HEALTH MANAGEMENT PRACTICES AND REPRODUCTIVE PERFORMANCE OF DUCKS IN NIGERIA

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Abstract: At present, duck production is in its infancy stage in Nigeria. Ducks are mostly reared extensively and concentrated in the hands of small-holder farmers. A survey on health management practices and reproductive performance of ducks was conducted in three south-west (Oyo, Osun and Lagos) and one north central (Niger) states in Nigeria. Primary data were obtained through structured questionnaires administered to 400 (100 per state) duck farmers and were analysed with descriptive statistics (percentage). Results on management of health-related challenges showed that 51.5% of respondents were practicing self-medication and majority in this category used ethno-veterinary medicines. Other measures adopted were neglect (12.25%), consumption of sick animals (10.50%), veterinary service (10.25%), among others. Reproductive performance estimates showed that about half (52.50%) of the respondents indicated 5–6 (24.75%) and 7–8 (27.50%) months as sexual maturity age of female ducks while the highest proportion (41.25%) indicated 16–20 eggs as clutch size. Hatchability rate was very high; 52% of duck farmers indicated that hatching rate was above 80%. Adoption of improved management systems by duck farmers will be of immense contribution to the health management and reproductive performance of ducks in Nigeria.

Key words: sexual maturity, ethno-veterinary medicine, hatchability, muscovy ducks, health-related challenges.

Introduction

Duck is one of the rarely exploited livestock in Nigeria despite a congenial environment for its husbandry across all agro-ecological zones and a readily available large market. A recent inventory survey of livestock in Nigeria revealed that duck is the third most widely domesticated poultry behind chicken and guinea fowl (Nwanta, et al., 2006; Hassan and Mohammed, 2003).

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Muscovy duck (*Cairina moschata*) and common duck (*Anas platyrhynchos*) are the two genera of ducks reared in Nigeria. However, reports of studies conducted in northern (Duru et al., 2006), western (Oguntunji et al., 2011) and eastern (Udedibie and Ogbonna, 2006) Nigeria have shown that Muscovy duck popularly known as local duck was the prevalent genus in Nigeria and is predominantly managed extensively.

There is no gain saying that the prevalence of traditional extensive system predisposes ducks to various environmental challenges with attendant poor performance in respect of growth, vitality, productivity and health of ducks relative to the semi-intensively and intensively reared ones. In an attempt to improve performance of rural poultry in the last two decades, there has been increasing interest by governments at federal and state levels in collaborating with international agencies to conduct studies on the current states of the poultry in order to facilitate the introduction of interventions that will enhance improvement of rural poultry production (Dafwang et al., 2010). Such a collaborative intervention becomes imperative due to the dearth of empirical studies directed to investigate various aspects of management, marketing, productive and reproductive performances, disease incidence and health management of ducks, among others, in Nigeria.

It is worthy of emphasis that efforts geared towards harnessing the potential of duck as an alternative source of animal protein would be a mirage and practically impossible in the absence of certain vital information on diseases, health management and reproductive performance which are presently meager in Nigeria. Such empirical information will be of great assistance to governmental and non-governmental organizations concerned with policy making and implementation on animal agriculture in Nigeria. Besides, such helpful information will be useful to practicing and intending duck farmers. In view of the foregoing, this study was undertaken to provide information on health management practices and reproductive performance of ducks in Nigeria.

**Material and Methods**

**Study area**

This study was conducted in three south-west states of Oyo, Osun and Lagos and Niger state in north central Nigeria. The vegetation and prevailing climatic conditions of the study area have been reported by Ogah et al. (2011), Yakubu (2011) and Oguntunji (2013). Primary data were collected from 400 duck farmers through questionnaires and the study covered 25 duck farmers from four local government areas (LGAs) of each state. The LGAs covered in this study are:

1. Oyo State: Oyo West, Oyo East, Atiba and Afijio LGAs,
2. Osun State: Iwo, Ayedire, Ejigbo and Ede LGAs,
3. Lagos State: Epe, Eredo, Eti-osa and Ikorodu LGAs and
4. Niger State: Machegu, Mokwa, Edati and Borgu LGAs.

Data collection

Primary data were collected from 400 duck farmers (100 from each state) through well-structured and pre-tested questionnaires. Data collection involved a multi-stage random sampling procedure whereby four local government areas were randomly selected in each state.

