Effectiveness of Traditional Methods of Incubation and Hatching of Eggs Among Indigenous Poultry Keepers in Kwara State, Nigeria

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Abstract

This study assessed the effectiveness of traditional methods of eggs incubation and hatching among indigenous poultry keepers in Kwara State, Nigeria to unravel the improvement in the techniques over time. Purposive and snowball sampling procedure were used to select 80 household local poultry keepers who were interviewed using structured questionnaire and the Key Informant Interview (KII) method for data collection. Four Local Government Areas were purposively selected while a non-probability snowball technique was used to select 80 respondents who are known for rearing indigenous chickens. Variables were appropriately measured. For example effectiveness was measured with a 4 point rating scale of Not Effective scored 1 point, Slightly Effective scored 2 points, Moderately Effective scored 3 points and Very Effective scored 4 points as the dependent variable while the independent variables were measured as either nominal, ordinal and interval scales. The results showed that poultry keepers in the study area identified natural incubation (64.0%) as the most common method of egg incubation, followed by kerosene incubator (63.4%) indigenous fabricated incubators (50%) and lastly by electric incubator (48.0%). Further results revealed that natural incubation (Mean = 2.66) was the most common method of incubation among local poultry farmers while kerosene incubation (Mean = 2.57) was ranked second with indigenous incubator (Mean = 2.19) occupying the third position in the mean ranks while electric method occupied the 4th and last position. There was a positive and significant relationship between respondents' knowledge of incubation ($r = 0.547$; $p \leq 0.01$) and the effectiveness of incubation among indigenous poultry keepers. The study established that indigenous incubation with the use of natural brooding was the most effective incubation method among the indigenous poultry keepers and knowledge of incubation was very crucial to an effective incubation process. This study adds to the body of scanty knowledge on traditional poultry incubation and hatching process.

Key words: incubation methods, local chicken, domestic chickens, small-scale poultry, village poultry.

Efficacité des Méthodes Traditionnelles D'incubation et D'éclosion des Œufs Chez les Aviculteurs Autochtones de L'État de Kwara, au Nigeria

Résumé

Cette étude a évalué l'efficacité des méthodes traditionnelles d'incubation et d'éclosion des œufs

chez les aviculteurs autochtones de l'État de Kwara, au Nigeria, pour démêler l'amélioration des techniques au fil du temps. Une procédure d'échantillonnage téléologique et boule de neige a été utilisée pour sélectionner 80 éleveurs de volaille locaux du ménage qui ont été interviewés au moyen d'un questionnaire structuré et de la méthode d'interview auprès des informateurs clés (IIC) pour la collecte des données. Quatre secteurs d'administration locale ont été choisis à dessein, tandis qu'une technique de boule de neige non probabiliste a été utilisée pour sélectionner 80 répondants qui sont connus pour élever des poulets autochtones. Les variables ont été mesurées de façon appropriée. Par exemple, l'efficacité a été mesurée à l'aide d'une échelle de notation de 4 points de Non efficace notée 1 point, Légèrement efficace notée 2 points, Moyennement efficace a obtenu 3 points et Très efficace a obtenu 4 points comme variable dépendante, tandis que les variables indépendantes ont été mesurées à l'aide d'échelles nominales, ordinales et d'intervalles. Les résultats ont montré que les éleveurs de volaille de la zone d'étude ont identifié l'incubation naturelle (64,0 %) comme étant la méthode la plus courante d'incubation des œufs, suivie de la couveuse à pétrole (63,4 %) des incubateurs fabriqués localement (50 %) et, enfin, de l'incubateur électrique (48,0 %). D'autres résultats ont révélé que l'incubation naturelle (moyenne = 2,66) était la méthode d'incubation la plus courante chez les producteurs de volaille locaux, tandis que la couveuse à pétrole (moyenne = 2,57) se classait au deuxième rang avec l'incubateur autochtone (moyenne = 2,19) occupant la troisième position dans les rangs moyens tandis que la méthode électrique occupait la quatrième et dernière position. Il y avait une relation positive et significative entre les connaissances des répondants en matière d'incubation (r = 0,547; p 0,01) et l'efficacité de l'incubation chez les éleveurs de volaille indigènes. L'étude a établi que l'incubation indigène avec couvaison naturelle était la méthode d'incubation la plus efficace parmi les éleveurs de volailles indigènes et que la connaissance de l'incubation était essentielle à un processus d'incubation efficace. Cette étude s'ajoute au peu de connaissances sur le processus traditionnel d'incubation et d'éclosion de la volaille.

