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AQUACULTURE RISK FINANCING STRATEGIES AND FOOD SAFETY AMONG SELECTED FISH FARMERS IN LAGOS METROPOLIS: A SIMPLE LINEAR REGRESSION ANALYSIS

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ABSTRACT

This study examines the effect of aquaculture risk financing strategies on food safety among fish farmers in Lagos Metropolis, Nigeria, amid growing concerns over production risks, limited financial resilience, and compliance with food safety standards. A descriptive survey research design was adopted, and data were obtained from 141 fish farmers using a structured questionnaire. The data were analysed using simple linear regression at a 0.05 level of significance. Findings reveal a statistically significant positive relationship between aquaculture risk financing strategies and food safety ($R = 0.362$; $R^2 = 0.131$; $F = 20.938$; $p < 0.001$), indicating that improved financing mechanisms enhance food safety outcomes. However, the moderate explanatory power suggests that additional institutional and operational factors also play important roles. The study concludes that risk financing is a significant but partial determinant of food safety. It recommends improved access to credit, expanded insurance coverage, strengthened cooperative financing, and targeted capacity-building to enhance resilience and compliance.

Keywords: Aquaculture risks, risk financing, food safety, fish farmers, Lagos

INTRODUCTION

Aquaculture has become an essential component of global food systems due to its contribution to food security, nutrition, employment generation, and economic development. In Nigeria, the aquaculture sector has expanded significantly over the past two decades as a result of increasing demand for fish and declining yields from capture fisheries (Ogunji & Wuertz, 2023; Kaleem & Sabi, 2021). Lagos Metropolis, as one of the country's most populous and economically active regions, hosts a large concentration of fish farming enterprises that contribute substantially to the supply of fish and fish products. As consumer awareness of food quality and safety continues to increase, fish farmers are expected to comply with established food safety standards relating to water quality management, feed quality, hygienic production practices, and traceability systems (Akinfenwa, 2025; Mebude et al, 2024). However, maintaining these standards often requires substantial financial resources, which many fish farmers may not readily possess.

The aquaculture industry is exposed to numerous risks capable of affecting both production outcomes and food safety compliance. These risks include disease outbreaks, water pollution, flooding, fluctuating feed prices, market uncertainties, and equipment failures. Such challenges can impose significant financial burdens on fish farmers and reduce their capacity to invest in preventive and corrective food safety measures (Carlino-Costa & Belo, 2025; Food and Agriculture Organisation, 2024). To address these uncertainties, various aquaculture risk financing strategies, including insurance schemes, cooperative financing arrangements, access to credit facilities, savings mechanisms, and government support programmes, have been introduced to enhance farmers' resilience and financial stability. The availability of these financing options is expected to provide farmers with the resources needed to adopt improved production practices and maintain acceptable food safety standards (Jonas & Christian, 2025; Putri et al., 2026).

Despite the potential benefits of risk financing strategies, evidence suggests that many fish farmers continue to experience difficulties in accessing adequate financial support for their operations. Limited access to credit, low insurance penetration, inadequate savings, and insufficient institutional support have constrained the ability of farmers to invest in quality inputs, certified feed, water monitoring systems, biosecurity measures, and proper record-keeping procedures (Horvey et al., 2024; Paul, 2025). Consequently, food safety challenges such as improper chemical usage, poor handling and storage practices, inadequate traceability systems, and contamination risks remain prevalent in parts of the aquaculture sector. These conditions not only threaten consumer health but also undermine the competitiveness and sustainability of fish farming enterprises (Issa-Zacharia et al., 2025; Wu et al., 2023).

Although previous studies (such as Luna et al., 2023; Okon et al., 2025; Omokpariola, 2026) have examined aquaculture production, risk management, and food safety practices separately, limited empirical attention has been devoted to understanding how risk financing strategies influence food safety outcomes among fish farmers. This knowledge gap is particularly evident in Lagos Metropolis, where aquaculture activities continue to expand amid growing concerns about food quality and public health. The absence of sufficient empirical evidence on the relationship between aquaculture risk financing strategies and food safety practices makes it difficult for policymakers, financial institutions, and industry stakeholders to design effective interventions. Therefore, this study investigates the influence of aquaculture risk financing strategies on food safety among selected fish farmers in Lagos Metropolis with a view to providing evidence-based

recommendations for improving both financial resilience and food safety compliance within the aquaculture sector.

