1. **Method**

The water samples were collected from the different tubewell(human), manger (animal farm) and waterer (poultry farm) at different upazilla in Dinajpur district and brought to the laboratory under aseptic condition for laboratory analysis. The research work was conducted during the period from July 2018 to july 2019.

1. **RESULTS**

Result of total viable count, Most probable number,cultural test, staining characteristics, biochemical test and antibiotic sensitivity test, including percentage of isolated bacteria are presented in different tables and described below under the following heading:-

Figure 1: Comparative analysis of TOTAL VIABLE COUNT FROM 3 SOURCES OF TUBWELL( BOX PLOT)

Table 1: Descriptive Table mean, mode, median, p-value, correlation or regression

**3.1 Total Viable Count (TVC/ in the form of CFU/ml) in water of different sources**

**Table 4.1: TVC of drinking water obtained from different tubewell of human**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type** | **Place** | **Sample no.** | **TVC** | **Log 10** | **TVC**  **Mean** |
| Tubewell water | Sadar | T1 | 2.7×103 | 3.43 | 2.55×103 |
| T2 | 1.7×103 | 3.23 |
| T3 | 2.5×103 | 3.40 |
| T4 | 5.0×103 | 3.70 |
| T5 | 2.5×103 | 3.40 |
| T6 | 1.0×103 | 3.0 |
| Birgonj | T1 | 7.5×103 | 3.70 | 3.11×103 |
| T2 | 1.1×103 | 3.40 |
| T3 | 1.5×103 | 3.0 |
| T4 | 1.5×103 | 3.87 |
| T5 | 5.0×103 | 3.04 |
| T6 | 1.5×103 | 3.17 |
| Kaharol | T1 | 1.1×103 | 3.70 | 2.85×103 |
| T2 | 1.5×103 | 3.40 |
| T3 | 5.5×103 | 3.0 |
| T4 | 4.5×103 | 3.87 |
| T5 | 2.0×103 | 3.04 |
| T6 | 2.5×103 | 3.17 |
| Birol | T1 | 1.1×103 | 3.70 | 2.88×103 |
| T2 | 1.5×103 | 3.40 |
| T3 | 5.5×103 | 3.0 |
| T4 | 4.5×103 | 3.87 |
| T5 | 2.0×103 | 3.04 |
| T6 | 2.5×103 | 3.17 |
| Chirirbandar | T1 | 4.2×103 | 3.70 | 3.20×103 |
| T2 | 3.5×103 | 3.40 |
| T3 | 2.5×103 | 3.0 |
| T4 | 3.0×103 | 3.87 |
| T5 | 2.5×103 | 3.04 |
| T6 | 3.5×103 | 3.17 |

Mean TVC: Sadar 2.55×103, Birgonj 3.11×103,  Kaharol 2.85×103 , Birol 2.88×103  and Chirirbandar 3.20×103 CFU mL-1

**Table 4.2: TVC of drinking water obtained from tubewell of dairy farm**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type** | **Place** | **Sample no.** | **TVC** | **Log 10** | **Mean**  **TVC** |
| Tubewell | Sadar | F1 | 2.7×103 | 3.43 | 2.3×103 |
| F2 | 1.7×103 | 3.23 |
| F3 | 2.5×103 | 3.40 |
| Birgonj | F1 | 7.5×103 | 3.87 | 3.6×103 |
| F2 | 1.1×103 | 3.04 |
| F3 | 1.5×103 | 3.17 |
| Kaharol | F1 | 1.1×103 | 3.04 | 2.7×103 |
| F2 | 1.5×103 | 3.17 |
| F3 | 5.5×103 | 3.74 |
| Birol | F1 | 4.2×103 | 3.62 | 3.2×103 |
| F2 | 2.5×103 | 3.40 |  |
| F3 | 3.5×103 | 3.54 |
| Chirirbandar | F1 | 4.2×103 | 3.62 | 3.4×103 |
| F2 | 3.5×103 | 3.54 |
| F3 | 2.5×103 | 3.40 |

Mean TVC : Sadar 2.3×103,  Birgonj 3.6×103, Kaharol2.7×103, Birol 3.2×103 and Chirirbandar 3.4×103 CFU mL-1