Pre-field investigation showed that ducks were reared to a certain extent in the selected LGAs compared to other areas in the states selected. However, non-popularity of duck made duck farmers be very few. In view of this, the respondents interviewed were contacted through snowballing sampling method: respondents were identified by asking respondents to give referrals to other persons believed to fit the study requirement (Nyoni and Masika, 2012).

The questionnaires were designed in the English language. The inability of some respondents to read and write in the English language coupled with the non-proficiency in the English language of some duck farmers necessitated the interpretation of the questionnaire to some respondents in the Yoruba language in south-west states. In addition, field assistants that understood Hausa, Boko/Baruba and English were employed to explain and interpret the questionnaires to duck farmers in Niger state.

Statistical Analyses

Data collected through the questionnaires were subjected to simple descriptive statistics (percentages, means and ranges) using statistical package for social science (SPSS, 2001) version 16.

Results and Discussion

Health management strategies

Various measures adopted for prevention and control of duck diseases (Figure 1) showed that the majority (51.5%) of respondents were practicing self-medication using ethno-veterinary medicines (EVM). Besides, 12.25% of respondents neglected sick birds, 10.25% engaged the services of veterinarians, 10.5% consumed sick birds, 0.25% resorted to sale, while ‘Others’ (15.5 %) adopted various measures such as ‘juju’ (charm) rings, magical cloths, and or did not experience any health challenges at all.
State differences were observed in preventive and curative measures adopted by respondents (Table 1).

Table 1. Health care management practices (%).

| States          | Sample size | OYO | OSUN | LAGOS | NIGER |
|-----------------|-------------|-----|------|-------|-------|
| Self-medication |             | 100 | 100  | 100   | 100   |
| Sale            |             | 1   | 0    | 0     | 0     |
| Neglect         |             | 4   | 10   | 13    | 22    |
| Veterinary service |          | 9   | 7    | 24    | 1     |
| Consumption     |             | 3   | 0    | 25    | 14    |
| Others          |             | 29  | 22   | 1     | 9     |

While more than half of respondents in Oyo (54%), Osun (61%) and Niger (54%) states adopted self-medication, only 37% of duck farmers in Lagos state adopted this measure. In addition, some of the EVM, conventional medicines for livestock and man commonly used for prophylactic and curative purposes for ducks in the study area are presented in Table 2.

Prevalence of self-medication could be attributed to the fact that the majority of the respondents were keeping local Muscovy ducks on extensive management
system (data not shown) which does not support intensive spending on health care management practices. Other possible factors may be attributed to the prevalence of small flock size and the non-availability or inaccessibility of respondents to veterinarians, most especially those in villages, while some that had access were financially incapacitated to procure drugs and settle veterinary bills.

The majority of duck farmers practicing self-medication were using ethnoveterinary medicine (EVM) (data not shown), which involves the use of natural products, especially plant products for treatment and/or in some cases for the prevention of diseases (Gueye, 1999). Prevalent use of EVM by respondents in this study agrees with the previous reports of Hunduma et al. (2010), Adeniyi and Oguntunji (2011) and Nyoni and Masika (2012) on health management of rural poultry in Ethiopia, Nigeria and South Africa, respectively. Since time immemorial, the use of EVM has been very popular and has been a common practice in the developing world, most especially among the rural livestock keepers before the advent of conventional drugs. Materials (roots, barks, leaves, fruits, seeds, etc.) commonly used for their preparations are sourced locally and were attested to be effective in preventing and curing duck diseases by respondents. The widespread use of traditional medicines in treatment of rural poultry was attributed to its low cost, local availability, easiness of application and the fact that it does not require modern technologies such as refrigeration (Mapiye et al., 2008). Though this method is plausible, nevertheless, in spite of the popularity of EVM among duck farmers, it is imperative to conduct on-farm tests to validate their potency as claimed by duck farmers in the study area in order to enhance documentation, preservation, commercialization and widespread use of those confirmed useful among them.

Furthermore, those farmers that neglected sick birds claimed never to have attempted any curative measures at all. This method was adopted due to the non-availability of veterinarians, lack of knowledge about duck diseases and management. Those that slaughtered and consumed sick birds resorted to this in order to pre-empt mortality and total loss of their investments on ducks. Slaughtering and consumption of sick animals is an age-long practice among livestock keepers in Nigeria. The sale of sick birds appears plausible from the economic point of view; however, this control measure is retrogressive and subtly encourages the spread of diseases through sick birds, serving as a repository and carriers of pathogens across borders to apparently healthy flocks.

