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The Prospects and Limitations of Japanese Quail (*Coturnix coturnix japonica*) Production in Nigeria- A Review

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Abstract

The exponential increase in population size in the developing countries including Nigeria necessitates a corresponding demand in animal protein supply to sustain the availability of protein for the human populace. Quails characterised by small size are regarded as a cheap additional source of animal protein, due to their low feed requirements, rapid growth, short generation, and gestation periods. In this paper review, the prospects of quail production, management, diseases and control strategies have been extensively discussed. It further highlighted other unique qualities of quail over other species of poultry to include; requirement of less amount of floor space, feed and high fecundity rate. Limitations to quail production in Nigeria includes; infectious diseases (Bacteria, viral & protozoan) and noninfectious (Drowning, smothering & cannibalism) which require necessary skills for successful quail production. Adequate biosecurity measures employed in poultry disease control are applicable in quail diseases prevention and control strategies. The study has implication on the potentialities of quail production as an excellent and affordable source of animal protein in Nigeria.

Keywords: *Animal protein, Diseases, Gestation, Limitations, Nigeria, Productions, Prospects, Quail*

1. Introduction

The continued rise in human population in the developing countries necessitates the need to establish additional sources of animal protein [1]. Animal protein constitutes about 17% of the total protein consumption in the average Nigerian diet compared to other developed nations with 68% in New Zealand, 71% in United States of America, 67% in Denmark and 60% in the United Kingdom [2]. In Nigeria, with a population of over 170 million, there is deficiency of animal protein security with the consumption put at about less than 10g/head/day as against the minimum daily intake of 65 g recommended by the Food and Agricultural Organisation (FAO) to be the minimum requirement for the growth and development of the body [1], [3], [4]. Boosting the poultry industry with a short generation interval is an alternative means of alleviating the deficiency of animal protein in Nigeria. Among these are the Japanese quail (*Coturnix coturnix Japanica*) raised primarily for their meat and eggs [5]. Generally quail production occupies a small but significant segment of the Nigerian poultry industry [6]. The Japanese quail have the advantage of small size, short life cycle, rapid growth rate, good reproductive potential, high fecundity rate, and shorter hatching periods when compared with the different species of poultry [1],[5]. The benefits of quail meat are known as high protein, essential fatty acids, and minerals such as sodium, potassium, and iron. Owing to high metabolic activity in this animal, the amount of glycogen stored in muscles increases and results in high quality meat [7]. Quail having carcasses made up of 76% of meat, 14% of skin, and 10% of bone, has the highest amount of meat and the least bone ratio among the other poultry products [7]. Japanese quail birds mature in about six weeks and are usually in full eggs production in 50 day of age [6]. The Japanese quails therefore have the potential to complement the obvious gap in the protein needs of Nigerians, necessitating means to improve their productivity and sustainability. One of the areas that need particular attention is common diseases and control of these diseases in the quail birds. Although, Japanese quails have been reported to be generally resistant to common diseases that may adversely affect other birds; they can however still be affected by several infectious and non-infectious diseases. Previous literature revealed that, little is known on the management, diseases and control of quail production in Nigeria. Few of the information available are unable to elucidate the major intricacies involved in quail production, diseases and control. This paper therefore presents first-hand information on the review of management procedures in

quail production; examines the prospects and limitations that may be envisaged in quail production in Nigeria. Suggestions were made to improve quail production and useful recommendations were made in order to meet the ever rising protein needs in Nigeria.

2. Origin and distribution

The common quail (*Coturnix coturnix*) is a small migratory Galliform species with an extensive Palaearctic distribution [8]. Quail domestication is believed to have started in China when a particular subspecies that commonly migrates between Europe and Asia were raised as pets and singing birds. The domesticated Coturnix was brought to Japan from China across the Korean bridge at about 11th century BC [9], [10]. Japanese quails (*Coturnix coturnix japonica*) were introduced in Nigeria by the National Veterinary Research Institute (NVRI) 1992 [11], [12], [13].

3. Breeds of Quail

There are two main kinds of quails suitable for breeding and they are the "Japanese" quail (*Coturnix japonica*) and the "American" quail (*Coturnix coturnix*). Japanese quail (*Coturnix quail*) are from pheasant family and are migratory birds which migrate between Asia and Europe. The region of origin of these birds is believed to be south-east Asia [13].

4. Rearing systems

The battery cage or deep litter systems are used to raise quail birds without any adverse consequences on their welfare, growth and development, provided that all requirements for their growth are well catered for with improved biosecurity measures [4], [14], [15].