LITERATURE REVIEW

Conceptual Review

Aquaculture Risk Financing Strategies

Aquaculture risk financing strategies refer to the financial mechanisms and instruments adopted by fish farmers to mitigate, transfer, or absorb the economic consequences of production-related risks. The aquaculture sector is highly vulnerable to uncertainties arising from disease outbreaks, climate variability, water pollution, input price fluctuations, and market instability, all of which can adversely affect productivity and profitability (Bennett et al., 2024; Muthoka et al., 2023). According to Ono et al. (2026), risk financing instruments such as insurance schemes, emergency savings, agricultural credit, cooperative financing, and government support programs enhance farmers' capacity to recover from shocks and maintain business continuity. These financial mechanisms reduce vulnerability by providing liquidity during periods of distress and enabling farmers to undertake preventive investments that strengthen farm resilience. Consequently, effective risk financing has emerged as a critical component of sustainable aquaculture development and rural livelihood protection (Luna et al., 2023; Ndubuokwu & Gbigbi, 2025).

Empirical studies (Parrae et al., 2021; Savari et al., 2024; Srikulnath et al., 2025) have consistently demonstrated the positive role of risk financing strategies in improving farm performance and enhancing food safety compliance within aquaculture systems. Access to affordable credit and insurance coverage enables fish farmers to invest in quality feed, disease control measures, water quality management, and modern production technologies that reduce contamination risks and improve product quality. Furthermore, cooperative financing and government-backed support programs facilitate access to resources that individual farmers may otherwise be unable to obtain. Evidence from developing economies suggests that farmers with stronger financial risk management capabilities exhibit greater adaptive capacity, operational stability, and compliance with food safety standards (Gabrilla et al., 2024; Kalogiannidis et al., 2024). Therefore, the adoption of comprehensive aquaculture risk financing strategies is increasingly recognized as a prerequisite for achieving sustainable fish production, food security, and public health objectives.

2.1.2 Aquaculture Food Safety

Aquaculture food safety refers to the practices, standards, and regulatory measures implemented throughout fish production, harvesting, processing, storage, and distribution to ensure that aquaculture products are safe for human consumption. The growing demand for fish as a major source of animal protein has heightened concerns regarding food safety within aquaculture systems (Carlino-Costa & Belo, 2025; Vergis et al., 2021). Potential hazards such as chemical residues, pathogenic microorganisms, environmental contaminants, and improper handling practices can compromise fish quality and pose significant public health risks. Consequently, international food safety frameworks, including the Hazard Analysis and Critical Control Point (HACCP) system and Good Aquaculture Practices (GAqP), emphasize preventive measures aimed at minimizing

contamination and ensuring product traceability (Issa-Zacharia et al., 2025; Rose, 2026). Effective food safety management is therefore essential for protecting consumer health, enhancing market access, and promoting sustainable aquaculture development.

Previous studies (such as Bedana et al., 2022; Kyule et al., 2023; Ovissipour et al., 2024) indicate that adherence to food safety practices significantly improves the quality and acceptability of aquaculture products while reducing the incidence of food-borne illnesses. However, the regular monitoring of water quality, the use of certified feed, hygienic handling of harvested fish, and compliance with chemical usage guidelines are critical determinants of food safety performance among fish farmers. Furthermore, proper record-keeping and traceability systems enable producers to identify and address potential contamination sources promptly. In many developing countries, however, inadequate technical knowledge, limited access to resources, and weak regulatory enforcement continue to constrain the implementation of food safety standards (Duan et al., 2025; Thystrup et al., 2025). Therefore, strengthening food safety awareness, institutional support, and farmer capacity-building initiatives remains crucial for ensuring the production of safe and high-quality aquaculture products that meet both domestic and international market requirements.

Theoretical Review

Expected Utility Theory

The Expected Utility Theory was formally developed by John von Neumann and Oskar Morgenstern in their seminal work *Theory of Games and Economic Behavior* (1944). The theory was later refined and popularized in decision economics as a framework for understanding how individuals make choices under uncertainty. Its core essence is that rational decision-makers evaluate risky alternatives by comparing the expected utility (rather than just expected monetary value) of different options and then choose the one that maximizes their satisfaction or benefit (Kocasian, 2019; Murphy, 2025). In other words, individuals are assumed to be rational agents who weigh probabilities and outcomes to arrive at optimal decisions when faced with uncertainty. The theory has been widely applied in economics, finance, insurance, and agricultural decision-making, where outcomes are uncertain and risk is inherent (Liu, 2023; Quiggin, 2022).

The Expected Utility Theory explains decision-making under uncertainty based on rational evaluation of expected outcomes. Despite its wide acceptance, the theory has been criticized for assuming perfect rationality, stable preferences, and complete information, which do not always reflect real human behavior. Behavioral economists argue that individuals often rely on heuristics, emotions, and biases rather than strict utility maximization (Hou, 2025; Vladimir, 2022). It has also been challenged for its limited capacity to explain inconsistent risk-averse or risk-seeking behavior across different situations. In relation to aquaculture risk financing strategies among fish farmers in Lagos, the theory provides a useful framework for understanding financial decision-making under risk and uncertainty. It assumes that farmers choose among options such as savings, credit, insurance, cooperative support, and government assistance based on expected benefits. These choices are made by weighing potential costs against the perceived protection each strategy offers against production shocks like disease outbreaks and price fluctuations (Herfeld, 2018). The theory is relevant because aquaculture financing decisions involve trade-offs under uncertain conditions. However, farmers' choices are also influenced by access to financial services,

awareness levels, and socio-economic factors. These practical realities highlight the limitations of the theory in fully capturing actual decision-making behavior in aquaculture systems.