It is interesting to note that a female respondent in Niger state among those classified as ‘others’ was found using ‘juju cloth’ for curing duck diseases. She claimed that all diseases are cured once the ‘magical cloth’ is tied around sick ducks. Besides, some respondents used ‘magical rings’ made of brass which are normally put on the leg of the sick ducks and were claimed to heal sick birds.
Table 2. Ethno-veterinary medicinal plants and orthodox drugs used for prevention and control of duck diseases.

| A. Ethno-veterinary medicinal plants | Local name | Part(s) used | Application form | Disease/sickness          |
|-------------------------------------|------------|--------------|------------------|---------------------------|
| 1. Elaeis guineensis Jacq. (Oil palm) | Igi Ope (Yoruba) | Oil | Rub the oil on the affected legs | Leg paralysis/ Lameness |
| 2. Butyrospermum parkii (Shear butter tree) | Igi Emi (Yoruba) | Oori (Yoruba) | Rub the oil on the affected legs | Leg paralysis/ Lameness |
| 3. Capsicum annum (Small pepper) | Ata Ijosi (Yoruba) | Fruit | Dried, ground and mixed with water to make the paste and then rub the paste on the affected leg | Leg paralysis/ Lameness |
| 4. Alium cepa (Onion) | Alubosa (Yoruba) | Bulb | Rub sliced onion on the affected legs or put sliced onion in drinkable water or rub the paste of onion and common salt on the affected leg | Leg paralysis/ Lameness |
| 5. Capsicum species (Pepper) | Ata (Yoruba) | Fruit | Dried, ground and soaked in drinkable water | Cures all kinds of duck diseases |
| 6. Citrus aurantifolia (Lime) | Orombowewe/ were (Yoruba) | Unripe fruit | Sliced and put in drinkable water | Cures all kinds of diseases |
| 7. Elaeis guineensis Jacq. (Oil palm) | Epo pupa (Yoruba) | Oil | The oil is put in the mouth of poisoned ducks | Antidote against poison |
| 8. Alium cepa and Capsicum species (Onion and pepper) | Alubosa and ata(Yoruba) | Bulb of onion and fruit of pepper | The paste of onion and ground pepper is put in drinkable water | Cures all kinds of diseases |
| 9. Lagenaria breviflora (Garden egg) | Tangiri (Yoruba) | Fruit | Cut the fruit and put in drinkable water and water baths | For prevention and control of duck diseases |
| 10. Solanum triangulare (Water leaf) | Gbure/ Gure (Yoruba) | Leaves and stems | Chopped and fed to the ducks | For deworming |
| 11. Moringa oleifera (Moringa) | Sogele (Hausa) | Fresh leaves | Mix the fresh or ground leaves with feed or put in drinkable water | Acts as multivitamin |

| B. Orthodox drugs | |
|-------------------|-----------|
| 1. Embarzin forte (VD) | Put in drinkable water | For prevention and control of diseases |
| 2. Keproceryl (VD) | | |
| 3. Neomycin - Chloramphenicol- Oxytetracycline (N.C.O.) (VD) | | |
| 4. Vitalyte (VD) | | Multivitamin |

| B. Drugs intended for man | |
|---------------------------|-----------|
| 1. Paracetamol tablet | Soaked in drinkable water | Cures all forms of diseases |
| 2. Ampicilus tablet | | |
| 3. Ampicillin tablet | | |
| 4. Chloramphenicol tablet | | |
| 5. Tetraycine capsule | | |
| 6. Septrin tablet | | |
| 6. Flagyl tablet | | |

| C. Non-drug remedy | |
|-------------------|-----------|
| 1. Ordinary water | Put the paralysed leg in water for some minutes | Leg paralysis/lameness |

( ) English name of ethno-medicinal plants in parenthesis VD–Veterinary drugs.
The factors responsible for the low adoption of self-medication, higher percentage of respondents engaging services of veterinarians and those consuming sick ducks in Lagos state compared to other states were multifaceted and interwoven. About one-third of respondents in Lagos state was keeping exotic ducks and was practicing improved (semi-intensive and intensive) management systems (data not shown). Taking into consideration the huge amount of capital ploughed into the purchase of ducks, pen construction, incubation, commercial feed ration etc., it will be very risky to adopt self-medication for prevention and control of duck diseases; hence, the need for services of veterinarians. Furthermore, synergy of some salient socio-economic factors such as being the most industrialized and urbanized state in Nigeria, in addition to high literacy and its cosmopolitan nature might have inadvertently contributed to a decline in relevance, patronage and poor knowledge of EVM plants, hence the low adoption of self-medication in Lagos state compared to other states under study.

