



## FACTORS INFLUENCING PERCEIVED KNOWLEDGE OF THERMOSTABLE NEWCASTLE DISEASE VACCINE AMONG LOCAL CHICKEN FARMERS OF PLATEAU STATE, NIGERIA

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### ABSTRACT

The study examined the factors influencing the perceived knowledge of thermostable Newcastle disease vaccine among local chicken farmers in Plateau State, Nigeria. Multi-stage sampling technique was used in selecting; 369 farmers. Data were collected through the use of a structured questionnaire and analysed using descriptive and inferential statistics. The results indicated that the mean age were 43 years, 8 persons; and 13 years, respectively. The study revealed a predominance of female respondents (58.8%), and majority (86.4%) were married. Notably, 78% of the farmers reported no interaction with agricultural extension agents, and 87% were not members of any cooperative society. Only 24.4% obtained information about the vaccine from Community Animal Health Workers (CAHWs), and a most (91%) had no access to credit. The results also indicated that 47.7% of respondents had low knowledge of the vaccine, while 55% lacked access to the technology. The results of logistic regression model revealed that sex ( $P<0.01$ ), age ( $P<0.01$ ), education ( $P<0.01$ ), household size ( $P<0.10$ ), flock size ( $P<0.01$ ), and farming experience ( $P<0.05$ ) were the factors influencing perceived knowledge and practices of thermostable Newcastle disease vaccine among local chicken farmers in the study area. The study concluded that sex, age, education, household size, flock size and farming experience were the factors influencing the perceived knowledge of thermostable Newcastle disease vaccine among local chicken farmers. Based on the findings, we recommend enhancing farmer capacity through targeted training and community demonstrations tailored to literacy levels, gender, and age, thereby addressing demographic variations that impact vaccine adoption.

**Keywords:** Factors, Knowledge, Thermostable, Vaccine, Chicken, Farmers

### INTRODUCTION

Agriculture serves as a vital foundation for economic development and food security in many regions worldwide. In developing nations such as Nigeria, this sector not only makes a substantial contribution to the Gross Domestic Product (GDP) but also plays an essential role in sustaining livelihoods, particularly in rural communities (Tanumihardjo *et al.*, 2020). Local chicken production in Nigeria is dominated by smallholder farmers who substantially practices extensive system of rearing. Livestock diseases have significantly imposed cost on this subsector through deaths, disease control and sometimes, restrictions in the trading of this animals (Nuvey *et al.*, 2022a). Diseases cause significant livelihood losses for households, which affects food security and the psychological well-being of individual farmers (Huntington *et al.*, 2021; Nuvey *et al.*, 2020 & Nuvey *et al.*, 2022b). The potential effects of unsafe food consumption due to the misuse of antibiotics in the production of these animal foods entering the food chain is a great concern to public health safety (Mshana *et al.*, 2021).

Preventive veterinary services, particularly vaccination, have been shown to be effective and profitable in controlling livestock diseases (Charlier *et al.*, 2022) and poultry subsector is not an exceptional. Vaccination is one of the greatest important tools for preventing diseases and in reducing



the economic losses of the poultry farmers. Vaccination is the cheapest, reliable, effective, economical and suitable substitute for prevention of diseases in poultry flocks. Vaccine is “an immune-biological substance designed to produce specific protection against a given disease (Melief *et al.*, 2015). According to Ledford (2020) a vaccine typically contains an agent that resembles a disease-causing microorganism and is often made from weakened or killed forms of the microbe, its toxins, or one of its surface proteins. Vaccines can be prophylactic (to prevent or ameliorate the effects of a future infection by a natural or "wild" pathogen), or therapeutic (to fight a disease that has already occurred). Thus, understanding the various types of ND vaccines available and their specific applications can empower farmers to make informed decisions that enhance the resilience of their poultry against this devastating disease (Yao, & Venugopal, 2022).