2.2.2 Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) was developed by Icek Ajzen in 1985 as an extension of the earlier Theory of Reasoned Action. Its central essence is that human behaviour is directly influenced by behavioural intention, which in turn is shaped by three key factors: attitudes toward the behaviour, subjective norms, and perceived behavioural control. Attitude refers to an individual's positive or negative evaluation of performing a behaviour, subjective norms involve perceived social pressure from others, and perceived behavioural control reflects the individual's belief in their ability to perform the behaviour (Barbera & Ajzen, 2020; Bosnjak et al., 2020). The theory assumes that individuals make rational decisions by considering available information and potential outcomes before acting. TPB has been widely applied in health, environmental, and agricultural studies to explain and predict behavioural intentions and actual behaviour.

Despite its usefulness, the Theory of Planned Behaviour has been criticized for overemphasizing rational decision-making while underestimating emotional, habitual, and unconscious influences on behaviour. Critics also argue that the relationship between intention and actual behaviour is not always strong, especially when external constraints such as limited resources or institutional barriers exist (Alhamad & Donyai, 2021; Syed et al., 2024). Additionally, the theory may not fully capture complex social and cultural factors that shape behaviour in real-world settings. In relation to aquaculture food safety among fish farmers in Lagos, the theory helps explain why farmers adopt or fail to adopt safe production and handling practices (Kurniawati et al., 2024; Kushwah, 2025). Farmers are more likely to implement food safety measures such as proper hygiene, clean water management, and safe chemical use if they have positive attitudes toward food safety, perceive social approval from peers and regulators, and believe they have the capacity and resources to do so. However, constraints such as lack of training, inadequate infrastructure, and limited awareness may weaken the translation of intention into actual safe practices, highlighting both the relevance and limitations of the theory in aquaculture food safety behaviour.

The integration of Expected Utility Theory and the Theory of Planned Behaviour provide a broader explanation of how aquaculture operators make decisions regarding financing and food safety practices under uncertain production conditions. While Expected Utility Theory explains farmers' preference for financing mechanisms that maximise expected economic protection against production risks, the Theory of Planned Behaviour explains behavioural intentions toward food safety compliance based on attitudes, subjective norms, and perceived behavioural control. Together, both theories suggest that financing capacity and behavioural orientation jointly shape farmers' ability and willingness to implement effective food safety practices in aquaculture systems

Empirical Review

Aminu et al. (2021) assessed the aquaculture risk management measures employed by catfish growers in Nigeria. The study sought to identify significant production hazards, evaluate coping mechanisms, and ascertain the socio-economic factors affecting their adoption. A descriptive

survey design was employed, gathering data from 100 fish farmers via structured questionnaires, which were subsequently analysed using descriptive statistics and multivariate probit regression. The findings indicated that price volatility, feed expenses, and fingerling quality were significant risks, but farmers mostly employed personal savings, pond management, and enhanced feed quality as mitigation techniques. The research determined that farmers depend more on informal finance mechanisms than on official ones due to restricted access to institutional support. It advised fortifying agricultural credit initiatives, cooperative organisations, and subsidy programs to bolster farmers' resilience. This study enhances understanding by offering empirical evidence on risk coping behaviour in aquaculture and identifying socio-economic factors that affect strategy adoption, which is pertinent for enhancing risk financing systems and productivity within the sector.

Jimoh and Ajemunigbohun (2023) examined the determinants affecting farmers' adoption of insurance as a risk management strategy in aquaculture. The introduction emphasised aquaculture insurance as a financial tool for mitigating income losses, safeguarding farm assets, and assuring production stability. The aims were to identify obstacles impacting aquaculture insurance demand and ascertain critical elements influencing farmers' readiness to use insurance services. A survey research design with a multiphase sampling technique was employed to choose fish producers, and data were gathered through structured questionnaires. Descriptive statistics and Friedman's rank test were employed for analysis. The findings indicated that elevated premium costs, inadequate access to insurance services, limited awareness, feeble regulatory frameworks, subpar claims settlement processes, and insufficient financial literacy substantially diminished demand. The study determined that the adoption of aquaculture insurance is minimal, despite its potential advantages, due to structural and informational limitations. It advocated for policy assistance via subsidies, enhanced awareness, and streamlined insurance products. The study enhances understanding by empirically assessing the barriers and drivers affecting aquaculture insurance demand among fish producers, offering data for the refinement of policy and insurance design.