**Table 4.3: TVC of drinking water obtained from manger of dairy farm**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type** | **Place** | **Sample no.** | **TVC** | **Log10** | **Mean**  **TVC** |
| Manger | Sadar | F1 | 4.80×107 | 7.681 | 4.66×107 |
| F2 | 4.4×107 | 7.643 |
| F3 | 4.8×107 | 7.681 |
| Birgonj | F1 | 2.8×107 | 7.447 | 2.0×107 |
| F2 | 4.4×105 | 5.643 |
| F3 | 3.2×107 | 7.505 |
| Kaharol | F1 | 4.00×106 | 6.602 | 2.8×107 |
| F2 | 3.60×107 | 7.556 |
| F3 | 4.40×107 | 7.643 |
| Birol | F1 | 2.80×105 | 5.447 | 2.8×107 |
| F2 | 4.80×107 | 7.681 |
| F3 | 3.60×107 | 7.556 |
| Chirirbandar | F1 | 2.60×107 | 7.415 | 4.2×107 |
| F2 | 5.20×107 | 7.716 |
| F3 | 4.80×107 | 7.681 |

Mean TVC: Sadar 4.66×107,  Birgonj 2.0×107, Kaharol 2.8×107 ,Birol 2.8×107 and Chirirbandar 4.2×107 CFU mL-1

**Table 4.4: TVC of drinking water obtained from tubewell of Poultry farm**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type** | **Place** | **Sample no.** | **TVC** | **Log10** | **Mean**  **TVC** |
| Tubewell | Sadar | P1 | 5.0×103 | 3.70 | 2.8×103 |
| P2 | 2.5×103 | 3.40 |
| P3 | 1.0×103 | 3.0 |
| Birgonj | P1 | 1.5×103 | 3.17 | 2.67×103 |
| P2 | 5.0×103 | 3.70 |
| P3 | 1.5×103 | 3.17 |
| Kaharol | P1 | 4.5×103 | 3.65 | 3.0×103 |
| P2 | 2.0×103 | 3.30 |
| P3 | 2.5×103 | 3.40 |
| Birol | P1 | 3.7×103 | 3.56 | 2.57×103 |
| P2 | 2.5×103 | 3.40 |
| P3 | 1.5×103 | 3.17 |
| Chirirbandar | P1 | 3.0×103 | 3.47 | 3.0×103 |
| P2 | 2.5×103 | 3.40 |
| P3 | 3.5×103 | 3.54 |

Mean TVC :Sadar 2.8×103, Birgonj 2.67×103, Kaharol 3.0×103, Birol 2.57×103 and Chirirbandar 3.0×103 CFU mL-1

**Table 4.5: TVC of drinking water obtained from waterer of Poultry farm**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type** | **Place** | **Sample no.** | **TVC** | **Log10** | **Mean**  **TVC** |
| Waterer | Sadar | P1 | 4.00×107 | 7.602 | 4.2×107 |
| P2 | 4.20×107 | 7.623 |
| P3 | 4.40×107 | 7.643 |
| Birgonj | P1 | 3.60×107 | 7.556 | 2.00×107 |
| P2 | 3.60×105 | 5.556 |
| P3 | 2.40×107 | 7.380 |
| Kaharol | P1 | 3.20×106 | 6.505 | 3.25×107 |
| P2 | 2.40×107 | 7.380 |
| P3 | 1.60×107 | 7.204 |
| Birol | P1 | 2.00×105 | 5.301 | 1.00×107 |
| P2 | 1.20×107 | 7.079 |
| P3 | 1.80×107 | 7.255 |
| Chirirbandar | P1 | 1.60×107 | 7.204 | 2.00×107 |
| P2 | 2.40×107 | 7.380 |
| P3 | 2.00×107 | 7.301 |

Mean TVC : Sadar 4.2×107 , Birgonj 2.00×107 , Kaharol 3.25×107 , Birol 1.00×107 and Chirirbandar 2.00×107103 CFU mL-1

Figure 2: Comparative analysis of **Most Probable Number (MPN/100ml)** FROM 3 SOURCES OF TUBWELL( BOX PLOT)/others

Table 2: Descriptive Table mean, mode, median, p-value, correlation or regression