Adherence to effective training programmes will ensure that farmers are well-informed about up-to-date vaccine technological advancements and superlative practices (Waweru *et al.*, 2023). These initiatives not only significantly condense the incidence of Newcastle Disease, it however, will ultimately lead to improved productivity and economic stability for poultry farmers (Wai *et al.*, 2022). There is a general lack of awareness regarding the differences between the vaccines, particularly concerning thermotolerance. Farmers did not mention thermotolerance as a criterion for choosing a vaccine, which suggests that they may not fully understand the benefits of using a more stable vaccine like Newcastle Disease Vaccine (NDV I<sub>2</sub>) for local chicken production. This lack of knowledge can lead to suboptimal vaccination choices. Farmers' knowledge about vaccines, including their effectiveness and storage requirements, is often limited. This lack of awareness can lead to misconceptions about the benefits of thermotolerant vaccines like I<sub>2</sub>, which may be overlooked in favour of more familiar options like NDV-L (La Sota), NDV-K (Kamorov) despite their lack of thermotolerance. We therefore, sought in this study to identify factors that influence the perceived knowledge of Newcastle disease vaccine- I<sub>2</sub> among local chicken farmers in the context of rural settlements of Plateau State. Specific objectives are to: describe the socio-economic characteristics of the respondents of local chicken farmers; describe level of knowledge of Newcastle disease vaccine; sources of the vaccine knowledge; access to vaccine; and factors that influence knowledge of this vaccine.

## **METHODOLOGY**

### **Study Area**

This study was conducted in Plateau State, Nigeria. The State is located in the North – Central Zone of Nigeria. Within its borders, the State is mostly mountainous, with a chain of hills and a variety of fascinating rock formations. The name “Plateau State” comes from the stunning geological scenery, which includes high lands that rise to 1,200 meters above the sea level at a height of 1,829 meters above sea level in the lowlands. The State has 17 Local Government Areas (LGAs) with Jos town as the headquarters. The State lies between Longitude of 8.480°E and 10.700°E, Latitude 8.300°N and 10.400°N with a land mass covering 30, 913sq kilometres. According to the 2006 national census, Plateau State had a total population of 3,206,531 (National Population Commission [NPC], 2006). Since no subsequent census has been conducted, current figures are based on demographic projections. The National Bureau of Statistics (NBS) and the United Nations Department of Economic and Social Affairs (UN DESA) estimate Nigeria's average annual population growth rate at about 2.6–3.0% (NBS, 2022; UN DESA, 2022). Applying this growth rate to the 2006 baseline, the projected population of Plateau State in 2025 is approximately 5.3 million.

The climate is characterised by two distinct seasons, wet and dry season. Rainy season typically runs from April to September and dry Season from October to March, with little to no rainfall. Peak rainfall occurs in July and August, often exceeding 350 mm/month. Driest months are December to February, with almost no precipitation.

### **Sampling Techniques and Sample Size**

The sampling techniques used for this study was multi-stage sampling procedure which consisted of stratified, purposive and simple random sampling techniques. In the first stage was the



stratification of the study area into the already existing three (3) agricultural zones of Plateau State namely: Northern, the Central and the Southern zone.

The second stage involved purposive selection of four (4) Local Government Areas (LGAs) from each of the three zones of Plateau State on the basis of intensity of production/rearing of local chicken. The third stage was random selection of three (3) villages each from the LGAs, making a total of 36 communities. In the final stage, simple random sampling technique was used to get a sample size at a proportion of 8% from the lists of 4,610 that was provided by the Village heads/Community animal health workers (CAHWs).

The sample size was determined using Yamane (1967) sample size determination formula (equation 1).

$$n = N / (1 + N(e)^2)$$

Where;

n = sample size

N = population size and

e = margin of error (usually 0.05 for confidence level)

#### **Method of Data Collection**

Data were collected through the administration of questionnaires were administered to the respondents randomly selected from the study area. The survey instruments collected data on farmer's socio-economic characteristics of the participating farmers, farmer's level of awareness and knowledge of the vaccine, access to vaccine and source of vaccine information.

