safety regulations, employee training, foodborne illness prevention, and the overall efficacy of food safety management systems. Key observations include:

The data indicates strong compliance with critical food safety measures among the surveyed restaurants. High mean scores on several items suggest that food safety regulations are well-followed, and staff training is prioritized. For example, the statement "The restaurant consistently follows all required food safety regulations" has a mean score of 4.64 (SD = .739), reflecting a strong consensus among respondents on the importance of adherence to regulatory standards. Similarly, "Ongoing food safety training is necessary for staff" received one of the highest scores, with a mean of 4.74 (SD = .546), underscoring a commitment to continuous staff education as essential for upholding food safety standards. These high scores indicate that respondents recognize the necessity of these fundamental practices, suggesting that restaurants not only understand regulatory requirements but are also actively taking steps to implement them. This level of compliance indicates a well-grounded approach to food safety in the majority of the surveyed establishments, contributing positively to the overall efficacy of their food safety management systems.

However, the data also highlights areas that may benefit from further improvement to strengthen food safety practices. For instance, regular monitoring received a slightly lower mean score of 4.11 (SD = .965), indicating some variability in respondents' perceptions of monitoring practices across establishments. This score suggests that while monitoring is generally implemented, there may be inconsistencies in its frequency or thoroughness, hinting at a possible gap in ensuring comprehensive oversight. Additionally, the statement concerning the enhancement of documentation practices scored 4.16 (SD = .809), pointing to an opportunity for restaurants to improve their documentation processes. Enhanced documentation could lead to better tracking and accountability within food safety practices, making it easier to identify and address any procedural lapses. Together, these areas for improvement

reveal a potential need for reinforcing regular monitoring and meticulous documentation, which could further elevate compliance and safeguard public health in the long term.

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
68.94	71.278	8.443	16

The dependent variable, compliance status, was encoded as a binary outcome: "Non-compliant" (0) and "Compliant" (1). This binary encoding enabled logistic regression analysis to determine the likelihood of restaurants being compliant with food safety management standards based on independent variables.

Variables in the Equation

	B	S.E.	Wald	Df	Sig.	Exp(B)
Step 0 Constant	2.242	.215	109.103	1	.000	9.417

In the initial model without predictors, the constant term shows a significant value (B = 2.242, Sig. = .000), indicating a baseline probability of compliance across the sample. The model's odds ratio (Exp(B) = 9.417) suggests a high baseline likelihood of restaurants being compliant in the absence of predictors.

Table 3: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	150.187 ^a	.031	.066

a. Estimation terminated at iteration number 6 because parameter estimates changed by less than .001.

Table 4 Classification Table^a

	Observed	Predicted			
		Label		Percentage Correct	
		Non-compliant	Compliant		
Step 1	Label	Non-compliant	0	24	.0
		Compliant	0	226	100.0
	Overall Percentage				90.4

a. The cut value is .500

Table 5: Variables in the Equation for logistic regression analysis

	B	S.E.	Wald	df	Sig.	Exp(B)	
Step 1 ^a	Yearsofoperation	.592	.246	5.768	1	.016	1.808
	TypesofRessturant	.530	.233	5.187	1	.023	1.699
	Constant	-.447	.995	.201	1	.654	.640

a. Variable(s) entered on step 1: Years of operation, Types of Restaurant.

3.2 Discussion of the result

The logistic regression analysis conducted in this study evaluated factors influencing the compliance status of restaurants with food safety management standards. The dependent variable, compliance status, was encoded as a binary outcome, with "Non-compliant" coded as 0 and "Compliant" as 1. This binary approach allowed the use of logistic regression to assess the likelihood of compliance based on independent variables such as years of operation and types of restaurants. By analyzing these predictors,

we gain insights into whether certain characteristics increase a restaurant's likelihood of adhering to food safety regulations, contributing to a better understanding of compliance trends within the industry.

The initial model, run without predictors, provided a baseline for compliance likelihood across the sample. Here, the constant term was significant ($B = 2.242$, $\text{Sig.} = .000$), with an odds ratio of 9.417, indicating a high likelihood of compliance even in the absence of specific predictors. This high baseline odds ratio implies that a majority of restaurants in the sample are generally compliant with food safety regulations, highlighting an overall favorable trend toward maintaining standards. Such findings suggest that, as a whole, the restaurant industry appears committed to food safety; however, this baseline does not account for individual characteristics that may enhance or reduce a particular restaurant's likelihood of compliance.

Upon adding predictors, the final logistic regression model identified two significant factors impacting compliance: years of operation and types of restaurants. Years of operation demonstrated a positive and significant effect on compliance ($\text{Exp}(B) = 1.808$, $\text{Sig.} = .016$), indicating that longer-established restaurants are approximately 1.8 times more likely to be compliant with food safety standards for each additional year they have been in operation. This could suggest that more experienced establishments may have stronger systems and routines in place, making compliance easier to achieve. The types of restaurants also showed a significant effect on compliance status ($\text{Exp}(B) = 1.699$, $\text{Sig.} = .023$), highlighting that different categories of restaurants may have varying abilities or priorities regarding food safety compliance, possibly due to factors like operational focus, resource availability, and customer expectations. These findings imply that targeted interventions might be more effective if tailored to specific types of establishments or levels of experience.