**4.2 Most Probable Number (MPN/100ml) in drinking water of different sources**

**Table 4.6: MPN of drinking water obtained from different tubewell of human**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type** | **Place** | **Sample no.** | **MPN** | **Mean**  **MPN** |
| Tubewell water | Sadar | T1 | 1 | 2.16 |
| T2 | 2 |
| T3 | 2 |
| T4 | 4 |
| T5 | 2 |
| T6 | 2 |
| Birgonj | T1 | 4 | 2.16 |
| T2 | 1 |
| T3 | 2 |
| T4 | 2 |
| T5 | 2 |
| T6 | 2 |
| Kaharol | T1 | 2 | 2.5 |
| T2 | 2 |
| T3 | 4 |
| T4 | 1 |
| T5 | 2 |
| T6 | 4 |
| Birol | T1 | 0 | 1.83 |
| T2 | 4 |
| T3 | 2 |
| T4 | 1 |
| T5 | 2 |
| T6 | 2 |
| Chirirbandar | T1 | 2 | 2.33 |
| T2 | 4 |
| T3 | 2 |
| T4 | 2 |
| T5 | 2 |
| T6 | 2 |

Mean MPN: Sadar 2.16,Birgonj 2.16, Kaharol 2.5, Birol 1.83 and Chirirbandar 2.33 colliforms/100ml water

**Table 4.7: MPN of drinking water obtained from different tubewell and manger of dairy farm**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type | Place | Sample no. | MPN | Mean  MPN |
| Tubewell | Sadar | F1 | 1 | 1.66 |
| F2 | 2 |
| F3 | 2 |
| Birgonj | F1 | 4 | 2.33 |
| F2 | 1 |
| F3 | 2 |
| Kaharol | F1 | 2 | 2.66 |
| F2 | 2 |
| F3 | 4 |
| Birol | F1 | 0 | 2.00 |
| F2 | 4 |
| F3 | 2 |
| Chirirbandar | F1 | 2 | 2.66 |
| F2 | 4 |
| F3 | 2 |
| Manger | Sadar | F1 | 17 | 14.00 |
| F2 | 14 |
| F3 | 11 |
| Birgonj | F1 | 14 | 17.33 |
| F2 | 17 |
| F3 | 21 |
| Kaharol | F1 | 14 | 14.00 |
| F2 | 11 |
| F3 | 17 |
| Birol | F1 | 21 | 16.33 |
| F2 | 17 |
| F3 | 11 |
| Chirirbandar | F1 | 11 | 15.33 |
| F2 | 21 |
| F3 | 14 |

Mean MPN:Tubewell water:Sadar 1.66, Birgonj 2.33, Kaharol 2.66, Birol 2.00 and Chirirbandar2.66 colliforms/100ml water

Mean MPN:Manger water:Sadar 14.00, Birgonj 17.33, Kaharol 14.00, Birol 16.33 and Chirirbandar 15.33 colliforms/100ml water

**Table 4.8: MPN of drinking water obtained from different tubewell and waterer of Poultry farm**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type** | **Place** | **Sample no.** | **MPN** | **Mean**  **MPN** |
| Tubewell | Sadar | P1 | 1 | 2.66 |
| P2 | 2 |
| P3 | 2 |
| Birgonj | P1 | 2 | 2.00 |
| P2 | 2 |
| P3 | 2 |
| Kaharol | P1 | 1 | 2.33 |
| P2 | 2 |
| P3 | 4 |
| Birol | P1 | 1 | 1.66 |
| P2 | 2 |
| P3 | 2 |
| Chirirbandar | P1 | 2 | 2.00 |
| P2 | 2 |
| P3 | 2 |
| Waterer | Sadar | P1 | 11 | 12.33 |
| P2 | 9 |
| P3 | 17 |
| Birgonj | P1 | 9 | 9.66 |
| P2 | 11 |
| P3 | 9 |
| Kaharol | P1 | 11 | 10.33 |
| P2 | 11 |
| P3 | 9 |
| Birol | P1 | 14 | 13.33 |
| P2 | 17 |
| P3 | 9 |
| Chirirbandar | P1 | 11 | 12.33 |
| P2 | 9 |
| P3 | 17 |

Mean MPN:Sadar 2.66, Birgonj 2.00, Kaharol 2.33, Birol 1.66 and Chirirbandar 2.00 colliforms/100ml water

Mean MPN:Sadar 12.33 Birgonj 9.66 Kaharol 10.33 Birol 13.33 and Chirirbandar 12.33 colliforms/100ml water

**4.3 Total Viable Count (TVC/ml) in water of different sources**

The table shows that there were no significance difference of TVC among the tubewell water at different upazila in dinajpur district.The highest TVC of tube-well water was in Chirirbandar(3.50±0.09) followed by the lower TVC were in Birol (3.44±0.16), kaharol (3.38±0.27), Sadar (3.36±0.23) and Birganj (3.35±0.34).