#### **Method of Data Analysis**

Data collected were analysed using both descriptive and inferential statistics. The descriptive was frequency distribution, percentage and mean. Inferential statistics was Multinomial logit regression (MNL). The model is specified as:

$$Y = (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, - \\ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \\ \beta_9 X_9 + \beta_{10} X_{10} + e.$$

where:

Y = Farmer's knowledge of Newcastle disease vaccine (low, average and high knowledge).

X<sub>1</sub> = Age of farmers (years)

X<sub>2</sub> = Sex (dummy); 1 = male; 0 = female

X<sub>3</sub> = Marital status (1 = married; 2 = single, 3 = divorced, 4 = widow)

X<sub>4</sub> = Household size (number of people)

X<sub>5</sub> = Level of education (years)

X<sub>6</sub> = Farming experience (years)

X<sub>7</sub> = Flock size (numbers)

X<sub>8</sub> = Extension contact (1 = yes; 0 = no)

X<sub>9</sub> = Membership of cooperative (1 = yes; 0 = no)

X<sub>10</sub> = Cooperative membership (1 = yes; 0 = no)

X<sub>1</sub> – X<sub>10</sub> = estimated parameters

b<sub>0</sub> = Constant

b<sub>1</sub> – b<sub>10</sub> = Coefficient of estimated parameters

e = Error term

## **RESULTS AND DISCUSSION**

### **Socio-economic Characteristics of the Respondents**

Table 1 presents a summary of the obtained household survey data in the study area. The age distribution of the respondents showed a comprehensive range, with the largest group belonging between 36-45 years (23.03%), while 21.95% fell within 26-35 years with an average of 43 years. This implies that the local chicken farmers were in their active years. The respondents reported



rearing local chicken for an average of 13 years, signifying moderate experience, which is crucial for chickens. This is suggesting younger farmers may possess the physical capacity to engage in demanding production activities, potentially aiding in the sustained supply of local chickens. The predominance of younger respondents may also enhance the long-term viability of local chicken farming. This finding is consistent with the results of Nuvey *et al.* (2023), which reported a mean age of respondents at 45 years. Younger farmers traditionally have better access to modern information sources, such as the Internet - social media. A study by Iddi *et al.* (2023) in Tanzania found that the majority of young chicken farmers used mobile phones to access upgraded chicken farming information. Correspondingly, Falola *et al.* (2021) in Nigeria found that younger farmers are more likely to use social media to gather information about chicken production than older farmers. Social media platforms allow farmers to share experiences and knowledge, promote peer learning, and reduce barriers to vaccine adoption (Pattabhi *et al.*, 2023).

The results also showed that 35.8% of the respondents had secondary education while 18.7% had tertiary education. This diverse educational landscape has indeed facilitated a transformation in the respondent's perceptions, as noted by Massresha *et al.* (2021). These findings align with Salum (2016), who reported a similar distribution, wherein more than half of respondents had secondary education, and a substantial proportion had primary education. The high literacy levels among these farmers, which may enable them to read and write, may serve as a precursor to innovation and the adoption of new technologies, such as NDV-I<sub>2</sub>. Furthermore, this outcome corroborates the assertions of De Oliveira Sidinei *et al.* (2021), who indicated that education facilitates the adoption of recommended health practices. Educated farmers evaluate the risks of diseases and their preventive measures, leading to better health outcomes for their flocks (Enaharo *et al.*, 2021).

The results also showed a predominance of female respondents at 58.8%, compared to 41.2% male respondents. This disparity may stem from the fact that many males are engaged in other agricultural enterprises, including the farming of large and small ruminants and crop production. The higher representation of females in this study likely reflects their motivation to support their households, as poultry farming offers a viable source of supplementary income. This trend may be attributed to historical gender roles and segregation within agricultural labour, which typically assigns men to more physically demanding outdoor tasks and women to indoor responsibilities. This observation aligns with research by Bada (2017), which highlights the division of labour within households. Furthermore, it echoes findings that highlight the critical contribution of women to labour needs in the agricultural sector across Africa (Palacios-López *et al.*, 2017).



