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Cross-Sectional Assessment of Poultry Infectious Diseases Across Different Production Systems and Breeds in Karachi

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Background:

In Karachi, Pakistan, poultry production is a pivotal source of income and nutrition, but the productivity is significantly limited by infectious diseases. Despite the significance of breed-specific disease dynamics to effective control, there is limited local epidemiological data on various production systems.

Objectives:

The purpose of this study was to identify the prevalence of the major infectious poultry diseases, evaluate the susceptibility by breed and age, and define the main management and biosecurity risk factors of the commercial and indigenous chicken population in Karachi.

Methods:

A multistage stratified sampling design was used to select three randomly chosen districts, where a cross-sectional survey was done. Backyard flocks, commercial broiler and layer farms, were all covered. Data was gathered due to the clinical examination, structured farmer questionnaires, and biological sampling (oropharyngeal, cloacal, blood, and fecal samples). The rapid antigen tests, ELISA, and PCR were used to detect major viral pathogens, bacterial pathogens, and parasitic pathogens. The descriptive statistics and multivariate logistic regression were used to analyze disease prevalence and risk factors.

Key Findings:

Infectious diseases were widespread in all production systems, among 80,000 birds that were investigated. In layers, bacterial infections had dominated, whilst viral infections had been more prevalent in broilers. The most common bacterial diseases were salmonellosis and colibacillosis, and the most common viral infections that were identified included Newcastle disease, infectious bronchitis, and infectious bursal disease. Protozoal infections were also low but significant (mostly coccidiosis). The incidences of disease were different according to breed and age, with salmonellosis among the older birds and Newcastle disease in the younger flocks. Risk factors included poor hygiene, insufficient vaccination, and poor biosecurity. Poor biosecurity (AOR = 3.42; 95% CI: 2.61-4.48), absence of vaccination (AOR = 2.87; 95% CI: 2.03-4.06), and deep-litter housing (AOR = 1.94; 95% CI: 1.31-2.88) were found to be significant predictors of occurrence of infectious diseases using multivariate logistic regression.

Implications:

The poultry sector of Karachi is significantly affected by infectious diseases, and this need is indicative of major lapses in the management of farms and the prevention of diseases. The results of this study can be used to justify the application of focused vaccination initiatives, better biosecurity, and breed-specific disease management methods to minimize the loss of production and improve the health of poultry in the area.

Keywords: Poultry Diseases; Disease Prevalence; Breed Susceptibility; Risk Factors; Biosecurity

Introduction:

One of the livestock subsectors of the world with the highest growth rate is poultry production, which is essential in terms of food security, nutritional sufficiency, and economic stability, especially in developing nations (FAO, 2019). The poultry industry has a significant role in the agricultural gross domestic product and is a source of inexpensive animal protein of high quality to a rapidly growing urban population in Pakistan (GOP, 2022). Karachi, as the biggest metropolitan city of the country, is a large center of commercial poultry production and consumption, which includes intensive broiler and layer production systems and small backyard and indigenous chicken production systems. Although poultry plays an economic and nutritional role, the production capacity of the birds in Karachi continues to be limited due to a large percentage of infectious diseases.

The most prominent causes of morbidity, mortality, and losses in the production of poultry are infectious diseases of bacterial, viral, and parasitic origin [1]. *Salmonella* spp., *Escherichia coli*, Newcastle disease virus (NDV), infectious bronchitis virus (IBV), infectious bursal disease virus (IBDV), and protozoal agents like *Eimeria* spp. are considered very common and often liable for reducing the growth performance, feed conversion ratio, lowering the egg production, and high mortality [2]. Poultry diseases (6th ed.). Elsevier. [3][4]. The diseases are further enhanced where there is a high population of urban and peri-urban poultry rings, where breaches of biosecurity, as well as lack of littering and control of free-moving birds, are typical [5].

The concept of breed-based vulnerability to poultry diseases has become one of the most important factors that define the epidemiology of a disease and yield [6]. With an emphasis on fast development and a high productivity rate, commercial broilers and layers might be more vulnerable to infectious agents in stressful conditions in the environment and management [7]. On the other hand, the indigenous and dual-purpose poultry breeds are viewed as more resilient to the endemic pathogens through natural selection and adaptation, yet they are commonly under-vaccinated and can act as the source of disease transmission [8]. This notwithstanding, the epidemiological evidence of breed specificity in Pakistan is hardly available, especially in a city like Karachi.

