Study on Management Status and Disease aspects of Pheasant (*Phasianus colhicus*) of Kathmandu Valley, Nepal

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ABSTRACT

Even though Nepal has several wild pheasant species, captive pheasant rearing for human consumption is a relatively new farming practice in Nepal. Pheasant farming is a growing practice among Nepalese farmers. However, farmers lack understanding and background in pheasant management techniques and associated diseases. The purpose of this study was to investigate the distribution, location, management status, and disease characteristics of commercial pheasant farming in the Kathmandu valley. A retrospective cross-sectional study was conducted in Kathmandu valley and the Central Veterinary Laboratory (CVL), from July to September 2021. The case records from 2017 to 2021 were analyzed at CVL and the farms were mapped based on their locations. The top ten pheasant diseases reported in CVL were identified and the disease outbreak farms were followed to get additional information on management aspects. A total of 42 pheasant farms were visited to collect data, and dead birds from these pheasant farms were submitted to CVL for postmortem and bacterial culture. MS-EXCEL and the online software "Open Epi" were used for statistical analysis. Sixty percent of the surveyed farms exclusively raised pheasants, while 40 percent practiced mixed farming. The source of hatching eggs was from abroad (12%), local breeding center (70%) and inter-district farms (18%). Ninety percent of the farms practiced some extent of biosecurity such as clothes changes and visitors log maintained. The temporal analysis identified that pheasant mortality was highest in July, followed by June and August. Of the total cases reported in retrospective study urolithiasis was responsible for 20.27 percent of deaths, Newcastle disease and Mycotoxicosis each were responsible for 13.51 percent of deaths of birds. Though urolithiasis is one of the leading causes of death there was no significant statistical associations ($p>0.05$) with ages and the flock size. The study collected the baseline data on management practices and disease distributions among the commercial pheasant farming in Kathmandu valley. We suggest, further studies on morbidity, mortality, seasonal stress, and economic aspects of commercial pheasant farming. Prior knowledge and expertise on management and health aspects related to farming is needed for sustainable pheasant farming in Nepal.

Keywords: *Pheasant farming, Kalij, disease distribution, management practices.*

INTRODUCTION

Nepal's unique geography with drastic elevation changes, and the accompanying wide range of eco-climatic conditions, has resulted in a very diverse range of flora and wildlife. Nepal hosts 118 ecosystems and is located at the crossroads of two bio-geographic domains: the Palearctic in the north and the indo-malayan realms in south (Udvardy 1975). Pheasants are birds of several genera within the subfamily phasianinae, of the family Phasianidae in the order Galliformes. Despite pheasants are introduced worldwide, they are native to Asia. There are 49 species native to Asia out of 181 species of pheasants (Ashraf, 2015). Among them 8 species of pheasant; Himalayan monal, (*Lophophorus impejanus*), satyr tragopan (*Tragopan satyra*), blood pheasant (*Ithaginis cruentus*), koklass pheasant (*Pucrasiamacrolopha*) and kalij pheasant (*Lophura leucomenalos*) and two lowland pheasants red junglefowl (*Galus galus*) and blue peafowl (*Pavo cristatus*) are recorded in Nepal (Poudyal et al., 2011). Himalayan monal (*Lophophorus impejanus*) is a national bird of Nepal and natively called as Danfe.

The ring-necked pheasant (*Phasianus colhichus*) is a game bird native to South Asia which first made successful introduction from Eastern China (Geaumont & Field, 2016). Pheasants are primarily used as game birds for hunters in Europe and eastern continent but in case of South Asia the native pheasants are listed in International Union for Conservation of Nature (IUCN). They are very popular for their nutritious meat with low fat and high essential amino acids (Ashraf, 2015). Pheasants are polygamous species (Baxter & Wolfe, 1973). Pheasant are easily distinguishable, male are large and have colorful plumage whereas females are simple (Ashraf, 2015; Lelliot & Yonzon, 1980). Females choose their mates on the basis of size, color, intensity of sexual ornaments to obtain good genes for their off-spring (Ashraf, 2015). In developing world, pheasant production and shooting is one of the most productive businesses (Fulton, 2021). They are eye catching and most impressive species in nature, therefore they are often put on display in aviaries and on posters for conservation and educational purposes and they are widely used as a source of food (McGowan & Garson 1995; Fuller & Garson 2000).