**Table 1: Socio-economic Characteristics of Respondents (n=369)**

Variables	Frequency	Percentage	Mean
<b>Age (Years)</b>			
18, -25	48	13.00	<b>43.09</b>
26-35	81	21.95	
36-45	85	23.03	
45-55	85	11.38	
56- 65	42	7.59	
66 and above	28		
<b>Level of Education</b>			
No formal education	57	15.4	<b>3.2</b>
Quranic	46	12.5	
Primary	65	17.6	
Secondary	132	35.8	
Tertiary	69	18.7	
<b>Sex</b>			
Male	152	41.2	
Female	217	58.8	
<b>Marital status</b>			
Married	319	86.4	
Single	36	9.8	
Widowed	13	3.5	
Divorced	1	3	
<b>Household size (no)</b>			
1 - 10	321	86.99	<b>7.83</b>
11 – 20	39	10.55	
21 – 30	8	2.2	
31 – 40	1	0.26	
<b>Flock size</b>			
0	146	38.6	
1 – 15	198	53.7	
16 – 30	18	4.9	
31 – 45	2	0.5	
46 and above	5	1.3	
<b>Farming experience</b>			
1 - 10	216	58.53	<b>13</b>
11 – 20	87	23.58	
21 – 30	36	9.76	
31 – 40	19	5.15	
41 and above	11	2.98	
<b>Contact with Extension Agents</b>			
Yes	83	22.5	
No	286	77.5	
<b>Membership of Cooperative Society</b>			
Yes	47	12.7	
No	322	87.3	
<b>Source of Income</b>			
Farming	240	65.0	
Business	71	19.2	
Formal Employment	28	7.6	
Informal Employment	19	5.1	
Remittance	11	3.0	
<b>Access to Credit</b>			
Yes	34	9.02	
No	335	90.8	

**Source:** Field survey, 2024.





Similarly, the results showed that majority (86.4%) the respondents were married, with 9.8% identifying as single. This result suggests that a substantial proportion of respondents exhibit a high level of responsibility and independent decisions that contribute to fulfilling domestic needs. This outcome aligns with the findings of Yohanna *et al.* (2021), which indicated that most of their study respondents were married, thus enhancing their responsibility and likelihood of adopting new technologies.

On access to agricultural extension, this study found that majority (77.5%) of respondents reported no interaction, while only 22.5% of the respondents had contact with agricultural extension agents in spite of the favourable outcome of extension contacts on agricultural productivity. This study finding is not in concurrence with the findings of Asadu *et al.* (2021) where they reported majority of the urban livestock farmers in Southern Nigeria had extension contact. However, this finding is in agreement with the submission of the Food and Agricultural Organisation (FAO, 2014), which opined widespread lack of resources and infrastructure that resulted to limited veterinary extension services in rural areas. This limited engagement with extension services is a significant constraint to effective vaccine uptake, particularly for the thermostable Newcastle disease vaccine ( $I_2$ ), with proper knowledge of handling, timing, and administration protocols to ensure efficacy.

#### **Respondents' Knowledge of Newcastle Disease Vaccine ( $I_2$ )**

The result presented in Table 2 indicated that a significant proportion (47.7%) of respondents possess limited knowledge regarding the Newcastle disease vaccine ( $I_2$ ) technology. The nearly half of the respondents lacking adequate knowledge of the NDV- $I_2$  vaccine, may suggest limited exposure to Newcastle Disease outbreaks or poor access to veterinary information. This low awareness may reflect negative perceptions or misinformation about vaccination benefits. Moderate knowledge levels (29.0%) among some farmers likely stem from prior training, experience with disease outbreaks, or proximity to veterinary services. High-knowledge respondents tend to have better education, socio-economic status, and access to vaccine vendors—factors that positively influence vaccine uptake. These findings align with previous studies (Nuvey *et al.*, 2023; Girma *et al.*, 2022; Sander *et al.*, 2020) that emphasize the role of information dissemination in shaping farmer perceptions. Robi *et al.* (2023) and Waweru *et al.* (2023) further highlight the importance of preventive health knowledge and geographic access. Lindahl *et al.* (2019) and Ahmed & Ahmed (2023) confirm that awareness and training are key drivers of vaccine adoption.