The age factor also makes a big contribution to the development and prevalence of poultry diseases. The age of the birds is a key factor predisposing them to viral infections, including Newcastle disease and infectious bursal disease, because of their weak immune systems, and predisposing them to chronic bacterial infections, including salmonellosis and colibacillosis [9]. Knowledge of the age-specific disease patterns is crucial to the development of effective vaccination plans and the enhancement of the strategy in the health management of flocks.

The risk factors associated with the environment and management, such as the type of housing, the amount of stocking, the level of ventilation, hygiene, water quality, feed contamination, and the practice of vaccination, have a strong impact on the dynamics of the disease spread among poultry populations [10]. High temperatures and humidity are some of the climatic stressors in Karachi that further weaken the immune response and predispose people to diseases [11]. Though there are vaccines and diagnostic tools, the control of poultry diseases in the area is mostly reactive, with a small involvement of laboratory confirmation and a lack of incorporation of epidemiological surveillance data in the management decision-making.

Thus, the current research was implemented to establish the prevalence of the main bacterial, viral, and parasitic diseases in both commercial and indigenous chicken in the selected districts of Karachi, the susceptibility to these diseases based on breed and age, and the most significant management, environmental, and biosecurity risk factors of the disease. Through the combination of clinical examination, laboratory diagnostics, and multivariate analytical research, this study also seeks to offer evidence-based ideas to help in achieving targeted vaccination programs, better biosecurity, and sustainable production of poultry in Karachi.

This study was aimed at assessing the prevalence, breed susceptibility, and risk factors of the major infectious diseases of commercial (broiler and layer) and indigenous (desi) chickens in Karachi. The study aimed to establish the prevalence of bacterial, viral, and parasitic infections among different breeds and production systems, age- and breed-dependent susceptibility to the infections, as well as examine the management, environmental, and biosecurity-related determinants of disease transmission. The evidence was to be used in evidence-based recommendation of designing specific vaccination strategies, enhancing biosecurity procedures, and maximizing husbandry operations to minimize the impact of poultry diseases in the area.

Hypothesis:

The study hypothesizes that there is a high prevalence of infectious diseases in Karachi, while breed, age, and production system influences on variations with the impacts of management practices, biosecurity measures, and vaccination status.

Materials and Methods:

Study Area:

The research was carried out in three chosen districts of Karachi, Pakistan, which are some of the significant poultry production areas having a large concentration of commercial and backyard poultry farms. Even small aspects such as backyard and desi (or indigenous) chicken flocks, were considered in these districts, which consisted of intensive commercial broiler and layer farms. The climate in Karachi is hot and humid, with a coastal climate that has been identified to favor the persistence and spread of infectious poultry diseases.

Study Design:

A cross-sectional epidemiological study was conducted to identify prevalence, susceptibility to breeds, and the risk factors of major bacterial, viral, and parasitic diseases in poultry. These were commercial broilers, commercial layers, and native chicken breeds that were reared in various management and biosecurity conditions.

Population and Sample Size of the Study:

The population that was studied was a group of poultry birds that had clinical manifestations of disease in commercial farms and backyard flocks. In the study, there were 80,000 sick poultry birds. Birds were classified as follows:

Type (broiler, layer, indigenous) of production.

Breed:

Age group (8 weeks, 8-20 weeks, >20 weeks)

Housing system (intensive, semi-intensive, backyard)

Sampling Strategy:

It used a multistage stratified sampling method. During stage one, the purposive selection of districts was done according to poultry density. During the second round, random selection of farms and backyard flocks was done within every district. Sampling of birds with clinical signs indicative of infectious diseases was done in the third stage. Owners of farms and flock handlers were interviewed by using a structured questionnaire that gathered data regarding issues of management practices, vaccination history, hygiene, housing, and biosecurity.

Clinical Examination:

Clinical examination was made of all the chosen birds. Respiratory signs, diarrhea, decreased feed consumption, decline in egg production, lameness, feather pecking, and mortality patterns were all observed. All flocks were entered into the system of clinical findings.

Sample Collection:

Aseptically, biological samples were collected from a sample of birds, and these included:

Respiratory viral and bacterial pathogens, oral swabs.