5. Management of breeding stock

5.1 Mating ratio

Fertility in Japanese Quails (*Coturnix Coturnix Japonica*) breeding is affected by different factors such as mating ratio [16]. Eggs of chicks from the quails housed in individual cages for genetic improvement purposes, female per male must not exceed 3. Furthermore, for a quail flock housed in colony cages, the male to female ratio that results in desired number of chicks to be produced is 1:4 [17].

6. Feeding Breeding Stock

Birds are essentially fed well-balanced and nutritious feed. To ensure good performance of Japanese quails in the warm humid tropics including Nigeria, it is recommended that diets containing 2500 kcal/kg metabolizable energy (ME) and 24% crude protein (CP) should be used [18].

7. Egg production

7.1 Some production traits of Quail

Domesticated quails do not have the tendency for brooding and hence eggs must be incubated under a broody live, or by artificial incubation [19]. Recent studies revealed that oval eggs are probably the best to be selected for incubation to achieve optimum hatchability in quail production. Whilst spherical eggs may not hatch at all and round eggs may only hatch sparingly [10]. Studies have shown that a total number of about 248-250 eggs are produced annually by a female quail with a life expectancy of 2-2 $^{1/2}$ years [6], [20].

8. Sexing

Vent examination technique is the most popular sexing in quails and is only possible at post hatching stage. These techniques may be inaccurate, require expertise, facilities and may not be affordable by many Nigerian farmers [10]. Egg colour, weight and shape are also evaluated to predetermine quail chick sex [10].

9. Nutrition

9.1 Nutrient composition of Quail diet

Feed intake in birds generally depends on the energy level of the diet. Studies revealed that low energy diet lead to poor performance despite the high quantity of feed consumed by quails. It was also observed that quails fed with low crude protein diet performed favourably well with those fed the control diet while those fed the high fat diet effectively utilized the feed conforming to the functions of fat in diet [18]. The body compositions of the quail in the treatments indicated that a certain proportion of fat and protein is necessary for good performance of quails [18], [21]. Quail can utilize a single diet for its production recommended ME levels of 2500 – 2800 kcal/kg ME in one single diet for Japanese quail [18], [21].

10. Common diseases of Japanese quails

10.1 Bacterial diseases

10.1.1 Bordetellosis is an upper respiratory disease, primarily seen in young quails, caused by infection with *Bordetella avium*. The disease is characterized by sneezing, oculonasal discharge, mouth breathing, tracheal collapse, and stunted growth [22], [23].

10.1.2 Fowl cholera is a disease of many avian species caused by infection with *Pasteurella multocida* (PM). PM is capable of multiplication in the bloodstream of a bird. As a result of this bacteremia, the organism may quickly colonize many organs, contributing to the typical purulent exudative lesions of fowl cholera seen in the joints, wattles, ovaries, brain, liver, spleen, and lungs [22] [24].

10.1.3 Mycoplasma meleagridis (MM)-This is introduced into a flock by contaminated equipment, shoes etc. The disease is characterised by drop in egg production and hatchability in breeder flocks. High mortality,

unthriftness, respiratory distress, stunting, crooked neck with deformity of cervical vertebrae, and leg deformation are common in young birds [25].

10.1.4 Fowl typhoid (FT) - This disease is transmitted by Salmonella enterica serovar Gallinarum, a non-motile host. FT is a severe systemic disease responsible for heavy economic losses in commercial poultry industry through morbidity, mortality and pathological lesions [26], [27].

10.1.5 Colibacillosis- This disease is generally seen in aged quails. It is caused by a bacterium called *Escherichia coli*, which is a gram negative, rod-shaped bacterium found normally in the intestine of the bird. The disease is characterised by difficulty to walk, loss of appetite and epilepsy are the symptoms of this disease [28].

10.1.6 Staphylococcal Infection: This infection is caused by Staphylococcal bacteria entering the body of quails through wounds in the body. The infected wound will grow into a blister. Even though this is not an acute disease, it affects the productivity of quails [29].

10.2 Viral diseases

10.2.1 Egg drop syndrome -76 (EDS-76) is a recognized disease of chickens and Japanese quails, which is of high economic importance because the birds do not become ill. The disease caused by duck adenovirus A and transmitted vertically in eggs; is characterised by decrease in production, fertility and hatchability of eggs [30].

