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MICROBIAL QUALITY OF DRINKING WATER USED IN POULTRY FARMS OF LAHORE

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Abstract

Water is the core of any poultry business because it is the medium through which birds are given nutrients and even vaccines. Any contamination in water means the whole flock will be under the threat of disease outbreak or stress at least. This study aimed to assess the presence of any kind of coliform bacteria in water sources at poultry farms in Lahore. Water samples were taken from controlled broiler farms, layer forms, and semi-controlled farms. These samples were carefully transported to the Department of Microbiology, University of Veterinary Sciences, Lahore for analysis. The two methods used in this study to analyze the water samples were the Viable Count (VC) Method and the Most Probable Number (MPN) method. The coliform bacteria which were focused in this study were salmonella and E. coli. A total of a hundred samples (n=100, controlled broiler farms n=50, layer farms n=32, semi-controlled farms n=18) were taken from farms. The overall rate of contaminated samples was observed at 30%(30/100). All these (30/100) samples have a higher colony-forming unit count than the 100 CFU/ml limit. A total of 32% (16/50) positive samples were observed in broiler farms water samples. The rate of positive coliform water samples in a layer farm sample was observed at 37.5% (12/32). Whereas, 33.3% (6/18) positive samples were observed in semi-controlled farms. All samples that showed positive results in the initial results were grown on EMB agar to confirm the presumptive test results. The study indicates that fecal contamination is happening to water sources being used in poultry farm operations at an alarming rate. The current study can be used as a baseline study for adaptation of better farm management practices to reduce the contamination of coliform Bacteria for poultry and indirectly for public health concerns.

Keywords: Poultry Sciences, Contamination, Microbiology, Quality of Water, Coliform Bacteria

INTRODUCTION

Water is considered the most valuable gift of nature to all living organisms on Earth. Clean and safe drinking water is a necessity for animal and human health(Raghavendra, 2024). It contains a minute quantity of many compounds and minerals and is a universal solvent. Water is and will always be a public health concern for developing and developed countries(Arefin et al., 2025). Pakistan is facing water quality issues due to the increasing population and the rapid pace of industrialization. A whopping 80 20% of the whole population of the country is not getting access to clean drinking water and only 20 percent has access to good quality water. This situation is alarming as no specific data is available for most of the areas(Ambreen et al., 2025).

Water quality is directly linked to the bird's health and performance. Any slight change in the quality of water is often the factor that decides the economic viability of the commercial farm(Yameen et al., 2025). The role of water is not limited to only a commodity but it's the carrier through which certain vaccines are given to poultry birds. It plays a vital part in the epidemiology of transmittable diseases. Numerous microorganisms reside in surface and groundwater contaminated with fecal material from animals, humans, and other ecological factors(Pokludová, 2025). When reservoirs, lakes, and groundwater resources are tainted by this pathogenic microorganism then these resources also become infectious and each time animals utilize such water, they will be exposed to pathogenic load which will ultimately cause immune challenges in them(Rathod et al., 2025).

There are many water-borne diseases impacting poultry. Water that is used as a supply to farm animals should be of safer quality and free of *Campylobacter, Salmonella, E. Coli*, and other related pathogens. The number of microbes in the water of birds should be 50 CFU/mL for coliforms and 100 CFU/mL as far as total bacteria are concerned(Saxena, 2025). Diseases are usually transferred to flocks using water and the problem usually invents itself from contamination of water sources by secretions and feces of sick birds it can also happen by consumption of drinking water previously polluted by pathogens that originate from man and another species example such case is *Escherichia coli* and *Salmonella(Pratama et al., 2025)*.

The poultry industry is prone to pathogens that spread through water and are therefore considered dangerous and life-threatening for a poultry business. If drinking water is not disinfected with chloride, there are more chances of infection from these kinds of microorganisms(Nakhaee & Hafez, 2025). *Campylobacter jejuni* has also been isolated several times, it forms the biofilm present in the nipple drinkers. Waterborne diseases are very old as far as their history is concerned. Bacteriological, parasitic, and viral diseases in poultry and poultry are related to the drinking of dirty water. In this industry, diseases like chronic respiratory disease, *avian cholera*, *Colibacillosis,* and *fowl typhoid* are usually disseminated through contaminated water. So, water used in poultry sheds must have acceptable chemical, physical, and biological value because that will help in the prevention of these kinds of diseases(Ahmed et al., 2025). *Campylobacter*, *Salmonellae,* and *E. Coli* are dangerous for bird's health if present in water or utensils. Certain chemicals are used to decrease the microbial load but those chemicals often create a different set of problems as per say fluoride reactions (Özyörü & Nigiz, 2025) use of better strategies and utensils enhances litter quality, improves the quality of drug dissipation, and reduces labor force thus reducing the risks of contamination (Rozsypal et al., 2025)

Many bacteria like *Enterobacteriaceae* and *Campylobacter salmonella* spread through water, drinkers, feeders, and walls. Different commercially available disinfectants are used to eradicate these contaminants from water waste and other sources(Adhikari et al., 2025). Even after extensive flock cleaning practices are taken by farmers 20% of farms are not effectively cleaned from these pathogenic contaminants. The best practice is to avoid the contamination from source rather than using any method to treat the infection at any later stage(Oliveira et al., 2024).