**Table 4.9: TVC of drinking water obtained from different tubewell for human**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Type of sample | Sadar  Mean±SD | Birganj  Mean±SD | Kaharol  Mean±SD | Birol  Mean±SD | Chirirbandar  Mean±SD | P Value |
| Tubewell | 3.36±0.23 | 3.35±0.34 | 3.38±0.27 | 3.44±0.16 | 3.50±0.09 | 0.406 |

The table shows that there were no significance difference of TVC of tube-well and manger water among the dairy farm at different upazila in dinajpur district.The highest TVC of tube-well water were found in birol (3.52±0.111) and chirirbandar (3.52±0.111) followed by Birganj (3.36±0.446), Sadar (3.35±0.107) and kaharol (3.31±0.372). The highest TVC of manger water was found in Sadar (7.67±0.021) followed by the lower TVC were found in Chirirbandar (7.60±0.164), kaharol (7.27±0.577), Birol (6.90±1.255) and Birganj (6.86±1.058), but there were significance difference of TVC between tubewell and manger water of dairy farm at different upazilla in dinajpur district.

**Table 4.10: TVC of drinking water obtained from tubewell and manger (dairy farm)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Type of sample | Sadar  Mean±SD | Birganj  Mean±SD | Kaharol  Mean±SD | Birol  Mean±SD | Chirirbandar  Mean±SD | P Value | TVC  Mean±SD | Mean  P value | Level of significance |
| Tubewell | 3.35±0.107 | 3.36±0.446 | 3.31±0.372 | 3.52±0.111 | 3.52±0.111 | 0.814 | 3.41±0.25 | 0.013 | \*\* |
| Manger | 7.67±0.021 | 6.86±1.058 | 7.27±0.577 | 6.90±1.255 | 7.60±0.164 | 0.607 | 7.26±0.75 |

The table shows that there were no significance difference of TVC of tubewell and waterer water among the Poultry farm of different upazila in dinajpur district.The highest TVC of tubewel water was Chirirbandar(3.47±0.070) followed by the lower TVC were kaharol (3.45±0.180), birol (3.38±0.196) ,Sadar (3.37±0.351) and Birganj (3.35±0.306). The highest TVC of waterer water was Sadar (7.62±0.020) followed by the lower TVC were Chirirbandar(7.30±0.088), kaharol (7.03±0.462), Birganj (6.83±1.107) and Birol (6.55±1.080), but there were significance difference of TVC between tube-well and waterer water of poultry farm at different upazilla in dinajpur district

**Table 4.11: TVC of drinking water obtained from tubewell and waterer of Poultry farm**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Type of sample | Sadar  Mean±SD | Birganj  Mean±SD | Kaharol  Mean±SD | Birol  Mean±SD | Chirirbandar  Mean±SD | P Value | TVC  Mean±SD | Mean  P value | Level of significance |
| Tubewell | 3.37±0.351 | 3.35±0.306 | 3.45±0.180 | 3.38±0.196 | 3.47±0.070 | 0.958 | 3.40±0.210 | 0.013 | \*\* |
| Waterer | 7.62±0.020 | 6.83±1.107 | 7.03±0.462 | 6.55±1.080 | 7.30±0.088 | 0.456 | 7.06±0.722 |

**4.4 Most Probable Number (MPN/100ml) in drinking water of different sources**

The table shows that there were no significance difference of MPN among the tubewell at different upazila in dinajpur district. The highest MPN of tube-well water was kaharol (2.50±1.22) followed by the lower MPN were Chirirbandar(2.33±0.81),Sadar (2.16±0.98), Birganj (2.16±0.98) and Birol (1.83±1.32).

**Table 4.12: MPN of drinking water obtained from different tubewell of human**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Type of sample | Sadar  (Mean±SD) | Birganj  (Mean±SD) | Kaharol  (Mean±SD) | Birol  (Mean±SD) | Chirirbandar  (Mean±SD) | P Value |
| Tubewell | 2.16±0.98 | 2.16±0.98 | 2.50±1.22 | 1.83±1.32 | 2.33±0.81 | 0.867 |

The table shows that there were no significance difference of MPN of tubewel and manger water among the dairy farm of different upazila in dinajpur district.The highest MPN of tubewel waterer was kaharol (2.67±1.154)followed by chirirbandar (2.66±1.154),birol (2.00±2.00), Birganj (2.33±1.521) and Sadar(1.67±0.577).The highest MPN of manger water was kaharol (12.33±4.16) followed by the lower TVC were Birganj (12.33±2.89), Chirirbandar (11.33±2.51), Sadar (10.33±1.15) and Birol (9.66±1.15) but there were significance difference of MPN between tubewel and manger of dairy farm at differeny upazilla in dinajpur district