10.2.2 Fowl Pox (FP) / chicken pox/sore head/avian diphtheria- This disease is transmitted by direct contact between infected and susceptible birds or by mosquitoes. Virus-containing scabs also can be sloughed from affected birds and serve as a source of infection. FP is manifested by wart-like lesions on unfeathered areas (head, legs, vent, etc.) (Dry form) and canker like lesions in the mouth, pharynx, larynx, and trachea (wet form) [25].

10.2.3 Infectious Bronchitis (quail bronchitis) / (IB): IB is a very contagious viral disease. The disease is spread by air, feed bags, infected dead birds, infected houses, and rodents. The virus can be egg-transmitted; however, affected embryos usually will not hatch. The severity of infectious bronchitis infection is influenced by the age and immune status of the flock, by environmental conditions, and by the presence of other diseases. Affected birds will be chirping, with a watery discharge from the eyes and nostrils, and laboured breathing with some gasping in young chickens. The infectious bronchitis virus infects many tissues of the body, including the reproductive tract. Eggshells become rough and the egg white becomes watery [25].

10.2.4 New castle diseases (ND): Newcastle disease affects all birds of all ages. There are three forms of Newcastle disease, mildly pathogenic (lentogenic), moderately pathogenic (mesogenic) and highly pathogenic (velogenic). Newcastle disease is characterized by a sudden onset of clinical signs which include hoarse chirps (in chicks), watery discharge from nostrils, labored breathing (gasping), facial swelling, paralysis, trembling, and twisting of the neck (sign of central nervous system involvement). In adult laying birds, symptoms include; decreased feed and water consumption and a sharp drop in egg production. The Newcastle virus can be transmitted through airborne route or introduced on contaminated shoes, poultry caretakers, feed deliverers, farm visitors, car tires, dirty poultry equipment, feed sacks, egg crates, and wild birds[25][31].

10.3 Protozoan diseases

10.3.1 Coccidiosis: This is considered an important disease because endogenous stages of the parasites and a high number of oocysts in feces were associated with intestinal lesions. This disease is transmitted by 3 Eimeria species (*E. tsunodai*, *E. uzura* and *E. bateri*) [32].

10.4 Fungal diseases

10.4.1 Aspergillosis: Aspergillosis or brooder pneumonia is a fungal infection seen especially in quail chicks. This infection is caused by a fungal organism called *Aspergillus fumigatus*. These organisms grow readily in wet food, wet litter, wet or rotten wood etc. The chicks get infected by contaminated food, unclean water and contaminated air. Major symptoms include sleeplessness, breathing problem, and loss of appetite, convulsions and sometimes results in death [29].

10.4.2 Candidiasis**:** This is also a fungal infection caused by fungal organisms of Candida family. Sore can be seen inside mouth and respiratory tracts of infected birds [25].

10.4.3 Aflatoxicosis**:** This disease is caused by a fungal organism called Aflatoxin. These fungal organisms grow readily in wet and old food. Aflatoxin is transmitted the body of quail through hatchery and contaminated food. The disease is characterised by loss of appetite, fatigue, silent gasping or gurgling sounds, mortality [25].

10.5 Ectoparasites

10.5.1 Lousiness

Lice infestation constitutes the common ectoparasitism of Japanese quails. The lice commonly recovered from quails include, *Menacanthus* spp, *Lipeurus* spp, *Gonoides* spp. Lousiness only becomes a problem when the number is high. The disease is characterised by irritation, anorexia, pale mucous membrane, loss in production and reduced egg production. The lesions found were plucking dermatitis, skin irritation, and mild to moderate [4].

11. Reported diseases and pests of Japanese quail (*Coturnix coturnix japonica*) in Nigeria.

Survey of literature revealed that a number of diseases affecting Japanese quails were reported in 6 of the 36 states of Nigeria (Figure 1).