Enteric bacterial and viral pathogen swabs, Cloacal.

Serological analysis of blood samples.

Fecal samples are to be studied in the scope of parasitology.

The samples were then taken to the laboratory under cold chain conditions to be examined further.

Laboratory Diagnosis:

Viral Diseases:

They included infectious bronchitis virus, infectious bursal disease virus, avian influenza virus, and Avian leukosis virus, which were screened with rapid antigen detection kits and enzyme-linked immunosorbent assays (ELISA). Confirmatory diagnosis was done by polymerase chain reaction (PCR), where the facilities existed.

Bacterial Diseases:

Rapid antigen kits and culture-based screening were the first to be used to detect bacterial pathogens like *Salmonella* spp. and *Escherichia coli*. ELISA and PCR tests were used to verify the selected samples. Isolation and identification were done by standard bacteriological procedures.

Parasitic Diseases:

The flotation and sedimentation methods were used to analyze fecal samples to identify gastrointestinal helminths and protozoal oocysts. Coccidiosis was diagnosed according to the fecal oocyte detection, lesion scoring, and clinical features.

Questionnaire Survey:

A set questionnaire was used to conduct interviews with farm owners and caretakers to obtain information about:

Production system and size of farm.

Vaccination schedules

Feed and water sources

Cleanliness and waste disposal.

Footbaths/Visitor control/Equipment sanitation Biosecurity measures.

Past disease outbreak history.

Data Control and Statistical Analysis:

The data were inputted in Microsoft Excel and were analyzed using statistical software (R software). The disease prevalence based on the breed, age group, and production system was calculated using descriptive statistics. The multivariate logistic regression analysis was carried out to establish the important risk factors related to the disease occurrence. Odds ratios (OR) with 95 percent confidence intervals (CI) were computed, and a statistical significance was established to be $p < 0.05$.

Ethical Considerations:

The experiment has been conducted according to the ordinary guidelines of animal welfare. Not a lot of stress was applied to the birds during sample collection, and verbal consent was received from the owners of farms before sampling.

Results:

The poultry farm-level analysis of poultry farms indicated that the prevalence of diseases at different locations was high. The prevalent ones were infectious avian nephrosis (57%), fowl pest (30%), and coccidiosis (low rate 2%). Coccidiosis (67%) was very common on other farms, probably due to bad litter handling and environmental exposure. There were also cases of avian diphtheria (58%) and Escherichia coli infection (56), which was quite high, indicating failure in biosecurity and sanitation measures in some places. Interestingly, there were no infectious diseases that were found in some farms. Disease management policies were different and incorporated antibiotic treatment, vaccination, sanitation methods, orally, through the nasal route, by injection, or taken up by drinking water. These results point to the importance of farm-level hygiene, biosecurity, and management practices, which had a critical role in the development of poultry diseases.

With the multivariate logistic regression model, insufficient biosecurity contributed significantly to the likelihood of occurrence of infectious disease (AOR = 3.42; 95% CI: 2.61-4.48; $p < 0.001$). Flocks that were not vaccinated stood close to three times the probability of infection than vaccinated flocks (AOR = 2.87; 95% CI: 2.03-4.06). The case of birds reared through deep-litter systems was also at elevated risks (AOR=1.94; 95%CI= 1.312.88). The occurrence of each disease was compared against the management practices, showing superior disease issues in low biosecurity as well as under-vaccinated flocks.