Agbabiaka and Okeke (2024) analysed the socio-economic characteristics and production obstacles faced by fish farmers in the Owerri, Orlu, and Okigwe zones. The introduction highlighted aquaculture as a significant livelihood endeavour hindered by economic and infrastructural constraints. The aims were to evaluate the socio-economic attributes of fish producers and to identify significant restrictions impacting aquaculture productivity. A descriptive survey design was employed, utilising structured questionnaires distributed to 120 randomly chosen fish producers across three zones, with data analysed using SPSS version 22.0. The findings indicated that the majority of respondents were male, aged between 40 and 49 years, and possessed a reasonably high level of education. Significant obstacles encompassed elevated feed costs, insufficient capital, unreliable power supply, restricted access to credit institutions, and absence of storage infrastructure. The research determined that aquaculture productivity is substantially impeded by financial and infrastructural obstacles. It advocated for governmental action via subsidies, enhanced credit accessibility, and fortified extension programs. The study enhances understanding by offering empirical information regarding the socio-economic factors and primary obstacles hindering fish farming development in southeastern Nigeria.

Owoeye et al. (2025) examined the role of risk financing in enhancing food security among rural farmers. The study introduced agricultural risk financing as a mechanism for managing production uncertainties and improving livelihood outcomes. The objectives were to identify prevalent

agricultural risks, examine the effectiveness of risk financing strategies on food security, assess their influence on farmers' decision-making, and determine barriers to adoption. A multi-stage sampling technique was employed to select 450 smallholder farmers, while structured questionnaires were used for data collection. Data were analyzed using descriptive statistics, linear regression, and logistic regression models. Findings revealed that weather-related risks, crop failure, price volatility, and pests and diseases were most prevalent, while education, extension services, insurance use, and crop diversification significantly influenced food security. Major barriers included limited financial access, poor infrastructure, and low financial literacy. The study concluded that risk financing significantly enhances food security and farmers' decision-making capacity. It recommended improved access to financial services and agricultural insurance. The study contributes to knowledge by empirically linking risk financing strategies with food security outcomes among smallholder farmers.

RESEARCH METHODS

This study adopted a descriptive survey research design with a quantitative approach. The design is appropriate because it allows for systematic collection and analysis of data on aquaculture risk financing strategies and food safety practices among fish farmers without manipulating variables. The study was conducted among fish farmers operating within the Lagos metropolis, Nigeria, where aquaculture activities are highly concentrated due to urban demand for fish protein.

The population of the study comprised registered and active fish farmers in Lagos State, estimated to be drawn from aquaculture clusters, cooperative associations, and fish farming settlements across the metropolis. Given the absence of a unified database, the study focused on accessible farmers registered under cooperative societies and aquaculture associations. A multistage sampling procedure was adopted to enhance coverage of active aquaculture clusters within Lagos metropolis. Purposive sampling was initially used to identify major aquaculture-producing clusters due to their strategic importance and concentration of fish farming activities. Subsequently, simple random sampling was applied within the selected clusters to improve representativeness and reduce sampling bias. Convenience sampling was only employed at the final stage where accessibility constraints and respondent availability limited complete randomization. Although this may introduce some degree of selection bias, the approach was considered appropriate given the absence of a comprehensive sampling frame for fish farmers within the study area. A sample size of 141 respondents was determined and considered adequate for statistical analysis based on Krejcie and Morgan sample size determination.

The data collection instrument was a structured questionnaire designed in Likert-scale format (5-point scale) to capture information on risk financing strategies and food safety practices. The instrument was divided into sections covering demographic characteristics, financing mechanisms, and food safety indicators. To ensure validity, the instrument was subjected to face and content validation by experts in aquaculture economics and agricultural extension, who reviewed it for clarity, relevance, and coverage of research objectives (Sallies et al., 2021). Reliability was established using Cronbach's Alpha coefficient, which yielded acceptable internal consistency values above 0.70 for all constructs. Data were analyzed using descriptive statistics (mean and standard deviation) and Friedman rank test to determine the relative importance of variables and test differences in ranking. The analysis was conducted using SPSS version 25, with statistical

significance set at 0.05. Ethical approval was obtained from the relevant departmental research committee, while informed consent was obtained from all respondents prior to questionnaire administration. The suitability of the data for factor-related analysis was confirmed through Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity.