The model summary revealed that the predictors explain a moderate portion of the variance in compliance status, with Cox & Snell R Square and Nagelkerke R Square values at .031 and .066, respectively. The classification table showed that the model was highly successful at predicting compliant cases, with a 100% success rate for these predictions, but failed to accurately classify any non-compliant cases. This overall classification accuracy of 90.4% suggests that while the model effectively identifies compliant establishments, it has limitations in detecting non-compliance. This outcome implies that additional variables, perhaps those that capture operational practices, management support, or financial resources, could improve the model's ability to predict non-compliance. As such, future research might explore these factors to develop a more comprehensive understanding of the determinants of compliance and thus inform policy and intervention strategies to further elevate food safety standards in the restaurant industry.

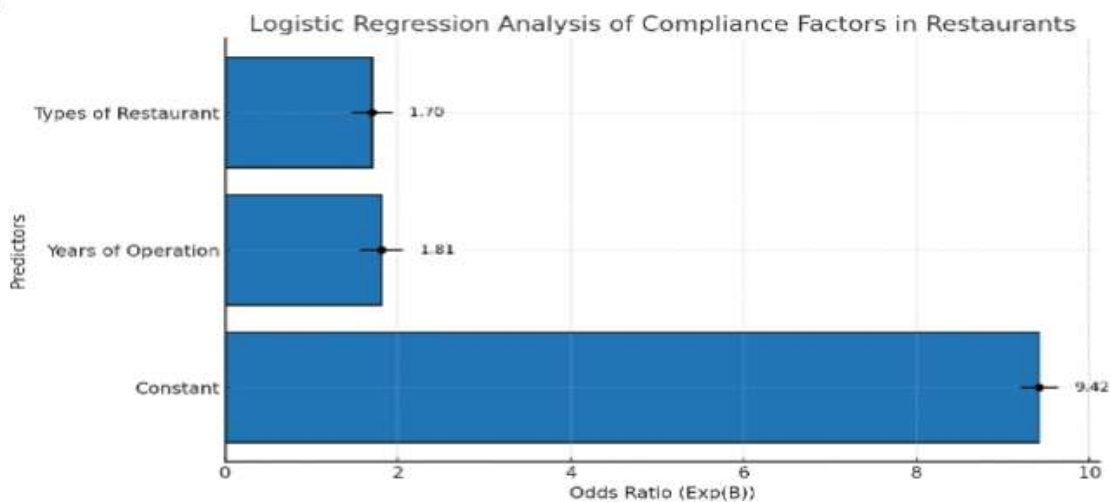


Fig. 1 Bar chart showing Logistic Regression Analysis of compliance factors in Restaurants

Here's a bar chart visualizing the logistic regression analysis results for restaurant compliance with food safety management standards. The chart displays the odds ratios (Exp(B)) for each predictor, with error bars indicating standard errors. Significant predictors are highlighted, showing that both "Years of Operation" and "Types of Restaurant" have an impact on compliance likelihood. This visualization helps clarify the relative influence of each factor on compliance

3.3 Interpretation

The results from the reliability analysis confirm that the survey instrument is robust for assessing food safety management system compliance and efficacy. The logistic regression analysis highlights key determinants of compliance, notably the years of operation and types of restaurants, which significantly impact compliance status. Established restaurants appear more likely to be compliant, suggesting experience and longevity may enhance the implementation of food safety practices. The variability in compliance based on restaurant type points to differences in operational capabilities or standards, warranting further exploration.

Overall, this analysis underscores the importance of consistent training, monitoring, and potential updates to food safety management practices to sustain compliance and improve public health outcomes. Further studies could consider additional variables, such as staff turnover rates and regional regulations, to provide a more comprehensive understanding of compliance drivers across diverse restaurant settings.

4. CONCLUSION

The research findings emphasize that while restaurants in Katsina Metropolis generally strive to comply with food safety standards, notable breaches in FSMS implementation continue to pose risks to public health. Inadequate staff training, inconsistent hygiene practices, and lapses in regular monitoring remain significant areas of concern. Logistic regression analysis suggests that older, more established restaurants are more likely to maintain compliance, likely due to experience and established systems. However, all types of restaurants showed a need for greater consistency in monitoring and documenting food safety practices.

This study concludes that stricter enforcement of food safety regulations, paired with comprehensive training programs and ongoing FSMS improvements, could significantly enhance compliance across the restaurant industry in Katsina. Moreover, local authorities, restaurant owners, and public health stakeholders should consider adopting standardized certification programs, such as HACCP, to strengthen the food safety culture within the metropolis. By fostering a robust FSMS framework, these recommendations have the potential to improve public health outcomes, reduce foodborne illness risks, and build consumer trust in the region's dining establishments.

5. RECOMMENDATIONS

These encapsulate the core findings and implications of the research, providing actionable recommendations for stakeholders in the food industry and public health sector more especially in Katsina state.

- Restaurant staff should undergo regular and comprehensive training on food safety, hygiene, and proper food handling procedures to minimize the risk of contamination and foodborne illnesses.
- Local authorities should enforce stricter compliance with FSMS, conducting more frequent inspections to ensure that restaurants adhere to food safety guidelines and standards.
- Establishing incentive programs for restaurants that maintain high food safety standards could encourage compliance and improve the overall food safety culture in the region.
- Increase public awareness about food safety to help consumers make informed choices about where they eat. This can also pressure restaurants to maintain high standards of hygiene and safety.

6. Research Contribution

This research makes significant contributions to the field of food safety by Providing detailed analysis of FSMS compliance in restaurants within Katsina Metropolis, contributing to the limited body of research on food safety in northern Nigeria. It also identifies key areas where restaurants in the region fall short in

food safety management, providing a foundation for policy interventions and improved industry practices. the study will also helps to reduce the risk of foodborne illnesses, ultimately contributing to improved public health outcomes in Katsina Metropolis.

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