Reproductive performance of duck

Reproductive performance of ducks is presented in Table 3.

Table 3. Reproductive performance of ducks.

| States | Sample size | OYO | OSUN | LAGOS | NIGER | OVERALL MEAN |
|--------|-------------|-----|------|-------|-------|--------------|
| Age at first egg (month) | | | | | | |
| < 5 months | 5 | 0 | 0 | 4 | 2.25 |
| 5-6 months | 26 | 25 | 35 | 13 | 24.75 |
| 7-8 months | 31 | 30 | 44 | 5 | 27.50 |
| > 8 months | 16 | 19 | 12 | 45 | 23.00 |
| Not known | 13 | 23 | 4 | 26 | 16.50 |
| Others | 9 | 3 | 5 | 7 | 6.00 |
| Clutch size (No.) | | | | | | |
| 5-10 | 19 | 13 | 20 | 4 | 14.00 |
| 11-15 | 30 | 26 | 16 | 27 | 24.75 |
| 16-20 | 36 | 39 | 48 | 42 | 41.25 |
| >20 | 7 | 14 | 12 | 21 | 13.50 |
| Others | 8 | 8 | 4 | 6 | 6.50 |
| Clutch/year (No.) | | | | | | |
| 1 | 9 | 10 | 10 | 6 | 8.75 |
| 2 | 49 | 49 | 13 | 67 | 44.50 |
| 3 | 20 | 27 | 39 | 13 | 24.75 |
| 4 | 8 | 7 | 29 | 1 | 11.25 |
| 5 | 1 | 0 | 2 | 1 | 1.00 |
| Others | 13 | 7 | 7 | 12 | 9.75 |
| Hatchability (%) | | | | | | |
| 40-50 | 3 | 8 | 4 | 1 | 4.00 |
| 51-60 | 9 | 12 | 16 | 0 | 9.25 |
| 61-70 | 10 | 13 | 16 | 2 | 10.25 |
| 71-80 | 19 | 16 | 8 | 20 | 15.75 |
| >80 | 46 | 45 | 47 | 70 | 52.00 |
| Others | 13 | 6 | 9 | 7 | 8.75 |
Age at first egg (AFE)

Variations were observed in AFE of ducks indicated by respondents. The highest proportion (27.5%) of respondents indicated 7–8 months, followed by 5–6 (24.5%) and above 8 months (23%) as AFE of their flocks. The range of AFE was 4–12 months. It is noteworthy that sizeable proportion (16%) of respondents across the states could not recall AFE of their ducks. The trend of results of AFE in southwest states (Oyo, Osun, and Lagos) in the present study was similar. Some respondents classified as ‘others’ (6%) submitted that their ducks have not commenced laying, while some in this category also claimed that they were not keeping female ducks but only males for sale and consumption.

The highest percentage of respondents indicating 7–8 months as AFE was similar to the reports of studies conducted in Northern Nigeria where Nwanta et al. (2006) and Duruet al. (2006) reported 6–8 months and 7.7 months, respectively.

There is the likelihood that management systems adopted in the study area exerted influence on AFE of ducks. It is noteworthy that Lagos state having the highest number of respondents practicing improved semi-intensive and intensive management systems (data not shown) and those feeding ducks with commercial feed rations (data not shown) recorded the earliest AFE of 5–6 months and the least proportion of duck farmers indicated AFE of above 8 months compared with other states. On the other hand, Niger state where almost all respondents were practicing an extensive management system (data not shown) had the highest proportion of farmers indicating AFE to be over 8 months. This is probably on account of birds being unable to reach body weight threshold required for the onset of egg laying early. Management systems adopted by farmers have been reported to influence AFE of Muscovy ducks in Nigeria. A comparative evaluation of different management systems by Etuket al. (2006) revealed disparity in AFE. AFE was reported to be 248.50, 206.70 and 202.70 days respectively, for Muscovy ducks reared semi-intensively, intensively with wallow and intensively-reared without wallow.