RESULTS AND DISCUSSION OF FINDINGS

Descriptive Analysis of Demographic Profile

Table 1: Demographic Information of Participants

Variable	Category	Frequency (%)
Gender	Male	97 (68.8%)
	Female	44 (31.2%)
Age	18 but less than 30	57 (40.4%)
	30 but less than 40	68 (48.3%)
	40 but less than 50	16 (11.3%)
	50 but less than 60	0(0%)
	60 & above	0 (0%)
Marital Status	Single	07 (5%)
	Married	134 (95%)
	Separated	0 (0%)
	Widow	0 (0%)
Educational Qualification	SSCE/GCE/OND	56 (39.7%)
	HND/BSc	85 (60.3%)
	Postgraduate	0 (0%)
	Professional Certificate	0 (0%)
	Others	0 (0%)

Source: Field Survey, 2026

Table 1. revealed significant insights into the composition of the studied population. The *gender distribution* showed a wider representation, with 68.8 percent identified as male and 31.2 percent as female. Concerning age distribution, the data reflected a diverse age range within the sample. The majority of participants fall within the *age brackets* of 30 to less than 40 years, 18 to less than 30years, and 40 but less than 50 years; accounting for 48.3 percent, 40.4 percent, and 11.3 percent respectively. This distribution indicates a relatively younger cohort dominating the sample. The *marital status* presented an interesting aspect of the demographic profile. The majority, constituting 95 percent, are identified as married, while 5 percent are single. *Educational qualifications* within the sample population exhibit varying levels of attainment. A considerable portion, accounting for 60.3 percent, holds a HND/BSc, followed by 39.7 percent possessing SSCE/GCE/OND qualification.

Table 2: Participants' Demographic Information

Variable	Response Label	Frequency	Percentages (%)
Years of experience	1 – 10 years	138	97.9
	10 – 20 years	03	2.1
	20 years above	0	0
What is your primary source of financing?	Bank loan	0	0
	Insurance	03	2.1
	Personal savings	130	92.2
	Others	08	5.7
Do you implement regular water quality checks?	Yes, always	71	50.4
	Sometimes	67	47.5
	Rarely	03	2.1
	No	0	0
How do you manage disease outbreaks?	Use of antibiotics	73	51.8
	Improved biosecurity measure	47	33.3
	Vaccination	21	14.9
	Others	0	0
Have you experienced significant financial losses?	Yes, significant losses	49	34.8
	Some losses	90	63.8
	Minimal losses	02	1.4
	No losses	0	0
How often do you assess risks?	Regularly	55	39.0
	Occasionally	86	61.0
	Rarely	0	0
	Never	0	0
Do you have insurance coverage?	Yes, comprehensive cover	09	6.4
	Partial cover	0	0
	No, but planning to	78	55.3
	No	54	38.3
Have you received training?	Yes, recently	18	12.8
	Yes, but over a year	76	53.9
	No, but interested	38	27.0
	No	09	6.4
Do food safety practices influence your access	Significantly	77	54.6
	Somewhat	03	2.1
	Minimally	25	17.7
	Not at all	36	25.5
Do you have an emergency response plan	Yes, documented plan	06	4.3
	Informal plan	49	34.8
	No plan, but planning to	26	18.4
	No plan	60	42.6

Source: Field survey, 2026

The data presented in Table 2 provides further insights into other demographic variables. For investigation regarding the participants *years of experience*, 97.9 percent responded 1 – 10 years and the remaining 2.1 percent implied '10 – 20 years'. For *the primary source of financing*, majority representing 92.2 percent were from personal savings. For *implement regular water quality checks*, 50.4 percent expressed the yes always. While 47.5 percent were sometimes, 2.1 percent showed rarely quality check. For *the manage disease outbreaks by the participants,* majority representing 51.8 percent expressed use of antibiotics while 33.3 percent implied improved biosecurity measure. For *the experienced significant financial losses due to aquaculture risks by the participants,* majority representing 63.8 percent expressed some losses while 34.8 percent implied yes, significant losses. For *how often do you assess risks by the participants,* majority representing 61.0 percent expressed occasionally while 39.0 percent implied regularly. For *the insurance coverage for fish farm against major risks by the participants,* majority representing 55.3 percent expressed no, but planning to while 38.3 percent implied 'No'. For *received training on aquaculture food safety practices by the participants,* majority representing 53.9 percent expressed yes, but over a year while 27.0 percent implied no, but interested. For *food safety practices influence by the participants,* majority representing 54.6 percent expressed significantly while 25.5 percent implied not at all. As for emergency response plan for aquaculture risks, 42.6 percent claimed 'No plan', while 34.8 percent showcased 'Informal plan'.