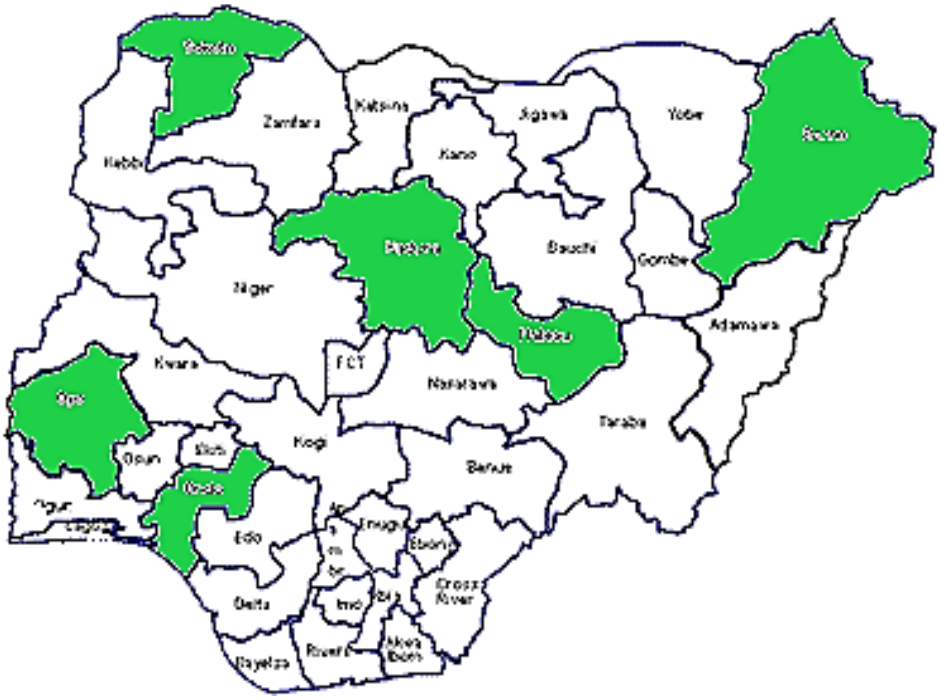

Figure 1: Map of Nigeria showing the states were diseases of quails have been reported across the 36 states of Nigeria. Incidences of diseases were reported in 6 states namely; Borno, Sokoto, Kaduna, Plateau, Oyo and Ondo states. Adopted and modified from http://www.soft2ools.com/jit_unesco/images/nigeria.gif

Table1: Reported cases of diseases of quail in Nigeria (2004-2014)

	Disease	Aetiology	State	References
Bacterial	Fowl cholera	*P. multocida* serotype A: 1, 3 and 4	Ondo	[33], [34]
	”	*P. multocida* serotype	Kaduna	[35]
	Fowl typhoid	*Salmonella enterica serovar gallinarum*	Plateau	[27]
	Fowl typhoid	*Salmonella enterica serovar gallinarum* *Salmonella bareilly*	Plateau	[12]
	Bordetollosis	*Bordetella avium*	Plateau	[23]
	Colibacillosis	*Escherichia coli*	Plateau	[23]
	Pastorollosis	*Pastorella multocida multocida surevor A4*	Plateau	[36]
	Citrobacter maulinae infection	Citrobacter species	Plateau	[12]
Viral	New castle disease (NCD)	ND Virus (velogenic viscerotropic strain)	Kaduna	[37]
	New castle disease (NCD)	ND Virus (velogenic viscerotropic strain)	Plateau	[12]
	”	”	Borno	[36]
	Egg drop syndrome (1976) (EDS’76)	Duck adenovirus A	Borno	[38]
	Avian encephalomyelitis	Hepatovirus	Oyo	[39]

Protozoan	Coccidiosis	*Eimeria colini, E. dispersa, E. acteri, E. uzura* and *E. coturicus*	Plateau	[12]
	”	*Eimeria bateri*	Kaduna	[40]
	Histomonosis	*Histomonas miliagridis*	Plateau	[12]
Haemoparasites		*Plasmodium circumflexum, P. relictum, P. nouxi, Haemoproteus nisi, H. columbae, and Aegyptienella pullorum*	Kaduna	[32]
Ectoparasites	Lice infestation	Menacanthus spp, Lipeurus spp and Gonoides spp	Sokoto	[4]
Others	Cannibalism		Plateau	[12]
	Smothering		Plateau	[12]
	Drowning		Plateau	[12]

Table 1 shows the distribution of the reported cases diseases of Japanese quail across 6 of the 36 states in Nigeria between 2004-2014. The diseases were mainly bacterial (Fowl cholera, Fowl typhoid, Bordetollosis, *Citrobacter maulinae* infection, Colibacillosis and Pastorollosis), Viral (Newcastle disease, Egg drop syndrome (1976) and Avian encephalomyelitis), Protozoan (Coccidiosis and Histomonosis), Haemoparasites (*Plasmodium circumflexum, P. relictum, P. nouxi, Haemoproteus nisi, H. columbae, and Aegyptienella pullorum*), Ectoparasites **(***Menacanthus* spp, *Lipeurus* spp and *Gonoides* spp) and Others (Cannibalism, smothering and drowning).