Many contagious bacteria can be identified in contaminated water directly. These bacteria usually have a fecal-oral route and hence detection of these bacteria in the water is tough. Intestinal microbes present in potable water are *Salmonella*, *Vibrio Cholera*, *Shigella*, *E. Coli,* etc(Nwadike et al., 2024). These are accountable for diseases that vary in their severity from mild to severe gastroenteritis and occasionally diarrhea dysentery. Water sources can be used for birds until it is within safe limits of drinking water quality range. If the range is exceeded extra stress is observed on different organs of birds and if the water has a minimum value for the pathogens many production indicators like Bursa size and FCR indicate it as well(Delamare et al., 2024).

The poultry sector is an important and vivacious section of agriculture and has an important influence on the national GDP (1.3%) in Pakistan. Hence, farmers may prevent many kinds of diseases in bird flocks by monitoring and controlling the quality of water used for drinking purposes which ultimately results in increased profit and decreased costs(Bist et al., 2024). The situation regarding water in Pakistan is a very major issue because the quality of the water being consumed in every industry and the biological purposes is not assessed regularly. The untreated water is indiscriminately going into downstream water bodies. The water contaminated from industrial, municipal, agricultural, and livestock waste all goes to downstream water(Djeffal et al., 2024). The supply of water is not at par with world standards and the usable water is often contaminated with fecal material. It is up to the extent that 22-40% of patients are suffering from diseases which are caused by consuming this unhealthy water directly or indirectly this even accounts for one-third of all the deaths occurring in the country(Agbasi et al., 2024).

The situation is even worse in the poultry industry where birds are getting water that is contaminated with fecal contamination. The sources of contamination like contaminated drinkers and feeders, and old water lines are not helping the cause either. This study is an effort to understand the extent to which this contamination from coliform is happening and what is the microbial quality of drinking water used in poultry farms of Lahore city(Moini & Ferdowsi).

2. MATERIALS AND METHODS

2.1. Ethical Considerations

No ethical approval was required, and all international, national, and institutional guidelines for animal care and use were followed during sample collection.

2.2. Study Area

The study was conducted in Lahore, Pakistan (31°34'55.3620'' N, 74°19'45.7536'' E), a major hub for the poultry industry. Water quality from poultry farms in the city and adjoining areas was assessed due to limited data on microbial contamination.

2.3. Sample Collection and Distribution

A total of 100 water samples were collected randomly from controlled broiler farms (n=50), layer farms (n=32), and semi-controlled farms (n=18). Samples were taken from water tankers, drinker lines, and roof tanks using sterile bottles after a 5-minute flow-off period to ensure consistency. The samples were labeled, stored at low temperatures, and transported to the University Diagnostic Laboratory, UVAS Lahore, for analysis.

2.4. Bacteriological Analysis

Water samples were tested for coliform bacteria using culture methods and biochemical characterization.

2.5. Culture Media Preparation

Commercially available media (Sigma, BDH, Merck) were prepared per manufacturer guidelines. Specific media included:

- **Lactose Broth**: Used for detecting fecal contamination.
- **Nutrient Agar**: Used for total viable count (TVC).
- **MacConkey Agar**: Used to isolate enteric bacteria.
- **Eosin Methylene Blue (EMB) Agar**: Used for coliform confirmation.

2.6. Total Viable Count (TVC)

The membrane filtration method was used to estimate TVC. A 100 mL water sample was filtered, and the membrane was incubated on nutrient agar plates at 37°C for 48 hours. Colony-forming units (CFU) were calculated using the formula. The permissible TVC limit was <100 CFU/mL.

2.7. Most Probable Number (MPN) Method

MPN analysis involved three steps: presumptive, confirmatory, and completed tests.

- **Presumptive Test**: Samples were inoculated in lactose broth tubes with Durham tubes, incubated at 37°C for 48 hours, and observed for gas and acid production.
- **Confirmatory Test**: Positive samples were streaked on EMB agar plates and incubated for 24 hours.
- **Completed Test**: Positive isolates underwent Gram staining and further biochemical tests.

2.8. Biochemical Characterization

Biochemical tests were conducted for further identification of coliform bacteria:

- **Gram Staining**: Differentiated Gram-positive and Gram-negative bacteria.
- **Catalase Test**: Differentiated Gram-positive cocci.
- **Oxidase Test**: Differentiated aerobic and anaerobic Gram-negative bacteria.
- **Motility Test**: Determined motility of Gram-negative rods.
- **IMViC Tests**: Included Indole, Methyl Red, Voges-Proskauer, and Citrate tests for enteric bacteria confirmation.

2.9. Statistical Analysis

Data were analyzed using standard statistical methods to evaluate microbial contamination levels in water samples.

3. RESULTS

A total of 100 (n=100) water samples were taken from rooster farms of Lahore city and its adjoining areas. The sampling from poultry farms was done randomly. Samples from water tankers, drinker lines, and over-the-roof tankers were taken in sterile plastic bottles after 5 minutes' flow-off time for consistent results. The collected samples were marked properly for the site of the sample, the time and date of sample collection, and the farm information. The classified water samples were transported in a container at low temperature in the University Diagnostic Laboratory, UVAS Lahore, and were processed for microbiological and biochemical analysis.