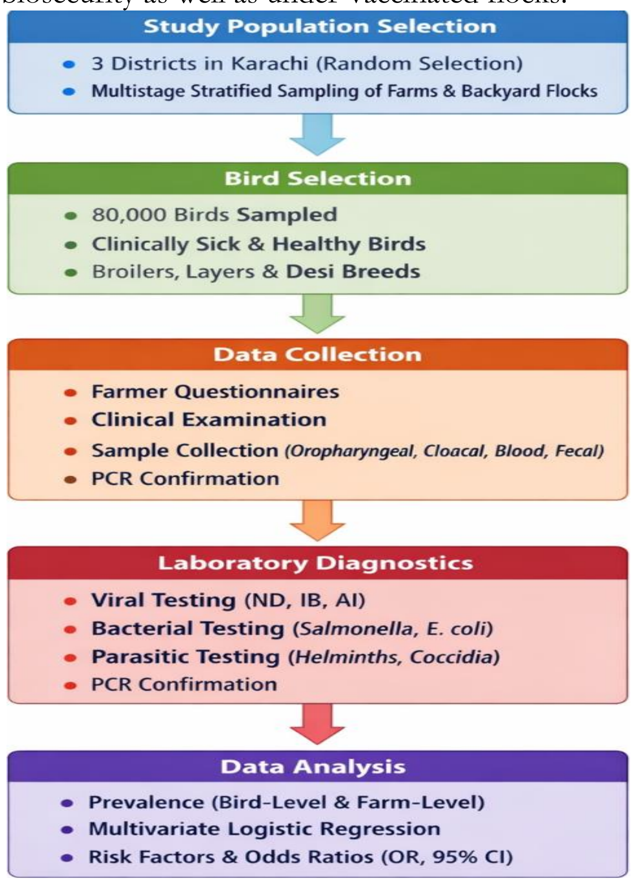

Figure 1. Flow diagram of the Poultry disease study in Karachi

Figure 1 demonstrates the workflow of the study which will include the process as farm selection, sample birds, and clinical and laboratory diagnostic and statistical analysis. A sample of both healthy and clinically sick birds was used to reduce the selection bias, and prevalence was determined at the bird and farm level. Multivariate logistic regression was done to identify risk factors of disease occurrence, which offered evidence-based information on the epidemiology of poultry diseases in Karachi.

Table 1 discussed the general trend in infectious disease occurrence in various poultry production systems in Karachi, which was different. In cases of layer chickens, bacterial infections were also the most prevalent, with a diagnosis rate of 52.29. The bacterial diseases were salmonellosis (38.56%), colibacillosis (6.70%), fowl cholera (4.79%), and necrotic enteritis (1.60%). The proportion of viral infections was the highest in the layers (23.95), with the most common being Newcastle disease (16.61), infectious bronchitis (3.19), avian influenza (2.56), and avian leukosis (0.64). Protozoal infections, mostly coccidiosis, were 5.75.

Table 1. Disease Prevalence by Production System in Karachi Poultry (N = 80,000)

Production System	Disease Type	Disease	Prevalence (%)
Layer	Bacterial	Salmonellosis	38.56
		Colibacillosis	6.70
		Fowl cholera	4.79
		Necrotic enteritis	1.60
	Viral	Newcastle disease	16.61
		Infectious bronchitis	3.19
		Avian influenza	2.56
		Avian leukosis	0.64
	Protozoal	Coccidiosis	5.75
Broiler	Bacterial	Salmonellosis	21.30
		Colibacillosis	7.69
	Viral	Infectious bursal disease	28.99
		Infectious bronchitis	15.38
		Newcastle disease	8.87
	Protozoal	Coccidiosis	6.50
Indigenous (Desi)	Bacterial	Mixed infections	—
	Viral	Mixed infections	—
	Protozoal	Mixed infections	—

In broiler chickens, viral infections were more common than bacterial or protozoal infections, with the most common viral pathogens being infectious bursal disease (28.99%), infectious bronchitis (15.38%), and Newcastle disease (8.87%). The bacterial infection in broilers comprised 28.99 with salmonellosis (21.30) and colibacillosis (7.69), and coccidiosis constituted 6.50% of protozoal infections. Mixed infections of bacterial, viral and protozoan origin were observed in Indigenous (desi) birds, but there was no specific prevalence rates mentioned. The findings imply that bacterial infections are considered to cause most disease in layers, whereas viral infections were more relevant in broilers, and the exposure of indigenous birds to various pathogens was probable, possibly because of the reduced level of vaccination and less intensive management.