12. Strategies for the control of quail diseases in Nigeria

12.1 Bacterial diseases

12.1.1 Pasteurellosis
Rodents (*Rattus rattus*) are believed to be involved in the spread and maintenance of pasteurellosis. Rodent control is therefore critical in the control of pasteurellosis. Administration of appropriate antibiotics, improved biosecurity and general sanitation on the farm are also quintessential [41].
12.1.2 Salmonellosis
Good sanitation and hygiene reduce the mature bird to bird transmission of *salmonella* spp. Rodent control and use of appropriate antibiotics [12].
12.1.3 Bordetollosis
The use of the vaccine has generally been less than successful. Antibiotic treatment of flocks suffering with bordetellosis has provided minimal clinical improvement. Improve sanitation and biosecurity. Chlorinate water (2-3ppm) [22], [29].
12.1.1 Colibacillosis
Hatchery hygiene should be improved to control colibacillosis and reduce production loss. Chloramphenicol drugs are administered for the treatment of this disease. However, indiscriminate use of antibiotics should be avoided because it may lead to the development of drug-resistant strains of bacteria [28].
12.1.5 Fowl cholera: There are three live PM vaccines available. The vaccines vary in virulence. The M-9 vaccine is the least virulent, the CU vaccine is the most virulent, and the PM-1 vaccine is intermediate in virulence. The disease can be effectively treated with several different antibiotics [22].

12.2 Viral diseases

12.2.1 Egg Drop Syndrome-76 (EDS-76) -Vaccination decreases virus shedding but do not prevent infection. Quarantine and disinfection are necessary, as duck adenovirus A is contagious by either direct or indirect contact [42].
12.2.2 Newcastle diseases (ND)
Vaccination with ND LaSota in drinking water reduces or prevents the number of mortalities completely and restores egg quality and production. Inactivated LaSota, LaSota vaccines and live vaccine B1 for chickens against ND were found to be safe and consequently induce the production of high and moderate antibody titre levels respectively in Japanese quails [12]. The strains of quails that produce high and low antibody titre levels following vaccination with inactivated ND virus have been developed in Japan. Maintenance of good management and biosecurity [12].

12.3 Protozoan diseases

12.3.1 Coccidiosis
Prophylactic anticoccidial treatment and vaccination. Improved litter management, good sanitation and hygiene [43].

12.4 Fungal diseases

12.4.1 Aspergillosis
There is no effective treatment for birds affected with brooder pneumonia. Maintaining high standards of hygiene in the premises, avoiding contaminated food, removing wet litter immediately and disinfecting the equipment regularly can prevent this disease. Set clean

eggs in incubator, clean out setters and hatchers; clean water drinkers daily; avoid wet litter conditions [29].

12.5 Lousiness

It is important that for maximum production, adequate preventive measures should be taken into consideration so as not to allow the infestation of lice exceed the level at which the impact of lice will manifest [4].

12.6 Non-infectious conditions

The common non-infectious conditions in quails production include; smothering, drowning and cannibalism. These could be controlled adequate stocking density, ventilation, mating; balanced ration Adjustment of feeders, drinkers to suit the quail birds could also reduce drowning [12].

13. Marketing in Nigeria

The demand for quail birds and its products in Nigeria is increasing rapidly due to its medicinal, nutritional and economic benefits [6]. A market survey both in Kaduna and Zaria revealed that a female quail bird sells for N 500 ($2.5) while male goes for N 250 – 300 ($1.25- 1.5), the price of egg go for N 20 –30 ($0.1-0.15). Cost of crate of quail eggs by supplier is N 100 ($ 0.5) and traders sell as high as N 300 ($1.5) Similarly, 1 kg of chicken meat goes for N600 ($3), but a quail which hardly weighs 0.5 kg at maturity attracts N 700 ($3.5)[12]. Quail farming business is no doubt a lucrative farming business in Nigeria and is gradually taking over chicken or any other poultry farming business in the country.

Conclusions and Recommendations

The small size, low feed requirements, short life cycle, good reproductive potential, good meat taste, better laying ability, rapid growth rate, shorter time of hatching and resistance to common poultry diseases as compared with the different species of poultry has made quail farming an important poultry business contributing enormously to protein supply through meat and egg production in Nigeria. A Limited data indicate number diseases even though in a limited scale as compared to conventional poultry have been reported in some states in Nigeria. Further investigations by the veterinary officers into the severity of the reported diseases in these states across the country are also significant in the control and further spread of such diseases. Adequate biosecurity measures employed in poultry disease have also been recommended in quail's diseases prevention and control strategies.

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