3.1. Bacteriological tests to analyses coliform bacteria

We used the two most used methods of Viable Count (VC) method and the Most Probable Number (MPN) method to analyze the coliform bacteria presence in poultry water samples.

3.2. Total Viable Count (TVC)

The total viable count of coliform bacteria was measured on a nutrient Agar medium from water samples. The method used for this technique is the membrane filtration technique, In this filtration technique, 100 ml of the water sample was poured through the membrane filter. The filtration membrane pores are very small in size bacteria cannot pass through these membrane pores. As they cannot pass from the filtration membrane, they were gathered on the surface of the filtration membrane. These freshly isolated bacteria on the filtration membrane were transferred to the culture medium of nutrient Agar on the Petri plates. After the incubation of 48 hours at 37 degrees centigrade, the total number of colonies on the surface of the nutrient Agar plate was counted for the total viable count. The formula for the total viable count used is given below.

CFU = No. Of colonies x Dilution factor/sample volume (ml) (Mirza et al., 2011)

The total allowed permissible limit for TVC in water is <100 CFU/ml.

Water samples from a total of 100 poultry farms around Lahore were taken for the determination of the presence of coliform bacteria in them. The carefully taken samples were first applied to nutrient agar plates. A total of 34 samples tested positive out of these 100 hundred samples on the colony-forming viable count method. The 30 samples which were tested positive have a higher viable count of colony-forming units. The standard used for the positive sample is a minimum of 100 CFU/ml. All these (30/100) samples have a higher colony-forming unit count than the 100 CFU/ml limit. A total of 32% (16/50) positive samples were observed in broiler farms water samples. The rate of positive coliform water samples in a layer farm sample was observed at 37.5% (12/32). Whereas 33.3% (6/18) positive samples were observed in semi-controlled farms

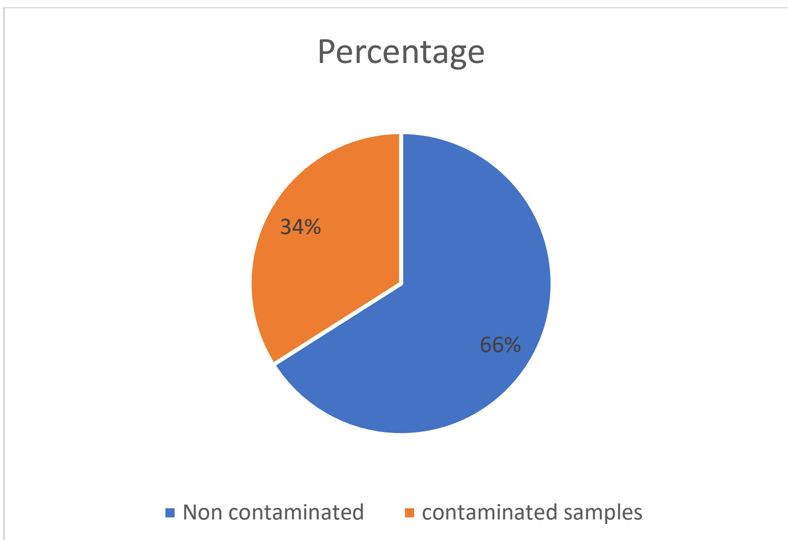

Fig 1: Representation of the overall coliform-contaminated and non-contaminated samples from poultry water samples**.**

3.3. Isolation of bacteria

3.3.1. Most Probable Number (MPN) Test

The MPN test estimates viable microorganism concentrations in water. Using serial dilution and lactose broth, coliform presence is determined by gas and acid production, indicating fecal contamination. A low coliform count suggests water safety, while high values indicate serious contamination.

- **Presumptive Test:** 34 out of 100 samples showed positive results, producing gas and color change in Durham tubes. MPN values were calculated using standard charts.
- **Highest and Lowest MPN Values:**
    - Broiler farms: 220 (highest), 24 (lowest).
    - Layer farms: 480 (highest), 11 (lowest).

- Semi-controlled farms: 70 (highest), 7 (lowest).

The MPN values for all 34 samples which were initially showed positive results are given in the table.

Table 01: Results of MPN test for 100ml water samples from poultry farms with 95% confidence limit with various combinations of positive and negative results from all three types of tubes (when 5 tubes of each 10ml, 1ml, and 0.1 ml were used)

Sr. No.	Name of poultry farms	No. of + ve test tube (Out of 5) (10 ml)	No. of + ve test tube (Out of 5) (1 ml)	No. of + ve test tube (Out of 5) (0.1 ml)	MPN per 100 ml	Lower Limit	Upper Limit
1	Akhowat poultry farm	3	2	0	14	4	34
2	Asf poultry farm	3	3	0	17	5	46
3	Ayefa	3	2	1	17	5	46
4	Big bird	4	2	1	26	9	78
5	Bird inn	2	3	0	12	3	28
6	Chaudhry poultry farm	5	3	0	79	25	190
7	Chicken n chicken	4	3	0	27	09	80
8	Dawn poultry	4	4	0	34	12	93
9	Globel poultry farm	4	3	1	33	11	93
10	Kausar poultry farm	3	3	0	17	05	46
11	NP poultry poultry farm	4	4	0	34	12	93
12	Rajpoot poultry	5	3	3	180	44	500
13	Hassan birds	3	3	0	17	05	46
14	Aslam poultry	2	2	0	19	02	21
15	Msa care poultry farm	3	2	1	17	05	46