Another possible factor influencing AFE of ducks could be climate. The southwest states (Oyo, Osun and Lagos) experience higher annual rainfall and low ambient temperatures compared to Niger state located in northern Nigeria. Most duck farmers in Niger state commented that ducks do not lay eggs in the dry season. In addition, some respondents submitted that differences in seasons in which ducks reach sexual maturity exert influence on AFE. Farmers in this group claimed that ducks that reached sexual maturity in the wet/rainy season commenced laying eggs earlier than those that reached sexual maturity in the dry season. Late sexual maturity in the dry season might be linked to the adverse effect of thermal stress on egg production. Few respondents (2.25%) indicated that duck began to lay eggs between 3 and 5 months, which is probably unlikely, more so as no good records were kept by most of the farmers.
Clutch size

An estimate of clutch sizes of duck shows that clutch sizes of 16–20 eggs were prevalent (41.25%), followed by those of 11–15 eggs (24.75%), 5–10 eggs (14%), above 20 eggs (13.50%) while some respondents among those classified as ‘others’ (6.5%) could not recall the clutch sizes of their flocks, are not keeping female ducks and/or their female ducks have not commenced laying. The clutch size range in the present study was 8–30 eggs. Similarly, comparison of results of the states under study revealed that the highest percentage of duck farmers in all the states indicated that the average clutch size was 16–20 eggs, representing 36, 39, 48 and 42% of all respondents respectively, in Oyo, Osun, Lagos and Niger states.

The higher percentage of duck farmers recording clutch size above fifteen eggs in their flocks in the present study is consistent with other studies in Nigeria where clutch sizes of 16–20, 16.4, 16.28 and 18 were reported by Adeyemi et al. (2008), Nwanta et al. (2006), Ola (2000) and Chia and Momoh (2012), respectively. Some respondents adduced variation in clutch sizes to seasonal change and that small clutch sizes were more common in dry season months. The small clutch sizes in the dry season were attributed to a scarcity or a lack of water for breeding purposes. However, this submission might not be true for studies have shown that the belief that effective copulation can only take place in water is a fallacy (Payne and Wilson, 1999) and that access to water does not improve fertility (Muelen Van der and Dikken, 2004).

Furthermore, some other factors contributing to small clutches as identified by duck farmers in the study area were theft of duck eggs, domestic accident and activities of predators. Nevertheless, the majority of respondents asserted that ducks are good layers and lay a higher number of eggs per clutch than chicken and other indigenous poultry species.

Number of clutches per year

The majority (44.5%) of respondents indicated that female ducks underwent two reproductive cycles in a year while 36% of respondents claimed to have 3–5 clutches. Those classified as ‘others’ (9.75%) were unable to give a categorical response on the clutch sizes of their flocks. Comparison across the states under study indicated that a higher percentage of respondents in Oyo (49%), Osun (49%) and Niger (67%) states indicated that female ducks underwent two reproductive cycles in a year. Conversely, the highest proportion (39%) of all respondents in Lagos state indicated three reproductive cycles for their ducks.

A scarcity of related studies on the number of clutches per year did not permit a head-to-head comparison with the results of the present study. Factors responsible for the discrepancies observed in the number of clutches per year were multifaceted. Some respondents adduced this to the weaning age of ducklings.
They submitted that if ducklings were weaned earlier or mother ducks were continuously disturbed by drakes, they may wean earlier than expected and start another reproductive cycle. In addition, some duck farmers submitted that poor mothering ability of some mother ducks resulting in loss of ducklings at an early age due to various environmental challenges such as flood, predators, heat stress, etc. does force female ducks to commence laying cycle again.

Hatchability

The majority (67.75%) of respondents in all states recorded high hatching rates of above 70%. Few respondents (19.50%) belonged to the intermediate group (51–70%) while the least proportion (4%) of duck farmers obtained 40–50% hatching rate. It is noteworthy that the proportion of farmers recording 80% hatching rate was higher in Niger state (70%) compared to respondents in southern states: Oyo (46%), Osun (45%) and Lagos (47%) states. Respondents classified as ‘others’ (8.75%) were unable to give an affirmative response on the hatching rate of their flocks.