Mots clés : méthodes d'incubation, poulet local, poulets domestiques, volaille à petite échelle, volaille de village.

Introduction

Poultry keeping contributes substantially to household food security, diversifies incomes and provides quality food, energy, manure and renewable assets in over 80% of rural households in the developing world (Sonaiya and Swan 2004). It is gaining tract in recent decades because of the characteristics of poultry birds which are usually small-sized and fast reproducing compared to most other livestock. Poultry keeping is a major component of the concept of small-scale agricultural development. Village chickens (rural poultry) have been observed to be eco-friendly and do not compete for scarce land resources, thermo-tolerant, resistant to some diseases; their eggs are good and meat is well flavoured. Akinola and Essien (2011) reported that rural poultry production systems in Africa are solely based on subsistence production where birds are kept as scavengers, and they usually get little or no input, such as feeding, health care and housing. Sonaiya and Swan (2004) noted that small scale poultry keeping by households uses family labour and locally available feed resources through free-ranging and some supplementary amounts of feed from the householders.

Aberra (2000) noted that high fertility and hatchability of village chicken in Africa is a

remarkable advantage. Some research reports however indicated that slow growth rate, late maturity, few egg yields, small-sized eggs, high mortality rate, extended reproductive cycle and extended inter-clutch sometimes cause low production and reproduction performances (Aberra, (2000); Dana *et al.* (2010). Magothe *et al.* (2012) opined that many households are found raising indigenous birds in Kenya for religious, social and cultural reasons. However, a dearth of information is however observed to exist on the traditional methods of incubation and hatching of indigenous eggs and their effectiveness. This study was therefore designed to: identify the traditional methods of incubation and hatching, assess the effectiveness of the identified methods, and establish the relationship between respondents' knowledge on incubation process with the effectiveness of incubation and hatching methods currently employed by poultry keepers in Kwara State, Nigeria.

In reviewing relevant literature, it was observed that local fowl's production is used for fighting hunger and poverty in Africa based on Kolawole in Behnassi *et al.* (2013). The study submitted that participation in the rearing of local chicken is not capital intensive as majority of rearers never feed them with energy rich food but scavenging is the main source of feed. This makes its production to be economically friendly. Hence, farmers, especially in rural areas engage in its production to supplement income and food consumption. Also, Mack *et al*. (2005) opined that encouraging the production of poultry among local farmers may increase the in-take of protein calories and help in the fight against malnutrition among rural dwellers in Africa. Many developing countries of Africa have been experiencing malnutrition and the fight against malnutrition has been on for many decades and in-take of protein has been a major aspect of it that needs to be improved. Chicken meat is an excellent source of protein accessible by all because no cultural barrier has been identified to work against its consumption. Although, affordability of the exotic breed may be a serious threat to the poor but the local breed of chicken is more accessible and their meat may be richer in terms of nutrients due to the savaging mode of feeding (Gondwe *and Wollny*, 2007). The findings established that over 91% of the local flocks constituted the migrating out of flock and they are mostly used for household consumption; participating in socio-cultural ceremonies in Malawi.

Materials and Methods

The study was conducted in Kwara State, Nigeria. The State has its capital in Ilorin. The State is located within the North Central geopolitical zone of Nigeria. The State is bounded by Benin to the west and by the Nigerian States of Niger to the north, Kogi to the east and Ekiti, Osun and Oyo to the south. The State has a population of about 3.3 million based on the 2006 National Population Census. The primary ethnic group is Yoruba with significant Nupe, Bariba and Fulani minorities. The State is typically an agrarian with the production of arable crops such as rice, tomato, cassava, soybean and others such as cocoa, sugarcane, cotton among others are commonly grown. People also engage in animal production such as poultry and the most popular among poultry are chicken. People also engage in the rearing of local fowls which study showed that the local fowls are primarily used for social and traditional purposes.