Table 2. Breed-Wise Disease Distribution in Selected Poultry Breeds

Breed	Bacterial Disease	Prevalence (%)	Viral Disease	Prevalence (%)	Protozoal Disease	Prevalence (%)
Australorp	Colibacillosis	35.71	Newcastle disease	14.28	—	—
	Salmonellosis	28.57	Mycoplasmosis	14.28	—	—
Broiler (commercial)	Salmonellosis	21.30	Infectious bursal disease	28.99	Coccidiosis	6.50
	Colibacillosis	7.69	Infectious bronchitis	15.38	—	—
Layer (commercial)	Salmonellosis	38.56	Newcastle disease	16.61	Coccidiosis	5.75
	Colibacillosis	6.70	Infectious bronchitis	3.19	—	—
Indigenous (Desi)	Mixed	—	Mixed	—	Mixed	—

Table 3 explained analysis based on the breed showed that there were significant variations in the number of cases of infectious diseases in poultry found in Karachi. Bacterial infections were the major causes of mortality in Australorp chickens, and colibacillosis and salmonellosis were common in 35.71 and 28.57 percent of the chickens, respectively, and viral diseases were mostly caused by Newcastle disease and mycoplasmosis, 14.28 and 14.28 percent, respectively. This breed was not recorded to have protozoal infections. Most of the commercial broilers were infected with viruses, the most common viral organisms being infectious bursal disease (28.99%) and infectious bronchitis (15.38%); bacterial infections were salmonellosis (21.30%) and colibacillosis (7.69%); protozoa infections comprised 6.50 percent coccidiosis. Again, in commercial layers, bacterial infection was predominant, mainly salmonellosis (38.56%) and colibacillosis (6.70%), whereas viral infections were mainly Newcastle disease (16.61%) and infectious bronchitis (3.19%), and coccidiosis was 5.75% protozoa infections. Mixed infections were found in indigenous (desi) birds between bacterial, viral, and protozoal infections, but no definite prevalence rates of the type were identified, probably due to lower vaccination coverage and more lax management procedures. Such findings indicate that breed and management systems have a significant impact on the nature and prevalence of infectious diseases in populations of poultry.

Table 3. Age-Wise Disease Trends in Poultry

Age Group (Weeks)	Predominant Disease	Production System	Notes
8–20	Newcastle disease	Broiler, Growing Layer	Young birds are most susceptible
>20	Salmonellosis	Layer	Older birds had a higher prevalence
All ages	Coccidiosis	Broiler & Layer	Low-to-moderate prevalence across ages

Table 3 discussed the age-based analysis, which showed that there are differences in the occurrence of the disease in various poultry production systems. Young birds were more prone to Newcastle disease at the age of 8-20 weeks and were especially susceptible to Newcastle disease when they were in the broiler and growing layer flocks. Conversely, older birds (above 20 weeks) and layer flocks were more susceptible to salmonellosis, which may be due to the increase in age of the birds. Both broilers and layer birds showed the presence of coccidiosis in all age groups, but the prevalence was low to moderate. This suggests that the age of the birds is a major factor that predisposes them to diseases, and the viral infections affect the younger birds, whilst bacterial infections are predominant in older birds.

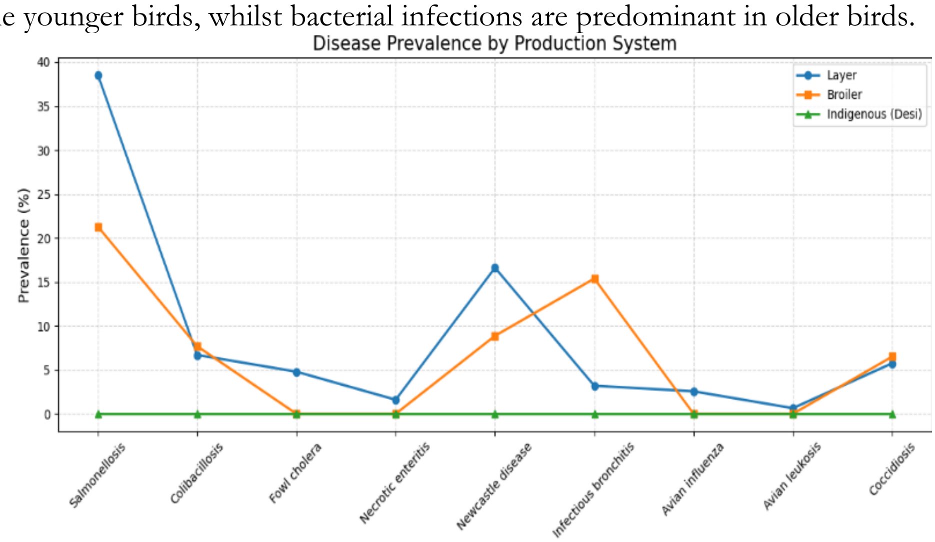

Figure 2. Line graph showing disease prevalence by production system

Table 4. Mean and Standard Deviation (SD) of Disease Prevalence (%)

