**Chapter IV**

**RESULTS**

**4.1 Effects of weight and FCR**

**4.1.1 Live weight**

Along the whole experimental period, increased live weight was experiential on all treated groups as well as on the control group of the broilers. The highest body weight was observed on garlic group (1354g ± 76) and the lowest body weight was recorded on tulsi group (1166g ± 82) (Figure 3). In the study, there had no significant (*p* >0.05) deviation on various treated groups comparing to the control group. In every group, either control or treated, highly significant (*p* ≤0.01) variation was evident on different observational periods (initial, 0-10days, 11-17days, 18-24days and 25-30days) of the study (Table 2).

**Figure 3: Live weight variation among control and different treated groups**

**4.1.2 FCR on live weight**

The Feed Conversion Ratio (FCR) of broilers on different stages of growth under various experimental treated groups is provided in Table 2. It was observed that, almost on every group (except tulsi) FCR was lower ranging from 1.33 to 1.46 (Tulsi 1.51) upto 10days and as a result there had no significant (*p >*0.05) variation. On other hand, among the experimental groups, highly significant (*p* ≤0.01) deviation was evident on 11-17days period and 18-24days period. However, significant variation (*p* ≤0.05) was observed on 25-30days period of this study. In the groups, highest FCR was recorded in tulsi (1.90) and lowest in garlic (1.66) (Figure 4); though the variation on both groups in different phases was insignificant. On control group, FCR was found as 1.45, 1.45, 1.60 and 1.68 which had highly significant variation. Moreover, FCR was significantly varied on synthetic antifungal nystatin sulphate group.

**Figure 4: FCR (Live weight) among control and different treated groups**

**Table 2: Effects of weight and FCR in the treatment groups**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Para-meters** | **Periods** | **Groups** | | | | | | | ***p*** |
| **T0** | **T1** | **T2** | **T3** | **T4** | **T5** | **T6** |
| Live Weight | D-1 (Mean ± SD) | 41.8 ± 0.8 | 42 ± 1 | 42.3 ± 2.4 | 42 ± 3.2 | 41.5 ± 1.1 | 41.7 ± 2.3 | 41.6 ± 1.9 | 0.14 |
| D-2 (Mean ± SD) | 187 ± 19.9 | 195 ± 17.7 | 201 ± 21.6 | 196 ± 11.4 | 181 ± 17.8 | 189 ± 15.2 | 186 ± 11.9 | 0.87 |
| D-3 (Mean ± SD) | 517 ± 27.3 | 519 ± 29.2 | 547 ± 54.9 | 521 ± 49.8 | 466 ± 52.8 | 486 ± 27 | 481 ± 31.3 | 0.59 |
| D-4 (Mean ± SD) | 923 ± 84.1 | 903 ± 109.7 | 933 ± 98.5 | 893 ± 57.8 | 807 ± 86.1 | 859 ± 71.4 | 865 ± 69.3 | 0.91 |
| D-5 (Mean ± SD) | 1324 ± 63.5 | 1293 ± 156.6 | 1354 ± 76 | 1299 ± 136 | 1166 ± 82 | 1270 ± 81.9 | 1276 ± 67.3 | 0.44 |
| ***p*** | **< 0.001** | **0.00** | **< 0.001** | **0.002** | **< 0.001** | **0.001** | **0.002** |  |
| FCR (Live Wt) | D-1 (Mean ± SD) | **-** | **-** | **-** | **-** | **-** | **-** | **-** | - |
| D-2 (Mean ± SD) | 1.45 ± 0.01 | 1.38 ± 0.03 | 1.33 ± 0.01 | 1.37 ± 0.01 | 1.51 ± 0.01 | 1.43 ± 0.02 | 1.46 ± 0.02 | 0.17 |
| D-3 (Mean ± SD) | 1.45 ± 0.03 | 1.45 ± 0.03 | 1.38 ± 0.03 | 1.47 ± 0.03 | 1.64 ± 0.03 | 1.56 ± 0.02 | 1.56 ± 0.01 | **0.01** |
| D-4 (Mean ± SD) | 1.60 ± 0.02 | 1.64 ± 0.02 | 1.59 ± 0.03 | 1.74 ± 0.03 | 1.84 ± 0.03 | 1.76 ± 0.02 | 1.70 ± 0.03 | **0.001** |
| D-5 (Mean ± SD) | 1.68 ± 0.03 | 1.71 ± 0.03 | 1.66 ± 0.03 | 1.82 ± 0.03 | 1.90 ± 0.03 | 1.80 ± 0.01 | 1.73 ± 0.03 | **0.04** |
| ***p*** | **0.01** | 0.09 | 0.07 | 0.06 | 0.07 | 0.09 | **0.05** |  |

D-1= Initial day, D-2= 0-10 days, D-3= 11-17 days, D-4= 18-24 days and D-5= 25-30 days;

T0= Control group, T1= Onion group, T2= Garlic group, T3= Neem group, T4= Tulsi group, T5= 0.1% CuSO4 group and T6= Nystatin Sulphate group;

SD= Standard Deviation;

Significant variation (*p* ≤0.05) and Highly Significant variation (*p* ≤0.01)

**4.2 Effects on biochemical parameters**

**4.2.1 Effects on carbohydrate, TP and albumin**

**Carbohydrate (Glucose)**

The glucose (mg/dl) level of control group and different treatment groups were not too much altered on aspergillosis affected broilers in this study (Table 3). There was no significant (*p* >0.05) deviation present on glucose after infection exposure as well as during treatment and post treatment period. But on the treated group of neem, glucose level was reduced gradually and varied significantly (*p* ≤0.05).