The study adopted a multi-stage sampling procedure using, purposive, and snowball techniques. At the first stage, a purposive sampling technique was used to sample Isin, Edu, Oyun and Moro Local Government Areas (LGAs) based on the level of rurality

and preponderance of local fowl rearing. At the second stage, one community (most rural) from each of the LGAs was purposively selected to make four (4) communities used for the study. At the third stage, the snowball sampling technique was used to identify and interview 20 households who are known for rearing local fowl within the communities. Thus, a total of 80 respondents were sampled and interviewed for this study using a structured interview schedule while Key Informant Interview (KII) was used to elicit qualitative data to buttress the quantitative data elicited with the interview schedule. Data were collected on the socio-economic characteristics of the respondents, method of egg incubation, reasons for rearing chicken and effectiveness of incubation methods among others. The variables in the research instrument were adequately and appropriately measured. For example, the effectiveness of different incubation methods was determined with the use of a 4 point rating scale of Not Effective scored 1 point, Slightly Effective scored 2 points, Moderately Effective scored 3 points and Very Effective scored 4 points. The sum of these scores: 1+2+3+4=10 divided by 4, gave the grand mean score of 2.5 that was used as a criterion for making a judgment of either it was effective or non-effective. Data collected were described with descriptive statistics like frequency, percentage and mean, while Pearson' Product Moment Correlation was used to analyse data and make inferences. Key Informant Interview was presented based on the guideline for presenting it in social science research. The incubation methods used among respondents include: natural incubation with local eggs where the broody hen sits on the egg for twenty-one days; the use of kerosene incubators, indigenous incubator which involves other methods apart from natural brooding, kerosene and electrically powered incubators. This may involve the use of sand or rice husks and, electric incubation.

Results and Discussions

Personal and socioeconomic profile of village poultry farmers

Results in Table 1 show that the majority (78.8%) of the indigenous chicken farmers in the study area were females while 21.2% were males. Most women tend to raise poultry for their households and traditionally raising birds by female members of a family especially among the younger ones is a way of knowing the fertility status and how caring such a girl would likely be in terms of caring for her children when she grows up. This is based on the report of the Key Informant Interview in Edu LGA as presented thus.

...rearing of local fowls among young people traditionally can be used to predict the future of such young persons. It tells about the future of people. A small boy and girl who rear fowl successfully are likely to be prosperous in life compared with the ones whose fowls are not doing well. In those days, we allowed young people to have possession of local fowls by naming it after them. They do not have much to give for the fowls in terms of routine management practices as we have in improved poultry these days. They don't feed, pack droppings and give vaccines and hatch eggs as these are practices that the fowls do naturally but everyone knew who isthe original owner and the care giver. Both the owner and the caregiver shared the chicks after hatching usually on a ratio of 40% to 60% for the caregiver and the owner. If I know that a little girl 'A' fowls are usually very productive, I could buy more for her. That was why many young persons in our community here had many local birds under their control as everyone will want to partner with such persons. The elders can begin to say such a young person will live a prosperous life... **Excerpt from a Key Informant Interview conducted in Edu LGA, Kwara**

State, Nigeria.

These poultry are usually called "family poultry". The term "family poultry" is used for systems that rely on family labour and, generally, locally available feed resources (FAO, 2004; Thieme *et al.,* 2014).

The table further revealed that only 3.7 percent of the respondents were younger than 30 years, 7.5 percent were between the ages of 30 and 39 years, around 30.0% were between the ages of 40 and 49 years, 38. 8% were between 50 and 59 years of age and 20 percent were 60 years and above. About 25 % of the respondents lacked formal education. Five percent, 22.5 percent and 28.8 percent of the respondents had adult, primary and secondary education, respectively while some (16.2%) of them had tertiary education. The findings corroborated the assertions of the Key Informant Interview reported above that younger ones were allowed to raise local fowls and in consonance with the findings of Akinola and Essien (2011) that reported active and young ages for the indigenous poultry farmers in Africa**.**

Similarly, as many as 63.8% of the respondents had monthly income ranging from N1,000 to N10,000 which is equivalent to $2.78 - $27.78 from poultry. The mean monthly income from poultry products was N2800±149, translating to $7.78 based on an exchange rate of N360 to 1 US$ at the time of the study. Although, many of the local chickens were not reared for commercial purpose but for social and traditional purposes as the report of KII revealed.

…interestingly, rearing of local fowls in those days was not usually done for commercial purposes. They are reared for social purposes like during festive periods and traditional rites like sacrifice … **Excerpt from KII in Isin LGA, Kwara State, Nigeria**

Purpose for keeping birds

The reasons for keeping birds may directly affect the intensification and management practices including incubation practice and the type of investment that will go into the production and management as submitted by SAHEL Bulletin (2015) that investment into a poultry enterprise has a strong correlation with the income. Evidence in Table 1 shows that 87.5% of the respondents indicated that indigenous birds were reared for social purposes, 11.2% reared them for cultural reasons while only 1.2% reared birds for economic reasons, serving as an income-generating enterprise. This finding conforms to the earlier results of the KII that indigenous birds are not reared for commercial reasons in most rural areas. Rather, they are reared for social and cultural purposes. Also, the study could be used to explain the assertion of Tadelle and Peter (2003) that households in Ethiopia keep birds for households mostly for consumption, other social and cultural reasons with few keeping it for income generation. Dwinger *et al*. (2003) asserted that farmers keep indigenous fowls in Africa mostly for religion and cultural considerations especially, among the resource-poor farmers. Further investigation using KII revealed that farmers who reared local fowls did that mostly for religious and cultural reasons as presented thus:

*…indigenous fowls are very useful for religious and cultural activities. In terms of taste they are better than the improved birds you call broilers and cockerels. They are also very useful for social activities especially, for festive period. They have tastier eggs and the eggs can be used for the treatment of many illnesses like typhoid fever and many others. If you want to learn more, you can visit me…***Excerpt from the KII in Oyun LGA, Kwara State, Nigeria**

The concept of religious used here according

Table 1: Personal and socio-economic characteristics of local poultry farmers in four selected Local Government Areas of Kwara State, Nigeria

Variable	Frequency	Percentage	Mean	Std Dev
Sex				
Male	17	21.2		
Female	63	78.8		
Age				
< 30.00	3	3.7		
30.00 - 39.00	6	7.5		
40.00 - 49.00	24	30		
50.00 - 59.00	31	38.8		
60.00+	16	20	51.03	8.36
Level of Education				
No formal Education	22	27.5		
Adult education	4	5		
Primary	18	22.5		
Secondary	23	28.8		
Tertiary	13	16.2		
Income from birds/month(naira)				
<1000	13	16.2		
1000-10,000	51	63.8		
10,001 and above	16	12.8	2,800.00	±149
Initial source of stock*				
Selective purchase	68	85		
Gift	9	11.2		
Purchase and gift	3	3.8		
Reasons for keeping birds*				
Cultural purpose	9	11.2		
Social purpose	70	87.5		
Income	1	1.2		
Consumption alone	6	7.5		

*multiple responses
1US$ = N360NGN
Source: Field survey, 2019.

to the respondents shows that local birds are being used for traditional religious activities and for socials, like the popular Christmas and new year period while for the cultural activities like new year festival, and other activities that are historical to particular towns and villages within the study area.

Identification of traditional methods of egg incubation used by poultry farmers

The majority (64.0%) of the local poultry keepers used natural brooding of eggs (Table 2). This is in agreement with the report of Metawork (2018) who noted that natural incubation is the most common method used in replacing and increasing the flock size in traditionally managed flocks. Kerosene incubator (63.4%) was the next most commonly used method of incubation, followed by the use of indigenous incubators (50%). The least common and less used incubation methods among the farmers were electric incubators (48.0%). The finding is in line with the report of the KII in one of the communities presented below:

… one of the good things about indigenous fowl is that they require less attention in terms of management practices. They do not require special feeds or drugs and incubation is naturally done by the birds without any interference of the owners. The owners do less work concerning care giving. This is not so in commercially grown improved poultry farms where everything is provided for optimum performance to be obtained...**Excerpt from KII in Edun LGA, Kwara State, Nigeria.**

On the number of eggs hatched and hatchability percentage, results in Figure 1 show that the average number per clutch, number of eggs hatched, number of eggs not hatched and hatchability percentage in this study are 12.05±3.1, 9.74±2.54, 2.48±2.20 and 78.01±17.56, respectively. These results are in agreement with the findings of Samson and Endalew (2010), who reported that productive hens lay on average, 10-18 eggs per clutch and high hatchability is attained when flexible means of incubation are employed. These results are also close to the report of Aberra *et al.* (2013) who reported that 12.8, 10 and 79.1% for the average number of eggs per clutch, number of eggs hatched and hatchability percentage, respectively.

Effectiveness of identified methods of incubation and hatching eggs

Results shown in Table 3 show that natural incubation (Mean = 2.66) was the most common method of incubation among local poultry farmers while kerosene incubation (Mean = 2.57) was ranked second with indigenous incubator (Mean = 2.19) occupying the third position in the mean ranks. The findings show that the natural brooding method and kerosene assisted

Table 2: Distribution of respondents based on the egg incubation method used in the past 2 years and the scoring for their usage

Variable	Frequency	Percentage	Mean	Std Dev	Rank
Natural incubation with local eggs	51	64.0	3.20*	0.40	1st
Kerosene incubator	50	63.4	3.17*	1.33	2nd
Indigenous incubator	40	50.0	2.50	1.97	3rd
Electric incubator	38	48.0	2.40	1.35	4th

Source: Field survey.
**Mean ≥3.0 = High level of use*
Multiple responses were given in this table; therefore, the percentage will not sum up to 100 but could be more.