Descriptive Analysis of Research Variables

Table 3: ***Descriptive Statistics of Aquaculture Risk Financing Strategies among Fish Farmers***

Variable	**M**	**SD**	**Interpretation**
Cooperative societies	3.83	1.36	High agreement
Personal savings	3.80	1.41	High agreement
Access to credit facilities	3.59	1.09	Moderate agreement
Government financial support	3.57	1.47	Moderate agreement
Insurance subscription	3.57	1.53	Moderate agreement

Source: Researchers' Computations, 2026

Note. M = Mean; SD = Standard Deviation. All items were measured on a 5-point Likert scale, where higher values indicate stronger agreement.

Table 3 presents the descriptive statistics of aquaculture risk financing strategies among fish farmers, showing that all variables recorded mean values above the neutral midpoint of 3.0, which indicates a general agreement on the relevance of these mechanisms in managing production risks. Among the strategies, participation in cooperative societies recorded the highest mean score (Mean = 3.83, SD = 1.36), closely followed by personal savings (Mean = 3.80, SD = 1.41). This suggests that farmers predominantly rely on informal and semi-formal financial arrangements to cushion the effects of financial shocks. The relatively high standard deviations for these variables indicate variability in responses, implying differences in farmers' access to cooperative networks and their capacity to accumulate savings. Access to credit facilities (Mean = 3.59, SD = 1.09), government

financial support (Mean = 3.57, SD = 1.47), and insurance subscription (Mean = 3.57, SD = 1.53) all exhibited moderate levels of agreement, but with varying degrees of dispersion. The lower variability in credit access suggests relatively more consistent experiences among farmers, although not necessarily widespread usage. In contrast, the higher standard deviations for government support and insurance indicate uneven access and adoption, likely reflecting structural barriers such as limited awareness, affordability constraints, and institutional inefficiencies. Overall, the results reveal a financing structure dominated by informal mechanisms, with limited reliance on formal financial instruments, highlighting gaps in financial inclusion within the aquaculture sector. The equal mean ranks observed between government financial supprot and insurance subscription suggest that respondents perceive these financing mechanisms as similarly important in managing aquaculture risks. This may indicate overlapping functional roles among these strategies in enhancing financial resilience. However, equal ranking does not necessarily imply equal utilization intensity, but rather comparable perceived relevance among respondents.

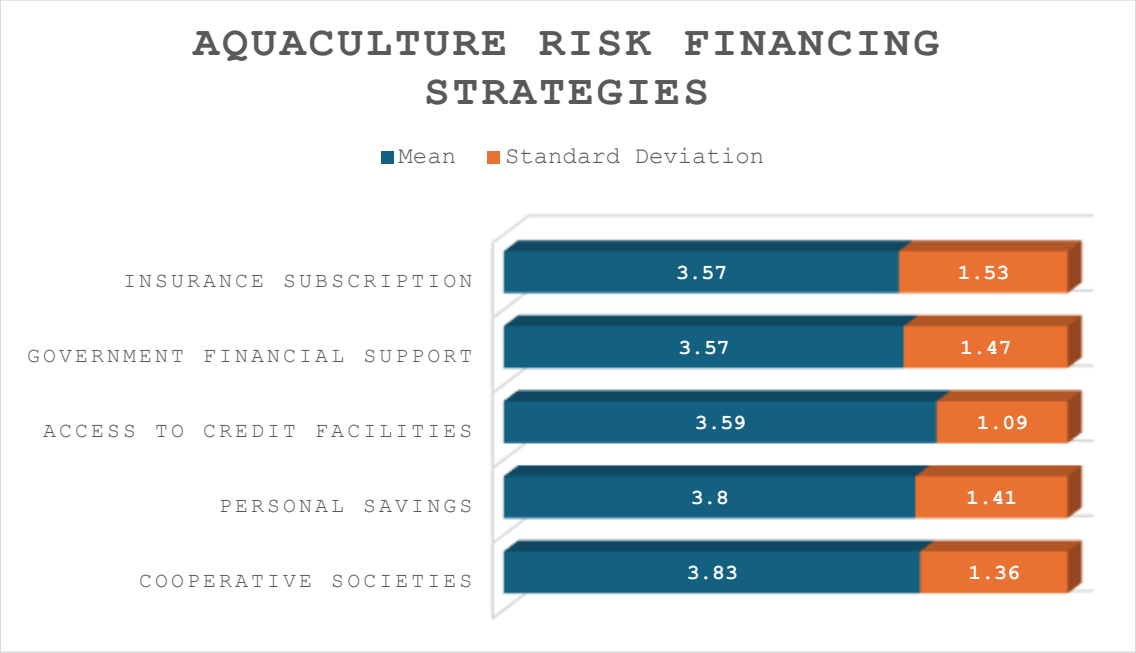


Table 4: *Descriptive Statistics of Aquaculture Food Safety Practices among Fish Farmers*