Production System	Disease Type	Mean Prevalence (%)	SD (%)
Layer	Bacterial	12.91	14.92
Layer	Viral	5.75	6.34
Layer	Protozoal	5.75	0.00
Broiler	Bacterial	14.50	6.81
Broiler	Viral	17.75	8.38
Broiler	Protozoal	6.50	0.00

The statistical analysis discussed in table 4 shows that the bacterial infections in layer chickens are highly variable (SD = 14.92%), which is mainly because Salmonellosis (38.56%) prevails over other bacterial pathogens. However, viral infections are more common in broilers with a mean prevalence of 17.75% and a wide variation range (SD = 8.38) than in layers with a prevalence of 5.75%. Protozoal infections, predominantly coccidiosis, are relatively lower with respect to prevalence and are uniform across the two production systems, which implies a consistent but minor effect on the health of poultry. These results show that the disease patterns of production systems are different and that specific management and biosecurity approaches should be adopted.

The Chi-square test was conducted to determine the overall rate of bacterial, viral, and protozoal infection in Layer and Broiler production systems. The test results gave a Chi-square statistic (kh2) of 18.11 and a p-value of 0.00012.

The p-value is lower than 0.05, which means that the differences are statistically significant between the prevalence of the diseases in the Layer and Broiler systems. Viral infections, especially infectious bursal disease and infectious bronchitis, are much more common in broilers, but bacterial infections are more variable in layers, especially because of the high prevalence of Salmonellosis. The protozoal infection is also low, but it is not significant in the two production systems. Such findings underscore the need to have disease management and biosecurity measures that are specific to production systems.

Table 5. Multivariate Logistic Regression Analysis of Risk Factors Associated with Infectious Diseases in Poultry Flocks in Karachi

Variable	Category	Adjusted Odds Ratio (AOR)	95% Confidence Interval	*p*-value
Vaccination status	Vaccinated (Ref.)	1.00	—	—
	Not vaccinated	2.87	2.03 – 4.06	<0.001
Biosecurity level	Adequate (Ref.)	1.00	—	—
	Inadequate	3.42	2.61 – 4.48	<0.001
Housing system	Cage system (Ref.)	1.00	—	—
	Deep-litter system	1.94	1.31 – 2.88	0.001
Farm hygiene	Good (Ref.)	1.00	—	—
	Poor	2.56	1.78 – 3.69	<0.001
Production system	Layer (Ref.)	1.00	—	—
	Broiler	1.63	1.14 – 2.32	0.007
Age group	≤8 weeks (Ref.)	1.00	—	—
	8–20 weeks	1.48	1.02 – 2.15	0.039
	>20 weeks	2.11	1.46 – 3.05	<0.001

Table 5 discusses the Multivariate analysis, which was carried out in logistic regression, with the aim of determining the significant risk factors related to the occurrence of the disease.

Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated, and statistical significance was calculated using $p < 0.05$.

Discussion:

Poultry enterprise is another business in Pakistan that has evolved within the past few years. Nonetheless, there is an alarming threat due to different infectious diseases to the industry of poultry farming, particularly at small scale level, and indirectly to the economy of the country [12]. Major poultry diseases are Newcastle disease (ND), *Escherichia coli* infection, Infectious coryza, Infectious bronchitis (IB), Coccidiosis, Enteritis, Fowl pox, Salmonellosis, Hydro pericardium syndrome (HPS), and Avian Influenza (AI) [13][14][15][16]. Among the primary causes of various diseases in poultry breeds, there are poor vaccination and poor feed. [17]. It was found that the poultry breed was not protected against infections through vaccination. This could be caused by an inappropriate vaccine used, maternal antibody, improper storage, brooding, and the vaccine, as explained by [18]. In the current research, 9.20 and 8.88% of ND positive broilers and the ND positive layers, respectively, were obtained compared to the results of the studies by [19][20]. The current evidence showed that ND still posed a threat to the poultry industry through its reemergence in the commercial flocks. A survey was carried out on Fowl typhoid disease in the Karachi district and presented only 1.34% incidence of the disease by [21].