Pheasant rearing system consist of primary two methods: intensive and semi-intensive rearing system while semi-extensive system is also applied in Europe. Semi-intensive system is also known as semi-natural system of rearing (Gheța et al., 2020). Breeding the wild birds in captivity gives rise to a problem of feather picking and cannibalism which causes heavy economic losses to the farmers. There are two main factors: extrinsic and intrinsic. Extrinsic factors include nutritional factors, environmental factors and condition of breeding while intrinsic factors depend on the birds such as social behavior, sex, age, stress, nervous, hereditary, and immunology (Nikolov & Kanakov, 2020).

Bacterial septicemia with parasitic infestation are more common in pheasants species similarly salmonellosis followed by enteric bacterial infections and then infection with *Mycoplasma gallisepticum*; also, infections with *Pasteurella multocida* and *Erysipelothrix rhusiopathiae* were common on ring-necked pheasant. (Fulton, 2021). With parasitic infection dominating the pheasant death bacterial disease and viral infection such as rotaviral enteritis; Marek's disease; lymphoid leucosis; were evident in the retrospective study, where the necropsy was submitted in Michigan State University Veterinary Diagnostic Laboratory (MSU VDL) for disease surveillance and diagnostic investigation (Liebhart et al., 2023).

MATERIALS AND METHODS

Study site and design

This study was carried out from July 2021 to September 2021 in the Kathmandu valley. The dead pheasants were brought to Central Veterinary Laboratory (CVL), Tripureshwor, Kathmandu for necropsy examination. After necropsy, the tissue samples such as liver and lungs were collected for the bacteriological study and virological investigations by rapid antigen tests. The study consists of two approaches; first, the farmers who submitted the dead birds were contacted by telephone and arranged onsite visits for the face-to-face interview using the questionnaire. On farm visit, the farmers were asked about the farm characteristics such as farm size, rearing system, shed type and biosecurity status. In addition, bird characteristics such as flock size, breed types, and population diversity were assessed. Farmers were requested to submit dead birds to CVL if they suspected disease and if unusual mortality was found. Second, the historical data of the postmortem and bacteriology unit of year 2017 to 2021 were analyzed.

Sample size

Actual locations and the numbers of farms were not able to estimate initially, as there have not been official records and kalij farming is relatively new profession in Nepal. Snowball sampling technique (Snowball Sampling on JSTOR, n.d.) was used to locate the farms of the pheasant. Therefore, with this technique, altogether, 42 pheasant farms were visited for the survey. 75 farms with the historic record of CVL were included in the analysis making total 117 farms in the study. The farms that submitted birds more than once within a week were considered duplicates and recorded each as a single farm.

Study area and profile

The survey was conducted in the farms of Kathmandu valley, which included the farms in Kathmandu, Bhaktapur and Lalitpur district. Yet, the historical data also includes farms from Nuwakot and Kavre.

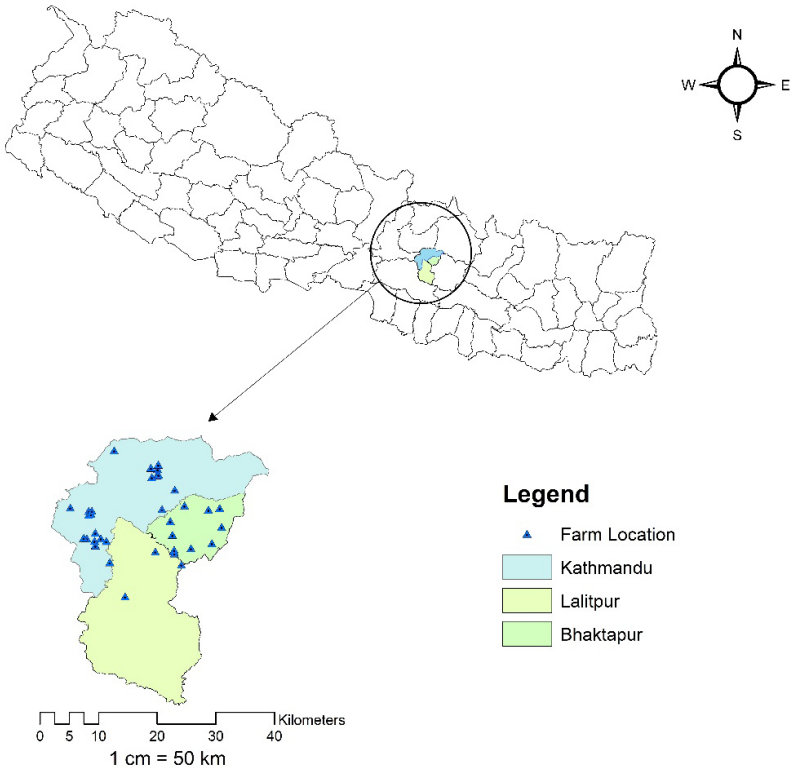

Figure 1 Study area and locations of pheasant farms (generated using QGIS 2.18)

Survey tools and data sources

A semi-structured questionnaire survey was prepared with the open and closed ended questions, which included the socio-economic aspect, management aspect, and disease occurrence history. The answers were collected by individual interview in very amicable environment with owner's consent. All the information was transferred into digital format using MS-Excel 2013.