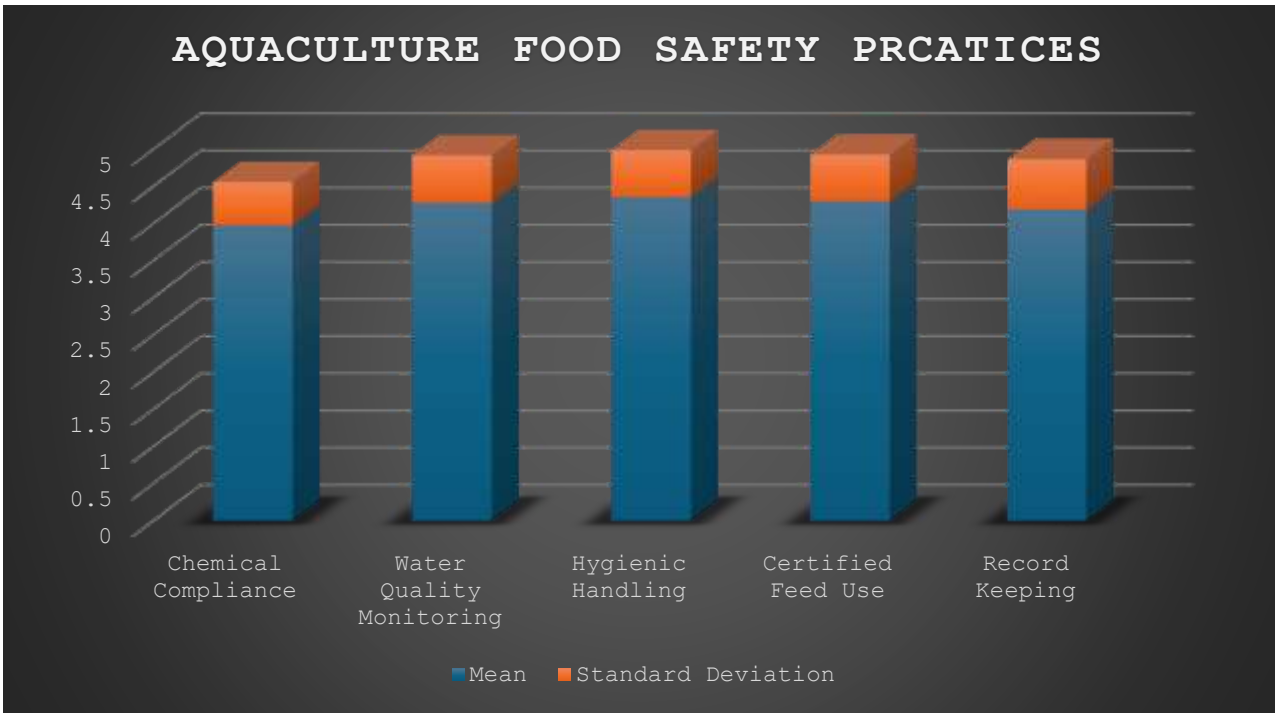
Variable	M	SD	Interpretation
Compliance with chemical use guidelines in fish production	3.98	0.58	High agreement
Regular monitoring of water quality to prevent contamination	4.28	0.64	High agreement
Hygienic handling and storage of harvested fish	4.36	0.63	Very high agreement
Use of certified feed to reduce food safety risks	4.30	0.65	Very high agreement
Proper record keeping for traceability and compliance (HACCP)	4.19	0.68	High agreement

Source: Researchers' Computations, 2026

Note: M = Mean; SD = Standard Deviation. All items were measured on a 5-point Likert scale where higher scores indicate stronger agreement.

Table 4 presents the descriptive statistics of aquaculture food safety practices among fish farmers, with all variables recording mean values well above the neutral midpoint of 3.0. This indicates a high level of agreement and suggests strong compliance with recommended food safety standards. Among the practices, hygienic handling and storage of harvested fish recorded the highest mean (Mean = 4.36, SD = 0.63), followed by the use of certified feed (Mean = 4.30, SD = 0.65) and regular monitoring of water quality (Mean = 4.28, SD = 0.64). These high mean scores reflect that farmers place considerable emphasis on operational practices that directly influence fish quality and contamination prevention. The relatively low standard deviations across these variables indicate consistency in responses, suggesting that these practices are widely adopted among the respondents.

Furthermore, adherence to recommended guidelines on chemical usage (Mean = 3.98, SD = 0.58) and proper record-keeping for traceability and compliance (Mean = 4.19, SD = 0.68) also demonstrate strong levels of agreement, although chemical management shows a slightly lower mean compared to other practices. The low dispersion observed across all variables implies minimal variation in responses, indicating a uniform pattern of food safety behaviour among fish farmers. Overall, the results suggest that aquaculture operators exhibit a high level of awareness and implementation of key food safety practices, particularly in areas related to hygiene, water quality, and feed management, which are essential for ensuring product safety and enhancing market acceptance.