16	M.H.traders	5	2	0	220	56	880
17	Haq Nawaz poultry	3	2	1	17	05	46
18	M.F poultry	4	3	1	33	11	93
19	M.A poultry	5	3	3	480	44	500
20	Nasir chicks	4	2	0	22	7	67
21	Hassan protein	4	3	1	33	11	93
22	Bismillah poultry	3	2	1	17	5	46
23	Hameed poultry	4	2	1	26	9	78
24	NP protein farm	3	1	1	14	4	34
25	Faisal poultry	3	1	0	11	2	25
26	Hi-tech poultry	3	2	1	17	5	46
27	Waseem farms	5	3	2	140	37	340
28	Lahore poultry	3	1	1	14	4	34
29	Arif poultry	4	1	0	17	5	46
30	Mirza poultry	5	2	1	70	23	170
31	Supreme poultry	3	2	1	17	5	46
32	Lahore protein	4	2	1	26	9	78
33	Chaudhry farms	2	1	0	7	1	17
34	Waleed sons	3	2	0	14	4	34

(if a sample in our test gave results of 3-2-0 (3*10, 2*1and 0*0.1) produces a value of 14 MPN which means each ml of sample has almost 14vcoliform microorganism in its each ml).

3.3.2. MPN data for water samples of broiler farms

The results of the MPN test for 100 water samples from Broiler poultry farms with a 95% confidence limit with various combinations of positive and negative results from all three types of tubes (when 5 tubes of each 10ml, 1ml, and 0.1 ml were used). The highest value from broiler farm samples is 220 and the lowest is 24 as shown in a given graph.

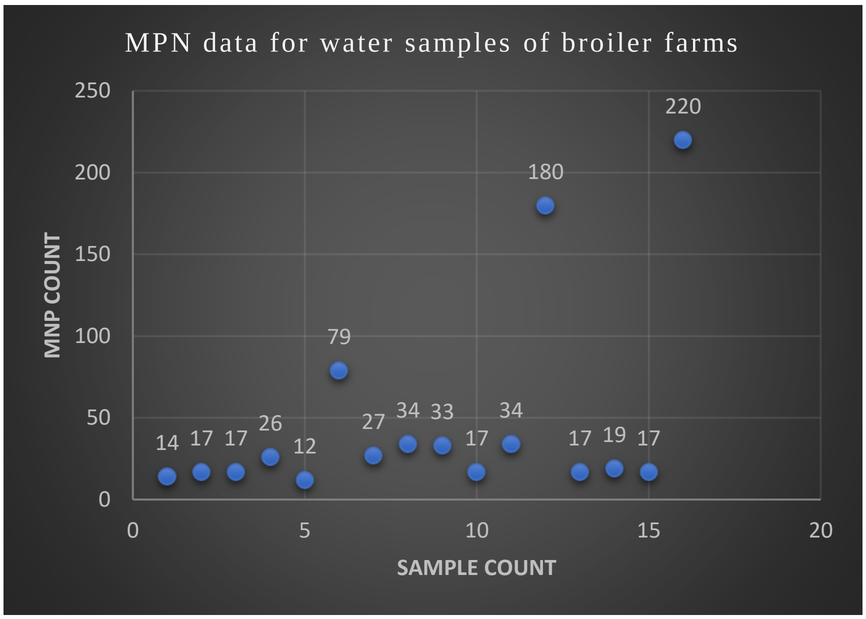

Fig 2: MPN data for water samples of broiler farms

3.3.3. MPN data for water samples of layer farms

The results of the MPN test for 100ml water samples from layer poultry farms with a 95% confidence limit with various combinations of positive and negative results from all three types of tubes (when 5 tubes of each 10ml, 1ml, and 0.1 ml were used). The highest value from layer farm samples is 480 and the lowest is 11 as shown in a given graph.