Similarly, for the retrospective study primary and secondary data of post-mortem unit, bacteriological unit, and virology unit of 2018 AD to 2021 AD of the Central Veterinary Laboratory (CVL) was used for the study of frequency of disease occurrence.

Statistical analysis

All the raw data was recorded in MS Excel. Descriptive analysis was performed for the farm characteristics and disease distribution. Similarly, the association of health outcomes with the important factors were tested by chi-square test and their corresponding p-values calculated to test statistical significance. An online statistical tool "Open Epi" was used for calculating the p-value.

RESULTS

Descriptive study of pheasant populations

The survey involved 42 pheasant farms; from which, 60% farms were rearing pheasants only while 40% of farms were mixed farms. The median flock size of the pheasant farm was 1200 while mean flock size of pheasant farm was 1656.58. Out of the total farm surveyed, the average land covered for pheasant farming was 30943 sq feet, the maximum land covered was 76664 sq feet and the minimum land covered by the farm was 2738 sq feet. Average number of feeders used in the farms were 19, while the average number of drinkers used were 18. Average egg laying period for the pheasants was 4.4 months primarily during February to May. Rearing system adopted in pheasant farm was dominantly semi-intensive (92%), which includes the brooding pen and flight pen. Similarly, despite pheasant being game bird 7% farm owners adapted the intensive rearing system. Out of total farm visited 88% farms reared only ring-necked species while remaining 12% farms introduced melanistic mutant in their farms. The characteristics of pheasant farms and population is depicted in the Table 1.

Table 1 Descriptive characteristics of pheasant population in the farm

	Mean ±SE	Min	Median	Max
Total pheasant population	1656±310	100	1200	12000
Total land covered (Sq. feet)	30943.2±2965.60	2738	27380	76664
Total no of feeders	19±1.82	5	15	50
Total no of drinkers	18±1.90	3	15	50
Egg laying period (months)	4.4±0.13	3	4	6
Note: Sq. feet is Square feet; Min is Minimum; SE is Standard Error; Max is Maximum				

From the survey, 12% of pheasants' eggs were either purchased from nearby farms or brought from abroad, while 17% were brought from abroad and 70% of the pheasant's eggs origin was from the farms locally. Interestingly, the community mainly residing in the edges of Kathmandu valley maintained the farms. The surveyed data showed that 90% of the farm applied biosecurity measures, although all the elements of biosecurity method was not strictly applied in the farms.

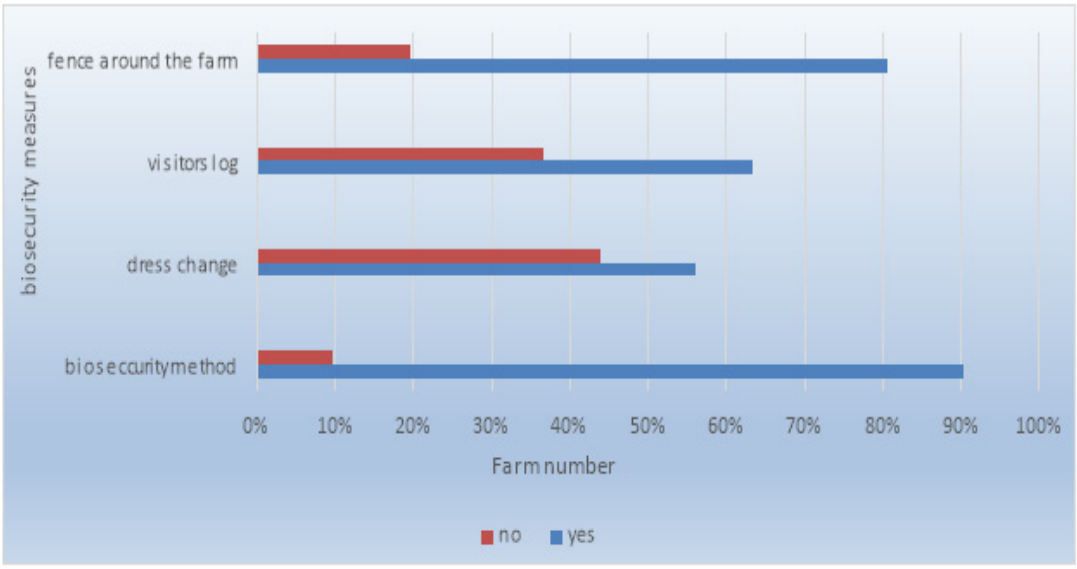

Figure 2 Graph showing the biosecurity status in pheasant farm.