**Total Protein (TP)**

The disease aspergillosis did not affect the total protein (g/l) level of broilers in this study. Among the treated groups nor on the different phases of a single treated group, there had no significant (*p* >0.05) variation all along the study period (Table 3).

**Albumin**

Though the TP was not varied significantly on all the different phases, but the level of albumin (g/l) was significantly (*p* ≤0.05) increased after the infection exposure (7.5, 10.4, 12.3, 11.8, 10.8 and 12.2) at different treated groups respectively (Table 3) comparing to control group (10.6). It was also observed that, highly significant deviation (*p* ≤0.01) was exposed at the post treatment period of this study. Moreover, there had a significant distinction on the control group and highly significant variation on garlic group as well during infection exposure, treatment and post treatment period.

**Table 3: Effects of onion, garlic, neem, tulsi, 0.1% CuSO4 and Nystatin Sulphate on carbohydrate, TP and albumin in broilers affected with aspergillosis**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Para-meters** | **Periods** | **Groups** | | | | | | | ***p*** |
| **T0** | **T1** | **T2** | **T3** | **T4** | **T5** | **T6** |
| Glucose | D-1 (Mean ± SD) | 285 ± 38.2 | 230 ± 19.2 | 226 ± 15.7 | 301 ± 78.5 | 284 ± 38 | 244 ± 58 | 245 ± 58 | 0.46 |
| D-2 (Mean ± SD) | 210.5 ± 12 | 221.3 ± 23 | 232.4 ± 12 | 254.3 ± 26 | 227.3 ± 36 | 275.8 ± 60 | 244.2 ± 35 | 0.38 |
| D-3 (Mean ± SD) | 222 ± 65.7 | 228 ± 43 | 209.3 ± 46 | 229 ± 8.3 | 280 ± 67.5 | 215 ± 50 | 231 ± 33 | 0.47 |
| ***p*** | 0.17 | 0.54 | 0.18 | **0.05** | 0.65 | 0.97 | 0.70 |  |
| Total Protein | D-1 (Mean ± SD) | 24.3 ± 6.1 | 16 ± 4.4 | 22.3 ± 3.1 | 28.3 ± 4 | 25.7 ± 13.3 | 23.7 ± 1.5 | 30 ± 10.8 | 0.16 |
| D-2 (Mean ± SD) | 26 ± 2 | 28.7 ± 15.1 | 32.7 ± 11.7 | 24.3 ± 6.5 | 28.3 ± 7.2 | 27 ± 8.5 | 22 ± 9.5 | 0.49 |
| D-3 (Mean ± SD) | 27.7 ± 3.8 | 27.3 ± 4 | 27.3 ± 2.1 | 27 ± 3.5 | 28.7 ± 2.3 | 22.3 ± 2.1 | 28 ± 1.7 | 0.89 |
| ***p*** | 0.41 | 0.16 | 0.08 | 0.69 | 0.16 | 0.07 | 0.14 |  |
| Albumin | D-1 (Mean ± SD) | 10.6 ± 1.7 | 7.5 ± 1.9 | 10.4 ± 0.2 | 12.3 ± 1.3 | 11.8 ± 4.8 | 10.8 ± 0.9 | 12.2 ± 3.6 | **0.04** |
| D-2 (Mean ± SD) | 12.1 ± 0.7 | 12.5 ± 5.9 | 13.7 ± 4.6 | 9.9 ± 1.4 | 11.3 ± 2.2 | 11.9 ± 2.5 | 11.1 ± 3.3 | 0.25 |
| D-3 (Mean ± SD) | 16.6 ± 8.7 | 10.7 ± 1.2 | 13 ± 1.4 | 11.2 ± 1.3 | 12.5 ± 0.6 | 11.4 ± 1.9 | 10.3 ± 0.9 | **0.003** |
| ***p*** | **0.02** | 0.13 | **0.01** | 0.99 | 0.08 | 0.47 | 0.28 |  |

D-1= After infection exposure (at day 18), D-2= During treatment period (at day 25), D-3= Post treatment period (at day 30);

T0= Control group, T1= Onion group, T2= Garlic group, T3= Neem group, T4= Tulsi group, T5= 0.1% CuSO4 group and T6= Nystatin Sulphate group;

SD= Standard Deviation;

Significant variation (*p* ≤0.05) and Highly significant variation (*p* ≤0.01)

**4.2.2 Effects on liver and kidney**

**Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT)**

The disease aspergillosis affects the liver harmfully. AST (u/l) and ALT (u/l) both are liver functional enzymes. While one of those values is increased, another will decrease. Both the values are comparable to each other during the disease period (Figure 5). After the infection exposure, AST level had highly significant (*p* ≤0.01) variation on different treated group where significant deviation (*p* ≤0.05) was found during the treatment stage (Table 4). On the both observational period, insignificant variation (*p* >0.05) was present in ALT level, but significant distinction was pragmatic during the post treatment period among the treated groups. Moreover, on the onion group, the variation of AST was significant where on neem group this was highly significant across the different observational period of the study. No group was found as significant on ALT at different phase of this study.