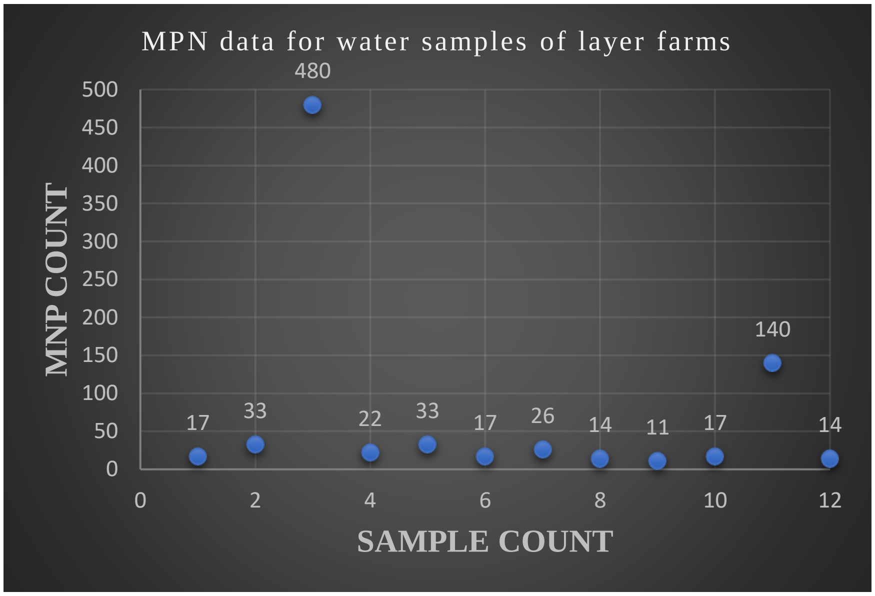

Fig 3: MPN data for water samples of layer farms

3.3.4. MPN data for water samples of semi-controlled poultry farms

The results of the MPN test for 100 water samples from semi-controlled poultry farms with a 95% confidence limit with various combinations of positive and negative results from all three types of tubes (when 5 tubes of each 10ml, 1ml, and 0.1 ml were used). The highest value from semi-controlled poultry farms samples is 70 and the lowest is 07 as shown in the given graph.

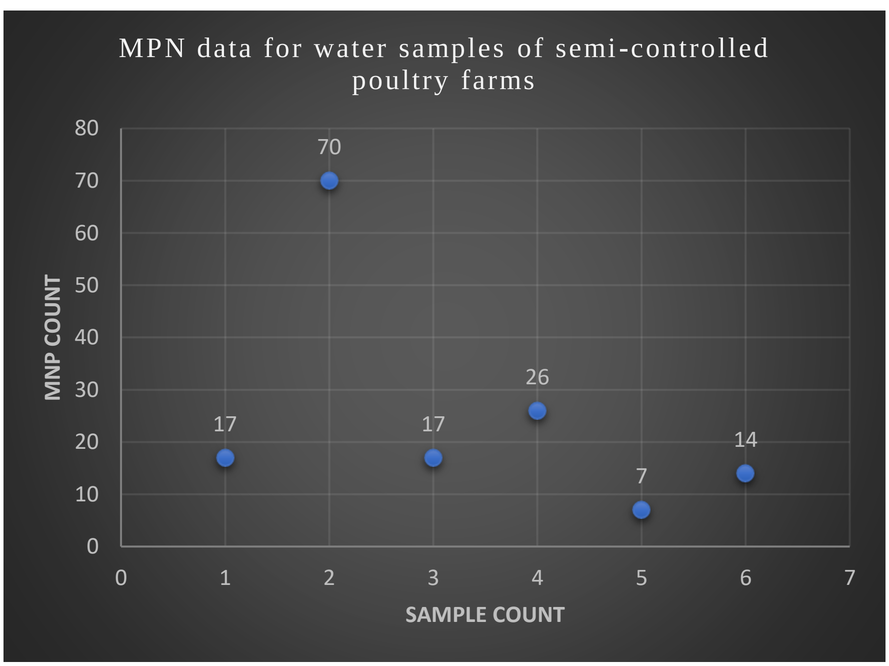

Fig 4: MPN data for water samples of layer farms

3.3.5. MPN data for water samples from all groups (Broiler, Layer, Semi-controlled)

The results of the MPN test for 100ml water samples from all groups (Broiler, Layer, Semi-controlled) with 95% confidence limit with various combinations of positive and negative results from all three types of tubes (when 5 tubes of each 10ml, 1ml, and 0.1 ml used). The highest value is from layer poultry farms' water sample and the lowest is the 07 from semi-controlled poultry farms as shown in the given graph.

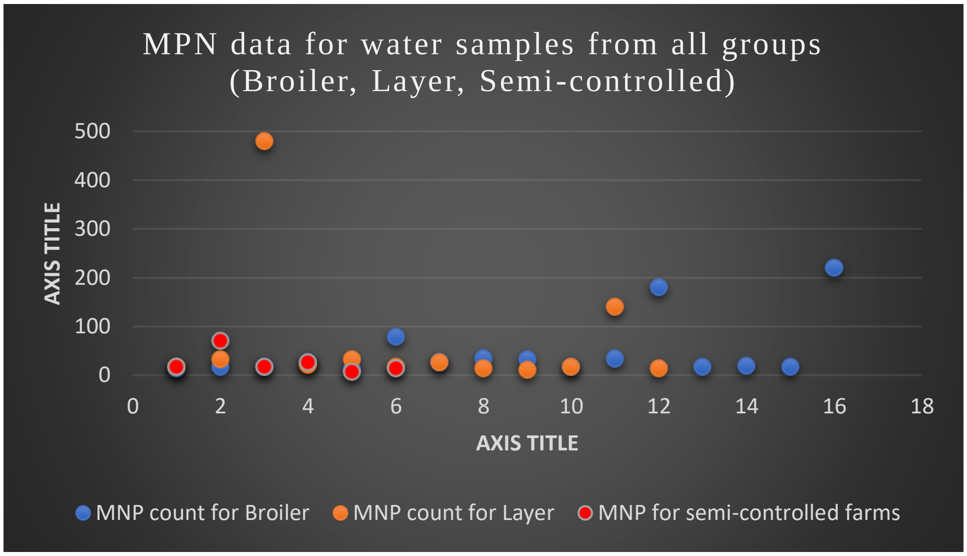

Fig 5: MPN data for water samples from all groups (Broiler, Layer, Semi-controlled)

3.4. Confirmatory and Completed Tests

- **Oxidase Test:** Differentiates aerobic and anaerobic Gram-negative bacteria.
- **Catalase Test:** Identifies Gram-positive cocci by air bubble formation.
- **IMViC Test:** Confirms coliform bacteria using Methyl Red, Indole, Voges-Proskauer, and Citrate tests.