According to a survey carried out in Nigeria, ND was regarded as the cause of 14.66, Fowl typhoid 12.02, and Coccidiosis 10.81 [22]. Subsequently, some workers have reported that Fowl typhoid was present in 18.4% (n=129/700) prevalence in Nigeria [23]. [24] reported the prevalence of Fowl typhoid between 2000 and 2008 in Korea. Based on the analysis done on the chicken breeds, Fowl typhoid was found to be 47.7, 28.4, 17.2, 5.1, and 1.3 per cent in commercial broilers, Baeksemi (a mixed breed of male meat-type breeder and female commercial layer), commercial layers, native chicken, and broiler breeders, respectively. Out of the infected broilers, more than 90 percent of the birds were of the age less than 2 weeks old, which shows that they may have been infected with *Salmonella gallinarum* through vertical transmission. This disease was common among Asian poultry. As an example, Fowl typhoid was diagnosed in India between 1996 and 2008.

Recent research has increased knowledge on the major infectious diseases of poultry and shown that disease control has been a major problem. [25] have performed an extensive literature review of Salmonella infection in poultry and have detected non-typhoidal Salmonella serotypes as the main agent of salmonellosis with an emphasis on their importance as a leading cause of foodborne zoonotic disease. The review also specified the mechanisms of transmission, such as horizontal and vertical, and the host immune responses and pathogen virulence factors, and emphasized the need to apply better control strategies to mitigate infection in poultry and further threats to human health [25]. Based on it, [26] conducted a systematic review and meta-analysis of infectious and parasitic poultry diseases in Ethiopia and reported a high prevalence of bacterial and protozoal infections and strong relationships between the type of production, the breed, and the source of samples and prevalence of the diseases. Their investigation also showed that bacterial isolates were very much resistant to antimicrobial use, and thus the critical importance of increased monitoring, biosecurity, and antimicrobial custodianship [26]. Simultaneously, [27][28] gave updated information on coccidiosis and Newcastle disease virus, respectively. [27] summed up the recent developments in Eimeria biology, host-parasite relationships, the role of gut microbiota, and limitations like anticoccidial drug resistance and vaccine efficacy, and proposed combined control methods as a sustainable approach to poultry production. The article by [28] emphasized the persistence of Newcastle disease around the world, defining virulent strains and the significance of genotype-related vaccines and ongoing molecular surveillance as the key to adequate management of the outbreak. All these studies highlight the current importance of infectious disease in poultry and the necessity to have extensive evidence-based control strategies [29]

Pakistan has now been regarded as the most intensive poultry farming region in the world. The fact that multiple mycotoxins are very prevalent in this region today may be explained by: improved analytical procedures, which have increased the possibilities of the occurrence of mycotoxin in conventional ingredients and complete feed; increased use of by-products and other alternative feed ingredients, which are more prone to harboring mycotoxins and by changes in global climatic conditions, which are more favorable to growth of mold and consequently to the production of mycotoxins. The climatic conditions in the country range between the tropical and semi-tropical and temperate; the worldwide trade of feedstuffs implies that feedstuffs are derived by growing crops, as well as imports and exports, and are exposed to various conditions during production and storage. Starter, grower, finisher, layer, and breeder rations will tend to contain varying amounts of protein, energy, vitamins, and minerals depending on the nutritional needs of the birds.

Recommendations:

There should be targeted vaccination plans adopted to protect the susceptible birds.
Biosecurity measures should be enhanced to avoid diseases.
Husbandry practices should be improved to minimize the risk of infection.
Awareness to farmers and caretakers should be provided for better disease management.
There should be a strong policy to support disease control and sustainable production.

Conclusion:

There is a high prevalence of infectious diseases among the poultry population of Karachi, which depends on the production system, the type of breed, and age. Layers and Australorp chickens were most susceptible to bacterial infections, including salmonellosis and colibacillosis, and to viral infections, including infectious bursal disease, Newcastle disease, and infectious bronchitis. Younger birds and broilers were susceptible. The rate of protozoal infection was lower in all systems, with coccidiosis as the main infection. The breed susceptibility, age, and measures of control affected the prevalence of the disease, and indigenous birds tended to have mixed infections. Poor biosecurity, absence of vaccination, high density of stocking, and inadequate management of the farm were among key contributors to risk factors, making it necessary to focus on evidence-based interventions.

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