Retrospective study of the pheasant populations

Frequency of disease

From the retrospective data from CVL, we found out that the frequency of disease was highest during the month of July while least during the month of December (Figure 3).

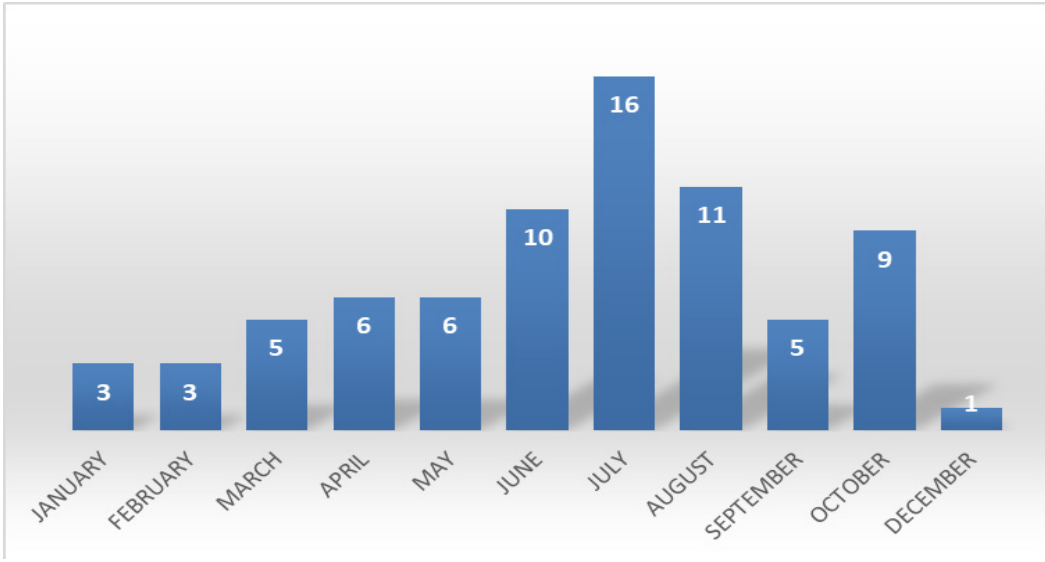

Figure 3 : Graph showing frequency of diseases occurrence according to months

Top 10 diseases of Pheasants

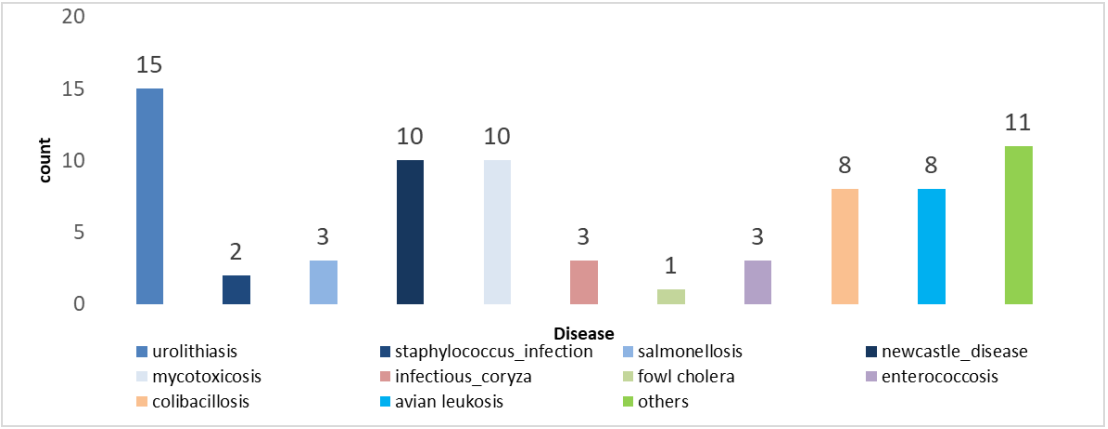

Figure 4: Graph showing frequency of common diseases reported in CVL

Out of the total samples tested in the CVL, 20.27% of the samples tested confirmed urolithiasis as a cause. Newcastle disease and mycotoxicosis accounted for the 13.51% each. Similarly, colibacillosis and avian leukosis accounted for 10.81% each of the total disease. Subsequently, infectious coryza, salmonellosis, and enterococcal infection were diagnosed in the bacterial culture accounting for 4.05 % each of the total disease reported. Lastly, fowl cholera was also reckoned in 1.35% of the cases presented.