3.5. CFU Count of Positive Water Samples

CFU data highlights coliform levels in farm water samples. Only samples with >100 CFU/ml are reported:

- **Controlled Broiler Farms:** 16/50 samples, highest 3200 CFU/ml, lowest 200 CFU/ml.
- **Layer Farms:** 12/32 samples, highest 4000 CFU/ml, lowest 750 CFU/ml.
- **Semi-Controlled Farms:** 6/18 samples, highest 2400 CFU/ml, lowest 760 CFU/ml.

Table 02: Results of CFU of positive water samples from poultry water samples

Sr. No.	Sample Code	No. of colonies	CFU
1.	Akhowat poultry farm	4	800

2.	Asf poultry farm	8	400
3.	Ayefa	10	200
4.	Big bird	60	600
5.	Bird inn	73	1460
6.	Chaudhry	10	200
7.	Chicken n chicken	50	1000
8.	Dawn poutry	22	440
9	Global	104	2080
10.	Kausar	160	3200
11.	NP poultry	22	440
13.	Rajpoot poultry	200	3000
14.	Hassan birds	30	600
15.	Aslam poultry	100	2000
16.	Msa care	64	1280
17	M.H.traders	100	2000
18.	Haq nawaz poultry	64	1280
19.	M.F poultry	200	4000

20.	M.A poultry	90	1800
21	Nasir chicks	55	1100
22.	Hassan protein	37	750
23	Bismillah poultry	60	1200
24	Hameed poultry	180	3200
25	NP protein farm	40	900
26	Faisal poultry	100	2000
27	Hi-tech poultry	145	2000
28	Waseem farms	60	1200
29	Lahore poultry	75	1300
30	Arif poultry	26	600
31	Supreme poultry	60	800
32	Lahore protein	96	1200
33	Chaudhry farms	70	1100
34	Waleed sons	34	2400

3.6. Comparison of all groups on CFU bases

3.6.1. CFU count in Controlled broiler farms

The highest CFU count observed in the controlled broiler farm water sample was 3200 CFU/ml. The data of only those samples whose colony count was observed higher than 100 CFU/ml. In this group, 16 out of 50 samples were proved to be higher than this 100 CFU/ml limit. The lowest value in these 16 samples is 200 CFU/ml as shown below.

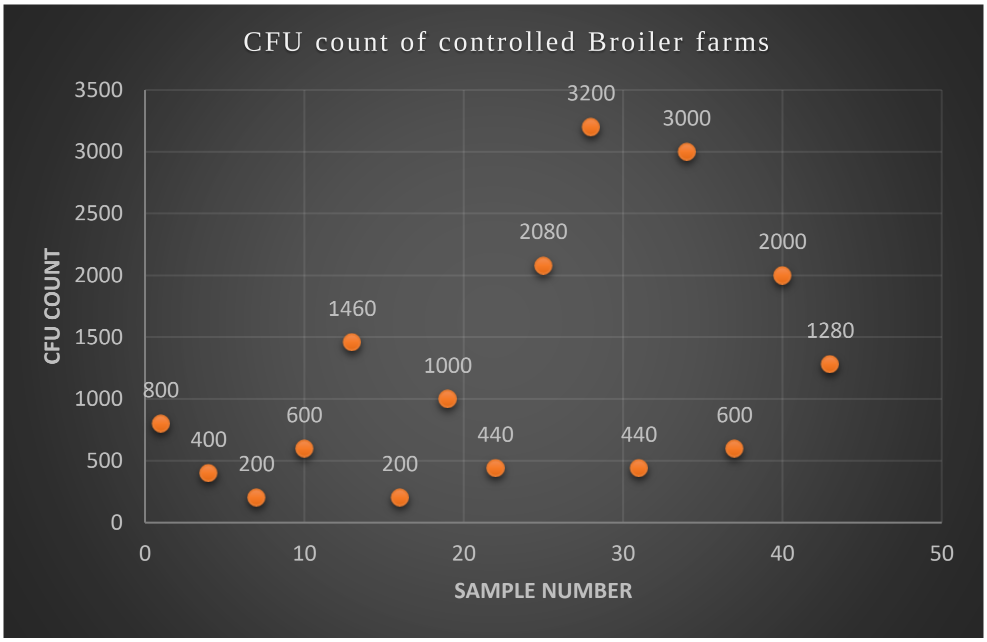

Fig 12: Coliform CFU counts in water samples of controlled broiler farms

3.6.2. CFU count in Layer farms

The highest CFU count observed in the layer farm water sample was 4000 CFU/ml. The data of only those samples whose colony count was observed higher than 100 CFU/ml. In this group, 12 out of 32 samples were proved to be higher than this 100 CFU/ml limit. The lowest value in these 12 samples is 750 CFU/ml as shown below.