**Table 2:** Distribution of Respondents' Based on Level of Knowledge of Newcastle Disease Vaccine ( $I_2$ ) (N=369)

Variable	Frequency	Percentage
Low knowledge	176	47.7
Medium knowledge	107	29.0
High knowledge	86	23.3

**Source:** Field survey, 2024

#### **Respondent's Sources of NDV-( $I_2$ ) Information**

The result in Table 3 showed that farmers in the study area accessed information about NDV- $I_2$  vaccination practices from various sources. This diverse access to information may help farmers achieve a better balance in their knowledge, enhancing their ability to make informed decisions regarding vaccination on their farms.

**Table 3:** Distribution of Respondents' Based on Sources of NDV-I<sub>2</sub> Information (N=369)

Variable	Frequency	Percentage
Extension Agent	25	6.8
Radio	78	21.1
Veterinarian	66	17.9
Community Animal Health Workers	90	24.4
Family and Friends	51	13.8
Community Leader	2	0.5
Neighbour	56	15.2
Cooperatives	1	0.3

**Source:** Field Survey, 2024. NDV-I<sub>2</sub> = Newcastle disease vaccine (Thermostable)

The results indicated that Community Animal Health Workers (CAHWs) served as the primary source of information for 24.4% of the study population. This suggests that information about NDV-I<sub>2</sub> is effectively communicated as these animal health providers live within the communities they serve. This finding aligns with the study conducted by Habiyaemye *et al.* (2017), which found that 35% of farmers relied on animal health technicians for vaccine information. Also, 21.1% of the farmers obtained their NDV-I<sub>2</sub> information from the radio. This can be attributed to the accessibility of transistor radios and phones with frequency modulation (FM) capabilities, making news readily available to farmers. The result supports the findings of Yohanna *et al.* (2021), who ranked radio as the second most important source of information on agricultural innovations.

#### **Respondents' Access to NDV-I<sub>2</sub>**

The results presented in Table 4 indicated that more than half (54.5%) reported a lack of access to ND vaccine, while less than half (45.5%) of the respondents in the study have access to the NDV-I<sub>2</sub> vaccine.

**Table 4:** Distribution of Respondents Based on Access to NDV-I<sub>2</sub> (N=369)

Variable	Frequency	Percentage
Yes	169	45.5
No	201	54.5

**Source:** Field Survey, 2024

This situation may be attributed to the distance to vaccine distribution points and the insufficient availability of service providers in rural areas. Proximity to agro-veterinary service providers has a positive effect on farmers' awareness of the ND I<sub>2</sub> vaccine. Conversely, farmers situated at greater distances from these suppliers encounter challenges in acquiring information about diseases and veterinary resources. This observation is consistent with the findings reported by Waweru *et al.* (2023), which underscore that proximity to agro-veterinary input suppliers, particularly vaccine vendors, significantly influences ND vaccine access.

#### **Factors Influencing Level of Knowledge of Newcastle Disease Vaccine (I<sub>2</sub>)**

The result in Table 5 highlights the significant roles of gender, age, education, and farming experience in shaping farmers' knowledge levels regarding the Newcastle disease vaccine (NDV-I<sub>2</sub>). Gender disparities are evident. Male farmers are less likely to fall into the lowest knowledge category (coefficient = -0.612,  $p = 0.000$ ) and more likely to attain moderate knowledge levels (coefficient = 0.598, significant at 1%). These advantages stem from greater mobility, access to training, and technological information—benefits rooted in socio-cultural norms and resource ownership. This aligns with findings by Dissanyake *et al.* (2022), who emphasize that male-headed households are better positioned to adopt agricultural innovations due to enhanced access and participation.