**Table 4.13: MPN of drinking water obtained from different tubewell and manger of dairy farm**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Type of sample | Sadar  Mean±SD | Birganj  Mean±SD | Kaharol  Mean±SD | Birol  Mean±SD | Chirirbandar  Mean±SD | P Value | MPN  Mean±SD | Mean  P value | Level of significance |
| Tube-well | 1.67±0.577 | 2.33±1.521 | 2.67±1.154 | 2.00±2.00 | 2.66±1.154 | 0.869 | 2.266±1.222 | 0.00 | \*\*\* |
| Manger | 14.00±3.00 | 17.33±3.51 | 14.00±3.00 | 9.66±3.00 | 16.33±5.03 | 0.811 | 15.40±3.68 |

The table shows that there were no significance difference of MPN of tubewell and waterer water among the Poultry farm at different upazilla in dinajpur district.The highest MPN of tubewell water was found in Sadar (2.66±1.154) followed by the lower MPN were kaharol (2.33±1.527), Chirirbandar (2.00±0.00), Birganj (2.00±0.00) and Birol (1.66±0.577). The highest MPN of waterer water Birol (13.33±4.04) followed by the lower MPN were Sadar (12.33±4.16), Chirirbandar(12.33±4.16), kaharol (10.33±1.154) and Birganj (9.67±1.154), but there were significance difference of MPN between tubewell and waterer water of poultry farm at different upazilla in dinajpur district.

**Table 4.14: MPN of drinking water obtained from different tubewell and waterer of Poultry farm**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Type of sample | Sadar  Mean±SD | Birganj  Mean±SD | Kaharol  Mean±SD | Birol  Mean±SD | Chirirbandar  Mean±SD | P Value | MPN  (Mean±SD) | Mean  P value | Level of significance |
| Tubewell | 2.66±1.154 | 2.00±0.00 | 2.33±1.527 | 1.66±0.577 | 2.00±0.00 | 0.709 | 2.133±0.833 | 0.00 | \*\* |
| Waterer | 12.33±4.16 | 9.67±1.154 | 10.33±1.154 | 13.33±4.04 | 12.33±4.16 | 0.635 | 11.60±3.11 |

Figure 3: Comparative analysis of **Most Probable Number (MPN/100ml)** FROM 3 SOURCES OF TUBWELL( bar)/others

Table 2: Descriptive Table mean, mode, median, p-value, correlation or regression

**4.5 Results of cultural examinations**

Cultural characteristics of each type of bacteria isolated from different water sample were studied for the isolatiom, identification of various bacteriological media. The staining property of primary culture of each of the different samples indicated the presence of more than one type of bacteria in the same smear. The pure cultures of the organism from each mixed culture were obtained by repeated streak plate method using different simple and selective solid media for study. The individual cultural characteristics of bacterial isolates are presented in table 4.15. The cultural characteristics of *E. Coli*, *Klebsiella* spp*, Salmonella* spp*, Shigella* spp*, Pseudomonas* spp, *Vibrio* spp and *Staphylococcus* spp exhibited on the media are presented in following figure.

**Table 4.15: Cultural characteristics of the bacterial isolates**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No** | **Suspected case of Bacteria** | **Name of Media** | **Cultural Characteristics** |
| 01 | *Escherichia coli* | EMB agar | Metallic sheen (greenish black) - |
| 02 | *Klebsiella* spp*.* | EMB agar | Brownish pinkish color colony |
| 03 | *Salmonella* spp*.* | SS Agar | Small non-lactose fermented with black center colony |
| Brilliant agar | Golden yellowish |
| 04 | *Shigella* spp*.* | SS Agar | Small non-lactose fermented grayish white colony |
| 05 | *Staphylococcus* spp*.* | Agar no. 110 | Medium yellowish colony |
| 06 | *Pseudomonas* spp*.* | CET agar | green pigment colonies |
| 07 | *Vibrio* spp*.* | TCBS agar | yellow pigmented colonies |

**4.8 Frequency of Isolated Bacterial Organism**

Ninety (90) water sample were collected from different sources; 30 from human water, 30 from dairy farm water and 30 from poultry farm water sources. From ninety (90) water sample *Escherichia coli* was isolated 82(15.95%) highly friquent and followed by *Salmonella* spp 81(15.75%), *Shigella* spp 80(15.56%), *Klebsiella* spp 79(15.36%), *Vibrio* spp 73(14.20%), *Pseudomonas* spp 60(11.67%) and *Staphylococcus* spp 59(11.47%).