All the factors like age in weeks and flock size had no significant difference in the occurrence of the urolithiasis in pheasants. There was no significant association of age (weeks) with the risk of development of urolithiasis in pheasant farm, (Chi-square value (Odds Ratio= 1.9, p= 0.3604). There was no significant association of flock size with risk of development of urolithiasis in pheasant farm (Odds Ratio =1.7$\chi 2$ = 0.1625, p= 0.4607) as shown in Table 2.

Table 2. Statistical analysis of bird's factor-" Age (weeks) and flock size" with urolithiasis

Bird related factors	**Urolithiasis**		**Odds Ratio (95%CI)**	**P value**
Age in weeks	**Yes**	**No**		
<12	10	39	1.9 (0.49, 7.88)	0.3604
>12	3	23		
Flock Size	**Yes**	**No**		
>1000	4	13	1.7 (0.44, 6.32)	0.4607
<1000	9	49		
Grand Total	13	62		

CI: Confidence interval

DISCUSSION

This research finding discovered 42 functional farms in Kathmandu valley and estimated the total population of the pheasants as 67,020 until September 9, 2021. The ring-necked pheasant was reared in most of the farms while portion of the farms began introducing melanistic mutant sub-species too. 93% of the pheasant farm were semi-intensive while 7% of these were intensively reared as semi-intensive farm provided the trees and hedges for the cover and protect them from natural predators (Liebing et al., 2020). The biosecurity measures on most of the farm were below average/good. An awareness of the level of biosecurity on the premises and information on production techniques that are related to the risk of disease transmission were both goals of the survey questions. Due to the infeasibility of all-in and all-out production strategy, maintaining adequate biosecurity on game bird breeding farms poses intrinsic difficulties (Dwight et al., 2021). There had been outbreak of ND recently and not application of the strict biosecurity measures might be responsible for disease outbreak. The reasons of disease outbreaks could be multispecies rearing and poultry farm nearby the pheasant farm. Every farm dealt with the problem of cannibalism and feather pecking, which might be due to high stocking density, composition of feed, environmental factors (light, sound, temperature and air) and bad management practice (Nikolov & Kanakov, 2020).

In our analysis, there was no significant relationship between flock size and age in weeks with the risk of development of urolithiasis in pheasant farm. However (Pennycott, 2000) has mentioned the mortality of the pheasants with the deposition of urates in heart and ureters which were associated with the pheasant coronavirus-associated nephritis.

While the sporadic feeds and not appropriate constituent in the feed and deficient water accessible as per flock size may have been a reason for urolithiasis in the pheasants of Kathmandu valley. The goal of the retrospective study provided a summary of the management status, with particular attention to common diseases affecting the health and welfare of pheasants.

CONCLUSION

The study has provided information on current farming status and major diseases dominant on pheasant farms in Kathmandu valley, Nepal. To our knowledge, our study is the first to quantify the pheasant rearing and their management in Kathmandu Nepal. The management status of the pheasant/kalij in Kathmandu valley were informative to our study suggesting the practice of farming with little knowledge. The study has shown that well recognized cause of high mortality, such as “pheasant urolithiasis” and Newcastle disease affected the pheasant farm in Kathmandu valley. Additional research that utilizes virus isolation techniques can potentially link pathogens found on farms

to those detected in birds from pheasant farms, which allows for tracing of a pathogen from farm to the other commercial poultry farms. This research has made a road map for the further investigation of the diseases causing mortality in pheasants and summarized the prevalent diseases in pheasant rearing. There is a requirement for specialists in the infectious disease determination and to address the management issue in building up pheasant farm and breeding center in Nepal.

ETHICS STATEMENT

The author acknowledges that the ethical policies, as noted on the journal's author guidelines page, have been cohered to and the appropriate review has been received. Since no physical intervention was done in live birds and all the studies were conducted in dead birds during the study, no any ethical permission was needed. However, a verbal consent was obtained during collecting the data from the farmers and use of the retrospective data from the CVL.

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CONFLICTS OF INTEREST

Authors declared that there is no conflict of interest in publishing this research paper.

DATA AVAILABILITY STATEMENT

On request, the corresponding authors could provide the findings that support the study's conclusions. Due to privacy or ethical constraints, the data are not available to the public.

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