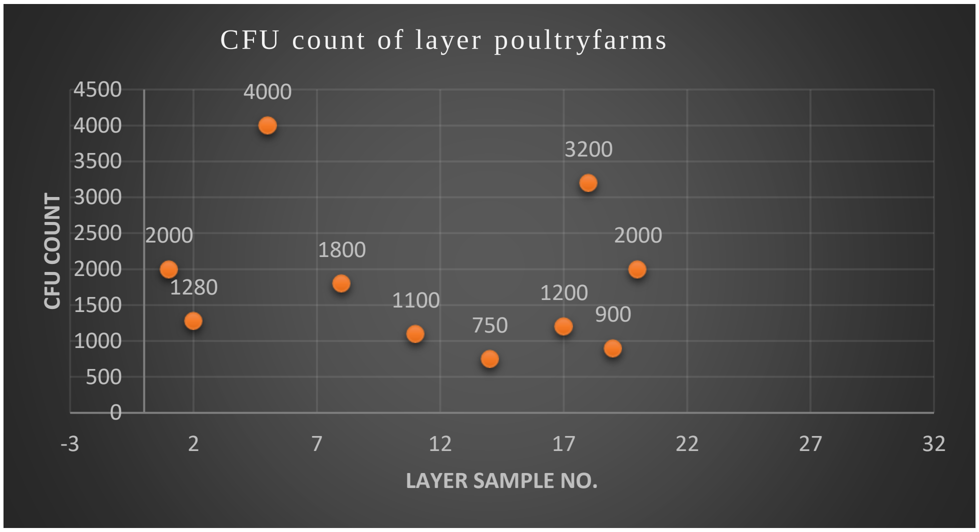

Fig 13: Coliform CFU counts in water samples of layer farms

3.6.3. CFU count in semi-controlled poultry farms

The highest CFU count observed in the layer farm water sample was 2400 CFU/ml. The data of only those samples whose colony count was observed higher than 100 CFU/ml. In this group, 6 out of 18 samples were proved to be higher than this 100 CFU/ml limit. The lowest value in these 6 samples is 7600 CFU/ml as shown below.

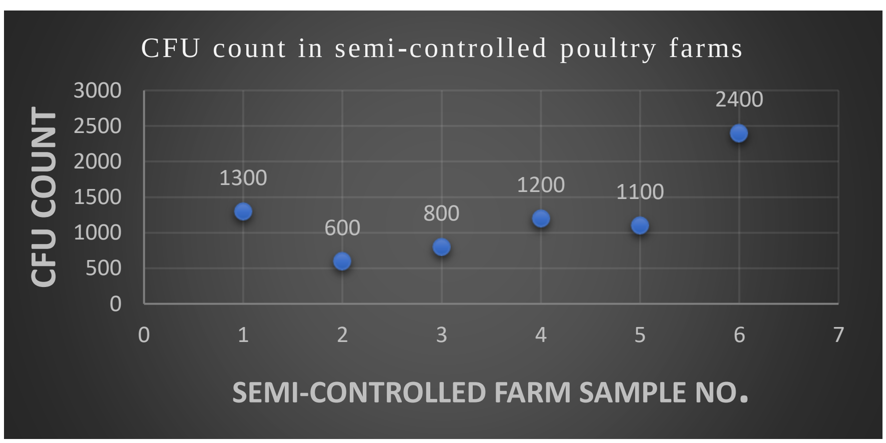

Fig 14: CFU count in semi-controlled poultry farms.

3.6.4. Comparison of CFU count among groups (Broiler, Layer, Semi-controlled)

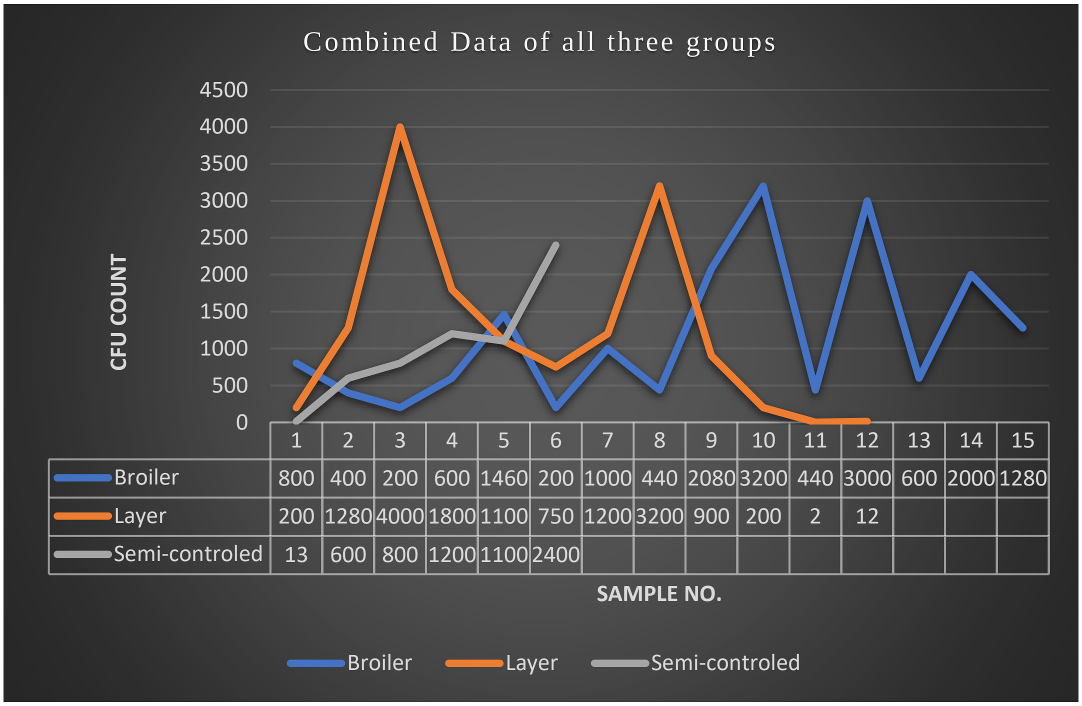

Fig 15: Combined CFU count of all groups (Broiler, Layer, Semi-controlled)