**Table 4.24: Frequency of Bacteria isolated from water samples**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Bacterial species** | **Number of isolate bacteria** | | | | | **Total (%)** |
| **Human** **water (30)** | **Dairy farm (30)** | | **Poultry farm (30)** | |
| **Tubewell water (30)** | **Tubewell water (15)** | **Manger (15)** | **Tubewell water (15)** | **Waterer (15)** |
| *Escherichia coli* | 26 | 13 | 14 | 15 | 14 | 82(15.95) |
| *Klebsiella* spp | 24 | 15 | 14 | 12 | 14 | 79(15.36) |
| *Salmonella* spp | 24 | 13 | 15 | 14 | 15 | 81(15.75) |
| *Shigella* spp | 25 | 12 | 14 | 10 | 15 | 80(15.56) |
| *Staphylococcus* spp | 15 | 8 | 15 | 7 | 14 | 59(11.47) |
| *Pseudomonas* spp | 15 | 7 | 15 | 8 | 15 | 60(11.67) |
| *Vibrio* spp | 25 | 10 | 15 | 10 | 15 | 73(14.20) |

**Fig. 4.12:** **Frequency of Bacteria isolated from water samples**

Figure 4: PCA/ PARTIAL ANLYSIS LIKE PREVIOUS ANTIBIOTIC WORK

Table 2: Descriptive Table mean, mode, median, p-value, correlation or regression

**4.9 Results of antibiotics sensitivity tests**

Antimicrobial susceptibility testing was performed using Muller-Hinton agar (Mumbai, India) plates as recommended by the Clinical and Laboratory Standards Institute. Seven (7) isolates of *E. coli, Klebsiella* spp*, Salmonella* spp*, shigella* spp*, Staphylococcus* spp*, Pseudomonas* spp*.* and *Vibrio* spp weresubjected to antibiotic sensitivity tests for tap water sample. The results of antibiotics sensitivity tests are presented in Table18,19 and 20.

**4.9.1 Results of antibiotic sensitivity test of *E. coli* spp*.***

The results of the antimicrobial sensitivity test by disc diffusion method with 10 chosen antimicrobial agents are presented in Table 4.25. Out of 15 *E. coli* isolates, 60% Gentamicin, 20% Ciprofloxacin, 13.33% Levofloxacin, 26.66% Ceftriaxone and 46.66% Chloramphenicol are sussceptible and 53.33% Colistin, 60% Ampicillin, 66.66% Amoxicillin, 60% Erythromycin, 46.66% Azithromycin are resistance.

**Table 4.25: Results of Antimicrobial susceptibility of the isolated *E. coli* spp*.* from tubewell water**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name of isolates | No. (%) | | | | | | | | | |
| *E. coli* (n=15) | GEN | CIP | C | LE | CTR | CL | AZM | AMP | AMX | E |
| Susceptible | 9(60) | 8(53.33) | 2(13.33) | 8(53.33) | 2(13.33) | 2(13.33) | 2(13.33) | 0 | 0 | 0 |
| Intermediate | 5(33.33) | 4(26.66) | 6(40) | 5(33.33) | 9(60) | 8(53.33) | 6(40) | 6(40) | 6(33.34) | 6(40) |
| Resistant | 1(6.66) | 3(20) | 7(46.66) | 2(13.33) | 4(26.66) | 5(33.33) | 7(46.66) | 9(60) | 10(66.66 | 9(60) |

**Note:** GEN=Gentamicin, CIP =Ciprofloxacin, C=Chloramphenicol, LE=Levofloxacin, CTR= Ceftriaxone, CL=Colistin, AZM= Azithromycin, AMP=Ampicillin, AMX=Amoxicillin, E=Erythromycin

I=Intermediate, S=Susceptible and R=Resistance

**4.9.2 Results of antibiotic sensitivity test of *Klebsiella* spp*.***

The results of the antimicrobial sensitivity test by disc diffusion method with 10 chosen antimicrobial agents are presented in Table 4.26. Out of 15 *Klebsiella* spp isolates, 60% Gentamicin, 53.33% Ciprofloxacin, 53.33% Levofloxacin, 33.34% Ceftriaxone, 60% Colistin and 60% Azithromycin are sussceptible and 53.33%Ampicillin 60% Amoxicillin, 13.33% Levofloxacin, 66.66% Erythromycin, 13.33% Azithromycin, 53.33% Ampicillin, 60% Amoxicillin, 60% Chloramphenicol are resistance.