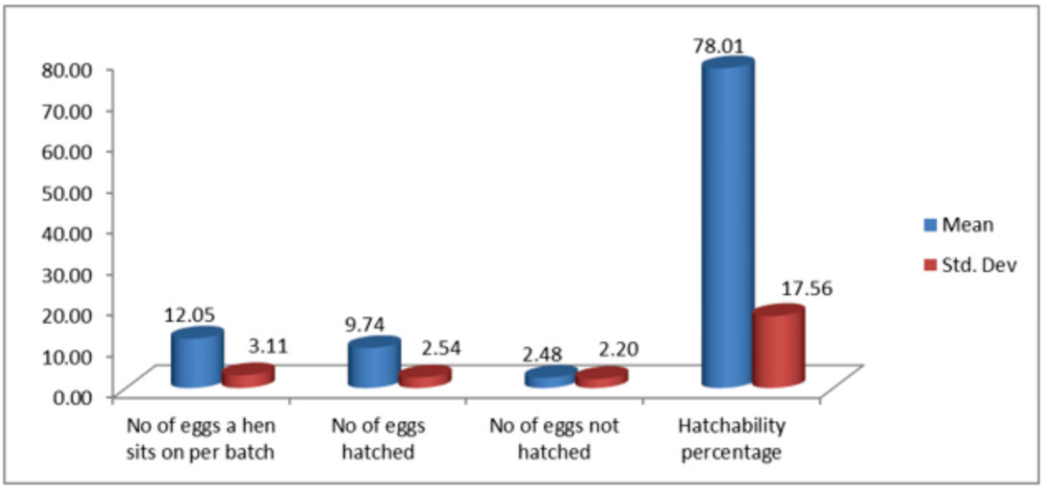

Figure 1: Productive characteristics of indigenous chicken in the study area

Effectiveness of identified methods of incubation and hatching eggs

brooding methods were the most effective egg incubation and hatching among farmers who reared indigenous fowls in Kwara State, Nigeria. This finding conforms to the earlier report of the KII which stated that few management practices were involved in raising local fowls. This may not be unconnected to the fact that they are not usually raised for commercial purposes. Thus, the size and flesh parameter may not be considered as in the case of improved birds like broilers where weight has been ascertained as a determinant of the price (Ziad, 2006).

Knowledge of incubation process and effectiveness

Results in Table 4 show respondents' knowledge (r = 0.547; p =0.01) of the incubation process had a significant relationship with the effectiveness of incubation and hatching methods. The positive relationship between the respondents' knowledge of the incubation method is an indication that they were effective in the incubation method where they

Table 3: Distribution of respondents based on the effectiveness of egg incubation and hatching methods

Variable	Mean	Std Dev	Rank
Natural brooding with local eggs	2.6	0.39	1st
Kerosene incubator	2.57	1.02	2nd
Indigenous incubator	2.19	0.94	3rd
Electric incubator	1.31	0.78	4th

Source: Field survey.
**Mean ≥2.5= cut off point for Effectiveness*

Table 4: Knowledge of incubation methods and their effectiveness

Variable	R	r^2	p-value
Knowledge of incubation process	0.547*	0.278	0.01

**significant at p = 0.01.*

recorded high knowledge. This has been documented in the literature by extant literature such as Madsen *et al.* (2003), Bock *et al*. (2005) and Abang *et al*. (2014), in their respective studies on the relationships between knowledge and effectiveness in the performance of tasks.This implies that the more they know and use a particular method of hatching and incubation, the more effective the method is. Awareness, orientation and training on new methods of incubation may be a positive influence on the effectiveness of poultry production in the study area.

Conclusions

Traditionally, the rearing of local birds could be used to predict the future of young people. Poultry keepers were involved in the rearing of local birds mostly for social and cultural reasons. The keepers in the study area practiced natural brooding with local eggs as the most common method of egg incubation. The most commonly used and most effective incubation method among the keepers was natural brooding. Poultry keepers' knowledge positively correlated with the effectiveness of incubation and hatching methods used in the local poultry production. Local poultry farmers should be taught the economics of poultry production and international best practices in poultry production should be disseminated to generate income from the poultry enterprise. This study adds to the body of scanty knowledge on traditional poultry incubation and hatching process.

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