HYPOTHESIS TESTING

H_o: Aquaculture risk financing strategies have no effect on food safety among selected fish farmers in Lagos, Nigeria

Table 5: *Regression Results on the Effect of Aquaculture Risk Financing Strategies on Food Safety*

Variables	**B**	**SE**	**β**	**t**	**p**	**95% CI**
Constant	18.808	0.660	—	28.494	< .001	[17.503, 20.114]
Aquaculture Risk Financing Strategies	0.156	0.034	0.362	4.576	< .001	[0.088, 0.223]
Model Statistics				**Value**		
R				0.362		
R^2				0.131		
Adjusted R^2				0.125		
F-statistic				20.938***		
Degrees of Freedom				(1, 139)		
Sample Size (N)				141		

Note. Dependent variable = Food Safety. B = unstandardized coefficient; SE = standard error; β = standardized coefficient; CI = confidence interval. ***p < .001. The model explains 13.1% of the variation in food safety outcomes among fish farmers. Adapted from the study findings.

The results of the simple linear regression analysis indicated that aquaculture risk financing strategies significantly predicted food safety among fish farmers, $F(1, 139) = 20.94$, $p < .001$, explaining 13.1% of the variance in food safety outcomes ($R^2 = .131$, Adjusted $R^2 = .125$). The regression coefficient for aquaculture risk financing strategies was positive and statistically significant ($B = 0.156$, $SE = 0.034$, $\beta = .362$, $t = 4.576$, $p < .001$, 95% CI [0.088, 0.223]). This finding suggests that improvements in risk financing mechanisms are associated with corresponding improvements in food safety practices among fish farmers. Specifically, a one-unit increase in aquaculture risk financing strategies is associated with a 0.156-unit increase in food safety scores. The standardized coefficient ($\beta = .362$) indicates a moderate positive effect, implying that access to and utilization of risk financing instruments contribute meaningfully to food safety performance within the aquaculture sector. Although the explanatory power of the model is modest, the statistically significant relationship highlights the importance of financial resilience mechanisms in supporting food safety compliance and operational sustainability among fish farming enterprises.

CONCLUSION, RECOMMENDATIONS, AND CONTRIBUTIONS TO KNOWLEDGE

The study assessed the effect of aquaculture risk financing strategies on food safety among fish farmers in Lagos Metropolis, Nigeria. Findings revealed a statistically significant positive relationship ($R = 0.362$; $R^2 = 0.131$; $F = 20.938$; $p < 0.001$), indicating that improved risk financing enhances food safety, although explanatory power remains moderate, suggesting other influencing factors. Results show that farmers mainly rely on informal financing such as personal savings and cooperatives, with limited access to formal credit, insurance, and government support. Despite

these constraints, food safety practices remain relatively strong. The study concludes that aquaculture risk financing strategies are a significant but partial determinant of food safety, underscoring the need for improved financial inclusion, insurance penetration, credit access, and capacity-building to strengthen sustainable food safety outcomes.

Based on the empirical evidence that aquaculture risk financing strategies significantly influence food safety outcomes, the study recommends the strengthening of financial inclusion mechanisms within the aquaculture sector. First, policymakers and relevant agricultural finance institutions should expand access to formal credit facilities tailored to fish farmers, with simplified eligibility requirements and reduced collateral constraints to enhance uptake. Second, there is a need to deepen insurance penetration through subsidised premium schemes and awareness campaigns, as aquaculture insurance remains underutilised despite its potential to mitigate production and food safety risks. Third, cooperative societies should be further strengthened through institutional support and capacity-building programmes, given their dominant role in farmers' financing structure. Fourth, government intervention should be intensified through targeted financial support programmes, including input subsidies and emergency financing schemes to enhance farmers' resilience to production shocks. Finally, structured training programmes on financial literacy and risk management should be implemented to improve farmers' ability to effectively utilise available financing instruments for improved food safety compliance and sustainable aquaculture development.

This study contributes to knowledge by providing empirical evidence on the relationship between aquaculture risk financing strategies and food safety, an area that has been insufficiently integrated in prior research. It advances the literature by demonstrating that financial risk management mechanisms significantly influence food safety outcomes in aquaculture, thereby linking financial resilience with public health compliance in a unified framework. The study further extends theoretical understanding by applying Expected Utility Theory and the Theory of Planned Behaviour to explain how financial decision-making and behavioural intentions jointly shape food safety practices. Methodologically, it offers a baseline simple regression model quantifying this relationship within the context of Lagos Metropolis, enriching the limited sub-national aquaculture literature in Nigeria. These contributions provide policy-relevant insights for strengthening financial inclusion and improving food safety governance in aquaculture systems.

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