**Table 4.26: Results of Antimicrobial susceptibility of the isolated *Klebsiella* spptubewell water**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name of isolates | No. (%) | | | | | | | | | |
| *E. coli* (n=15) | GEN | CIP | C | LE | CTR | CL | AZM | AMP | AMX | E |
| Susceptible | 9(60) | 8(53.33) | 0 | 8(53.33) | 5(33.34) | 9(60) | 9(60) | 0 | 0 | 0 |
| Intermediate | 6(40) | 7(46.66) | 6(40) | 5(33.33) | 10(66.66) | 6(40) | 4(26.66) | 7(46.66) | 6(40) | 5(33.33) |
| Resistant | 0 | 0 | 9(60) | 2(13.33) | 0 | 0 | 2(13.33) | 8(53.33) | 9(60) | 10(66.66) |

**Note:** GEN=Gentamycin, CIP =Ciprofloxacin, C=Chloramphenicol, LE=Levofloxacin, CTR= Ceftriaxone, CL=Colistin, AZM= Azithromycin, AMP=Ampicillin, AMX=Amoxicillin, E=Erythromycin

I=Intermediate, S=Susceptible and R=Resistance

**4.9.3 Results of antibiotic sensitivity test of *Salmonella* spp*.***

The results of the antimicrobial sensitivity test by disc diffusion method with 10 chosen antimicrobial agents are presented in Table 4.27. Out of 15 *Salmonella* sppisolates, 60% Gentamicin, 66.66% Ciprofloxacin,13.33% Chloramphenicol, 6.66% Levofloxacin, 33.33% Ceftriaxone, 53.33% Colistin, 53.33%Azithromycin are sussceptible and 53.33% Chloramphenicol, 60% Levofloxacin, 66.66% Ampicillin, 66.66% Amoxicillin, 60% Erythromycin are resistance.

**Table 4.27: Results of Antimicrobial susceptibility of the isolated *Salmonella* sppfrom tubewell water**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name of isolates | No. (%) | | | | | | | | | |
| *E. coli* (n=15) | GEN | CIP | C | LE | CTR | CL | AZM | AMP | AMX | E |
| Susceptible | 9(60) | 10(66.66) | 2(13.33) | 1(6.66) | 5(33.33) | 8(53.33) | 8(53.33) | 0 | 0 | 0 |
| Intermediate | 6(40) | 5(33.33) | 5(33.33) | 5(33.33) | 10(66.66) | 6(40) | 7(46.66) | 5(33.33) | 0 | 6(40) |
| Resistant | 0 | 0 | 8(53.33) | 9(60) | 0 | 1(6.66) | 0 | 10 (66.66) | 10(66.66) | 9(60) |

**Note:** GEN=Gentamicin, CIP =Ciprofloxacin, C=Chloramphenicol, LE=Levofloxacin, CTR= Ceftriaxone, CL=Colistin, AZM= Azithromycin, AMP=Ampicillin, AMX=Amoxicillin, E=Erythromycin

I=Intermediate, S=Susceptible and R=Resistance

**4.9.4 Results of antibiotic sensitivity test of *Shigella* spp*.***

The results of the antimicrobial sensitivity test by disc diffusion method with 10 chosen antimicrobial agents are presented in Table 4.28. Out of 15 *Shigella* sppisolates, 66.66%Gentamicin, 66.66% Ciprofloxacin, 73.33% Ceftriaxone, 53.33% Levofloxacin are sussceptible and 60% Chloramphenicol, 33.33% Colistin, 53.33% Azithromycin, 66.66% Ampicillin, 66.66% Amoxicillin, 60% Erythromycin are resistance.