3.6.5. Comparison Among Groups

- **Highest CFU:** Layer farms (4000 CFU/ml).
- **Lowest CFU:** Semi-contRolled farms (760 CFU/ml).

4. DISCUSSION

According to WHO, 60 percent population of the world lacks access to clean drinking water and this indicates how bad the situation is in the poultry sector. According to (Attia et al., 2024) 80 percent of all diseases at 33% of overall deaths in Pakistan are due to water-borne diseases. As indicated by (Ebrahimi et al., 2024) main focus of many government agencies responsible for fecal material management is on human fecal material whereas equally dangerous 85 % of animal fecal material goes unmanaged and often contaminates the downstream rivers or canal systems. Locally the same fecal material often causes huge problems for other animals too as it contains many pathogenic strains very important for diseases in poultry(Kobuszewska & Wysok, 2024).

In Pakistan, meat and eggs are a stable part of the food chain and any contamination in these sources means a direct threat to public health. The water sources often used to supply water to many poultry farms are the main source of coliform pathogenic Bacteria(Arshad et al., 2024). The contamination often occurs due to improper waste management, poor quality of systems of sanitary and drinking water supply, and lack of water filtration and disinfection activities. The water contamination has reached a point where every part of the food chain either its poultry or agriculture is feeling the pinch (Ali et al., 2024).

Our study was mainly focused on the aspect of isolation of coliform-forming bacteria from poultry water samples in the area of Lahore and its adjoining areas. Techniques used for water sampling word the same as used by(Kumari et al., 2024). For this purpose, poultry farms of three different kinds were sampled. A water sample from a Broiler poultry farm, layer poultry farm, and semi-controlled poultry farm was taken. The ideal situation for water samples is for them to be free from any kind of coliform bacteria, but our study showed that a total of 30 samples out of hundred were contaminated with coliform bacteria. It was revealed that water from the ground sources was clear of any kind of coliform bacteria but the same water was contaminated with said bacteria when it reached the birds in ultimately(Khanal et al., 2024). It indicates an aspect that shows that fecal contamination is happening in the supply of water. Difficult contamination is evident from the presence of E. Coli in the water samples. 30% rate of prevalence indicates faecal management al practices at farm level are not at par with the requirements. The rate of coliform presence in our samples is slightly lower than (Papadakis et al., 2024) whose coliform count was 16/24 from water samples. The results of (Rizal & Asyfiradayati, 2024) are similar to our findings as they state industrial contamination of water is the major reason for the drop in the quality of water.

The study of (Murei et al., 2024) also conducted a study in Nepal to test the presence of coliform bacteria drinking in water, over 100 samples were taken to check the presence of coliform bacteria and that was found that 27% of samples were contaminated with the above-mentioned bacteria. These results are almost like the rate of prevalence in our study which showed a 30% prevalence. Results of the recent study are more in common in comparison to the study conducted by (Latheef et al., 2024) in Iran where modern techniques like PCR rather than the MPN method were used to assess the presence of *salmonella*, *vibrio cholerae,* and *E. Coli* in the water samples. All these bacteria cause serious problems in living organisms. A study showed that 34% of samples out of 115 samples were positive for the presence of E. Coli while 4% of samples were positive for salmonella and 3% were positive for *Vibrio cholerae*. The study also proves that *salmonella* and *E. Coli* are causing problems like hemorrhagic colitis, abdominal cramps, diarrhea, and cholera in both animals and humans.

(Dragon et al., 2024)isolated the coliform threat from different sources of poultry including water samples. The research indicated the threat is real and needs a comprehensive strategy. The presence of *E. Coli* and that too colistin-resistant *E. Coli* is a point where a threat should be taken carefully. Either step should be taken to avoid the contamination of water through fecal contamination or any alternative way of tackling the issue should be adopted before the resistance gets to a point where it's not possible to control. The author used a method similar to our research to isolate the bacteria from water samples and conducted further studies on the isolated organism for resistant profile and gene identification(Gharaibeh et al., 2024). The results of our study indicate a very alarming situation where faecal contaminants are contamination the water used in poultry farms around Lahore region. The use of this contaminated water in poultry operations is causing many disease outbreaks(Saim et al., 2024). This is not only causing economic losses in the poultry industry it is also causing a public health threat as the same poultry meat or egg end up in the consumer food chain. The already used methods of the blind use of antibacterial agents to get rid of these bacteria is not a solution but rather a bigger separate issue. It is time to prevent fecal contamination at the farm level as it will help farms and communities both in a single go as an economical as well as a public health concern(Farooq, 2024).

5. References

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