A high hatching rate of above 70% reported by the majority of respondents in the study area agrees with previous studies in Nigeria and elsewhere that a hatching rate of Muscovy duck was high (Ola, 2000; Nwanta et al., 2006; Duru et al., 2006; Banga-Mbako et al., 2007), but contradicts a recent study in north-central state in Nigeria where a hatching rate was reported to be 57% for Muscovy ducks (Chia and Momoh, 2012).

Ducks are known for their high fecundity in the study area and the majority of respondents testified that a hatching rate of duck was higher than that of any other local poultry species. A lower hatching rate recorded by some farmers may be attributed to pre-incubation environmental factors that duck eggs were subjected to. Probing of duck farmers on construction, sanitation and location of nest boxes revealed that in most cases duck eggs as well as embryos were vulnerable to adverse environmental factors. In some cases, nest boxes and litters were not provided at all and ducks laid eggs on bare ground in the backyard and nearby bushes before eggs were picked and stored. In some other cases, the location of nest boxes in unprotected open spaces exposed eggs, litter and incubating mother ducks to direct sunlight and/or rain/water.

Another contributing factor to poor hatchability was season. The majority of duck farmers complained of discrepancies in a hatching rate between wet and dry seasons. Some duck farmers submitted that a higher hatching rate of ducklings was observed in the wet season relative to the dry season while some did not observe any seasonal difference. Similarly, the seasonal variation in hatchability of duck eggs has been reported by Asian investigators. Gajendran and Karthickeyen (2009) and Padwa et al. (2009) reported higher hatching rates of duck eggs in the rainy season than in thermally stressed summer months in India. Decreased hatchability under higher ambient temperature has been postulated to be linked to the altered
metabolism during embryonic development resulting from a change in the biochemical component of eggs under heat stress (Ladjali et al., 1995).

**Conclusion**

It is evident that the majority of duck farmers in the study area engaged in self-medication using ethno-veterinary drugs to treat ducks. A higher hatching rate of Muscovy ducks is a major plus to duck farming in the study area. Change in season, most especially, high environmental temperature commonly experienced in dry season months adversely affected reproductive performance of ducks in general. It is imperative to encourage duck farmers to adopt improved management (semi-intensive and intensive) systems which will help a lot in improving the health and reproductive performance of ducks in the study area. The on-farm investigation of the potency of the EVM drugs is necessary for their preservation, standardization, commercialization and recommendation for use.

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R e z i m e

U danasnjie vreme, proizvodnja pataka u Nigeriji je u povoju. Ova proizvodnja je uglavnom ekstenzivna i skoncentrisana u rukama malih prozvođača. Istraživanje o postupcima upravljanja zdravljem i reproduktivnim karakteristikama pataka je sprovedeno u tri jugozapadne države (Ojo, Osun i Lagos) i jednoj severo-centralnoj državi (Niger) u Nigeriji. Primarni podaci su dobijeni primenom strukturiranih upitnika, koji su podeljeni proizvođačima pataka, kojih je bilo 400 (100 po državi) i analizirani su primenom deskriptivne statistike (procenat). Rezultati o rešavanju problema, vezanih za zdravlje su pokazali da su 51,5% ispitanika primenjivali samolečenje i većina ispitanika u ovoj kategoriji su koristili etno-veterinarske lekove. Ostale mere koje su primenivane uključivale su zanemarivanje (12,25%), komzumiranje proizvoda od bolesnih životinja (10,50%), veterinarsko lečenje (10,25%), između ostalih. Procene reproduktivnih performansi su pokazale da je oko polovina (52,50%) ispitanika ukazala na 5–6 (24,75%) i 7–8 (27,50%) meseci, kao doba seksualne zrelosti ženke, dok je najveći deo ispitanika (41,25%) ukazao na 16–20 jaja kao veličinu nasada. Stopa sposobnosti jaja za leženje je bila visoka; 52% proizvođača pataka su naveli da je stopa sposobnosti jaja za leženje bila preko 80%. Usuvačenje unaprijeđenih sistema upravljanja od strane poljoprivrednika, koji se bave uzgojem pataka, će predstavljati ogroman doprinos upravljanju zdravljem i reproduktivnih performansi pataka u Nigeriji.

Ključne reči: seksualna zrelost, etno-veterinarska medicina, sposobnost jaja za leženje, maskovi/mošusne patke, izazovi u vezi sa zdravljem.

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