**Table 4.28: Results of Antimicrobial susceptibility of the isolated *Shigella* sppfrom tubewell water**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name of isolates | No. (%) | | | | | | | | | |
| *E. coli* (n=15) | GEN | CIP | C | LE | CTR | CL | AZM | AMP | AMX | E |
| **Susceptible** | 10(66.66) | 10(66.66) | 2(13.33) | 8(53.33) | 11(73.33) | 1(6.66) | 0 | 1(6.66) | 0 | 0 |
| **Intermediate** | 3(20) | 3(20) | 4(26.66) | 5(33.33) | 4(26.66) | 9(60) | 7(46.66) | 4(26.66) | 5(33.33) | 5(40) |
| **Resistant** | 2(13.33) | 2(13.33) | 9(60) | 2(13.33) |  | 5(33.33) | 8(53.33) | 10(66.66) | 10(66.66) | 9(60) |

**Note:** GEN=Gentamycin, CIP =Ciprofloxacin, C=Chloramphenicol, LE=Levofloxacin, CTR= Ceftriaxone, CL=Colistin, AZM= Azithromycin, AMP=Ampicillin, AMX=Amoxicillin, E=Erythromycin

I=Intermediate, S=Susceptible and R=Resistance

**4.9.5 Results of antibiotic sensitivity test of *Pseudomonas* spp*.***

The results of the antimicrobial sensitivity test by disc diffusion method with 10 chosen antimicrobial agents are presented in Table 4.29. Out of 15 *Pseudomonas* sppisolates, 60% Gentamicin, 80% Ciprofloxacin,13.33% Chloramphenicol, 26.66% Colistin, 46.66% Levofloxacin,66.66% Azithromycin are sussceptible and 60% Chloramphenicol,46.66% Colistin,73.33% Ampicillin, 80% Amoxicillin, 73.33% Erythromycin are resistance.

**Table 4.29: Results of Antimicrobial susceptibility of the isolated *Pseudomonas* sppfrom tap water.**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name of isolates | No. (%) | | | | | | | | | |
| *E. coli* (n=15) | GEN | CIP | C | LE | CTR | CL | AZM | AMP | AMX | E |
| Susceptible | 9(60) | 12(80) | 2(13.33) | 7(46.66) | 2(13.33) | 4(26.66) | 10(66.66) | 0 | 0 | 0 |
| Intermediate | 4(26.66) | 2(13.33) | 4(26.66) | 5(33.33) | 4(26.66) | 4(26.66) | 3(20) | 4(26.66) | 3(20) | 4(26.66) |
| Resistant | 2(13.33) | 1(6.66) | 9(60) | 3(20) | 9(60) | 7(46.66) | 2(13.33) | 11(73.33) | 12(80) | 11(73.33) |

**Note:** GEN=Gentamicin, CIP =Ciprofloxacin, C=Chloramphenicol, LE=Levofloxacin, CTR= Ceftriaxone, CL=Colistin, AZM= Azithromycin, AMP=Ampicillin, AMX=Amoxicillin, E=Erythromycin

I=Intermediate, S=Susceptible and R=Resistance

**4.9.6 Results of antibiotic sensitivity test of *Vibrio* spp*.***

The results of the antimicrobial sensitivity test by disc diffusion method with 10 chosen antimicrobial agents are presented in Table 4.30. Out of 15 *Vibrio* sppisolates, 66.66% Gentamicin, 66.66% Ciprofloxacin,13.33% Chloramphenicol, 46% Colistin, 53.33% Levofloxacin, 73.33% Ceftriaxone are sussceptible and 13.33% Gentamicin, 60% Chloramphenicol, 46.66% Colistin, 13.33% Ciprofloxacin, 13.33% Levofloxacin, 66.66% Ampicillin, 66.66% Amoxicillin, 60% Erythromycin are resistance.

**Table 4.30: Results of Antimicrobial susceptibility of the isolated *Vibrio* sppfrom tap water.**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name of isolates | No. (%) | | | | | | | | | |
| *E. coli* (n=15) | GEN | CIP | C | LE | CTR | CL | AZM | AMP | AMX | E |
| Susceptible | 10(66.66) | 10(66.66) | 2(13.33) | 8(53.33) | 11(73.33) | 6(40) | 0 | 0 | 0 | 1(6.66) |
| Intermediate | 3(20) | 3(20) | 4(26.66) | 5(33.33) | 4(26.66) | 9(60) | 7(46.66) | 5(33.33) | 5(33.33) | 5(33.33) |
| Resistant | 2(13.33) | 2(13.33) | 9(60) | 2(13.33) | 0 | 0 | 8(53.33) | 10(66,66) | 10(66,66) | 9(60) |

**Note:** GEN=Gentamycin, CIP =Ciprofloxacin, C=Chloramphenicol, LE=Levofloxacin, CTR= Ceftriaxone, CL=Colistin, AZM= Azithromycin, AMP=Ampicillin, AMX=Amoxicillin, E=Erythromycin

I=Intermediate, S=Susceptible and R=Resistance