Age also plays a critical role. A negative coefficient (-0.081,  $p < 0.01$ ) and marginal effect (-0.010) for the low knowledge tier suggest that older farmers are less likely to be in the lowest knowledge group. However, this may reflect a reduced willingness to invest in vaccine-related knowledge as age increases. Terfa *et al.* (2015) attribute this to older farmers' reluctance to engage

with new technologies, shaped by risk aversion and limited openness to innovation. Simitowe *et al.* (2016) further highlight the high search costs older individuals face when accessing technological information. In contrast, younger farmers are more likely to possess moderate knowledge, as noted by Kagoya *et al.* (2018), due to their adaptability, energy, and proficiency with technology.

**Table 5:** Factors Influencing Levels of Knowledge of Newcastle Disease Vaccine (I<sub>2</sub>)

Parameter estimates	Low knowledge level		Moderate knowledge level	
	Coefficient	Marginal effect	Coefficient	Marginal effect
Constant	9.78896 (1.704)		2.832368 (1.701)	
Sex	-0.612*** (0.335)	0.045	0.598*** (0.355)	0.165
Age	-0.081*** (0.014)	-0.010	-0.036 (0.013)	0.002
Marital status	-0.569 (0.366)	-0.080	-0.190 (0.322)	0.025
Level of education	-1.001*** (0.159)	-0.162	-0.126*** (0.162)	0.080
Household size	-0.004 (0.033)	0.007	-0.077* (0.037)	-0.013
Flock size	-0.011 (0.008)	0.002	-0.036*** (0.010)	-0.005
Farming experience	0.074* (0.021)	0.005	0.080** (0.021)	0.006
Cooperative membership	-0.797 (0.558)	-0.085	-0.530 (0.564)	-0.010
Access to credit	-0.026 (0.319)	-0.026	0.210 (0.324)	0.039
Extension contact	-0.110 (0.377)	-0.050	0.301 (0.391)	0.063
Log pseudo-likelihood	-306.18883			
LR chi <sup>2</sup> (20)	163.65			
Prob > chi <sup>2</sup>	0.0000			
Pseudo R <sup>2</sup>	0.2109			

**Note:** \*\*\*, \*\* and \* significant at 1%, 5% and 10% levels of probability. Figures in parentheses are the standard error. High level of knowledge (base or referent outcome).

**Source:** Field survey, 2024.

Education presents a nuanced influence. Although higher educational attainment appears to correlate with lower overall knowledge levels (coefficients = -1.001 and -0.126,  $p < 0.01$ ), marginal effects revealed that formally educated farmers are 16.2% less likely to be categorised as having low knowledge. Moreover, each additional year of education increases the likelihood of moderate knowledge by 8.0%. This suggests that education enhances critical thinking and information utilisation, fostering better analytical and problem-solving skills. These outcomes are consistent with De Oliveira Sidinei *et al.* (2021), and Wolff *et al.* (2017), who affirm that education catalyses the adoption of recommended animal health practices.

Farming experience further contributes to knowledge acquisition. Positive coefficients of 0.074 and 0.080 (significant at 10% and  $p < 0.05$ , respectively) indicate that each additional year of experience increases the likelihood of farmers being classified within low and moderate knowledge levels by 0.5% and 0.6%, respectively. Experienced farmers are generally more familiar with chicken management and disease prevention techniques. This observation aligns with Waweru *et al.* (2023) and Etuah *et al.* (2020), who found that increased experience fosters better understanding and utilization of ND vaccines, ultimately enhancing flock health and productivity.





## CONCLUSION AND RECOMMENDATIONS

The study concluded that local chicken farmers exhibit a low level of knowledge regarding thermostable Newcastle disease vaccine, which is influenced by factors such as sex, age, education and farming experience. On the basis of this study findings, we therefore recommend that there is a need to strengthen farmer capacity through targeted, practical training and community-based demonstration, with materials tailored to literacy levels, gender, and age groups to address demographic variations influencing uptake. Also, expansion of veterinary extension coverage by training and equipping community-based animal health workers, ensuring accessible and timely vaccination services.

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