**Phase: 01 Phase: 02 Phase: 03**

**Figure 5:** Comparison of AST and ALT in different groups on 3 observational phases

**Creatinine**

Creatinine (mg/dl) is a kidney functional enzyme. In case of the disease aspergillosis, while liver is damaged, the kidney will also be destroyed. But in this study, kidney remains normal as like as healthy non-infected broilers. The infectious agent did not modify the creatinine level range from 0.4 to 0.6 (Table 4) in the treated groups comparing to the control group. As a result, the variation was also insignificant (*p* >0.05) either within the groups or different phases on a single group.

**Table 4: Effects of onion, garlic, neem, tulsi, 0.1% CuSO4 and Nystatin Sulphate on liver and kidney in broilers affected with aspergillosis**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Para-meters** | **Periods** | **Groups** | | | | | | | ***p*** |
| **T0** | **T1** | **T2** | **T3** | **T4** | **T5** | **T6** |
| AST | D-1 (Mean ± SD) | 217.4 ± 20 | 194.5 ± 3.3 | 184.7 ± 3.7 | 229.8 ± 1.3 | 236.5 ± 32 | 259.4 ± 42 | 250 ± 25.7 | **0.003** |
| D-2 (Mean ± SD) | 211.2 ± 13.5 | 223.4 ± 10.5 | 242.9 ± 11 | 213.8 ± 1.2 | 230.4 ± 43.4 | 212 ± 15.4 | 202.2 ± 30.4 | **0.03** |
| D-3 (Mean ± SD) | 223.6 ± 46.1 | 240.4 ± 38.2 | 215.3 ± 22.9 | 209.9 ± 11.1 | 231.9 ± 23.2 | 216.9 ± 31.3 | 231.5 ± 18.2 | 0.68 |
| ***p*** | 0.28 | **0.03** | 0.13 | **0.01** | 0.73 | 0.49 | 0.81 |  |
| ALT | D-1 (Mean ± SD) | 9.7 ± 2.8 | 10.1 ± 2.1 | 7.8 ± 2.6 | 5.4 ± 1.7 | 8.3 ± 2.1 | 7.7 ± 1.1 | 3.1 ± 3.1 | 0.9 |
| D-2 (Mean ± SD) | 11.5 ± 0.7 | 10 ± 2.2 | 15.6 ± 3.1 | 17 ± 3 | 8.2 ± 1.5 | 10.3 ± 5.2 | 8.9 ± 3.5 | 0.39 |
| D-3 (Mean ± SD) | 10.3 ± 4.1 | 9.5 ± 3.9 | 7.3 ± 0.8 | 7 ± 0.7 | 6 ± 1.5 | 6.6 ± 3.5 | 6.8 ± 0.4 | **0.05** |
| ***p*** | 0.16 | 0.65 | 0.32 | 0.22 | 0.88 | 0.22 | 0.10 |  |
| Creati-nine | D-1 (Mean ± SD) | 0.6 ± 0.1 | 0.5 ± 0.1 | 0.4 ± 0.1 | 0.4 ± 0.1 | 0.6 ± 0.1 | 0.5 ± 0.1 | 0.5 ± 0.1 | 0.85 |
| D-2 (Mean ± SD) | 0.4 ± 0.1 | 0.5 ± 0.1 | 0.5 ± 0.1 | 0.5 ± 0.1 | 0.5 ± 0.1 | 0.5 ± 0.1 | 0.5 ± 0.1 | 0.95 |
| D-3 (Mean ± SD) | 0.5 ± 0.1 | 0.4 ± 0.1 | 0.5 ± 0.1 | 0.5 ± 0.1 | 0.4 ± 0.1 | 0.4 ± 0.1 | 0.5 ± 0.1 | 0.72 |
| ***p*** | 0.57 | 0.75 | 0.86 | 0.70 | 0.40 | 1.00 | 0.75 |  |

D-1= After infection exposure (at day 18), D-2= During treatment period (at day 25), D-3= Post treatment period (at day 30);

T0= Control group, T1= Onion group, T2= Garlic group, T3= Neem group, T4= Tulsi group, T5= 0.1% CuSO4 group and T6= Nystatin Sulphate group;

SD= Standard Deviation;

Significant variation (*p* ≤0.05) and Highly significant variation (*p* ≤0.01)

**4.2.3 Effects on lipid profile**

**Cholesterol**

Cholesterol (mg/dl) level was increased after infection exposure and during the post treatment period whereas reduced level of cholesterol was pragmatic during the treatment episode (Table 5), though the deviation was not significant (*p* >0.05). None other than different treated groups’ cholesterol level was significantly (*p* ≤0.05) changed on the control group of this study.

**Triglycerides (TG)**

In the present study, highly significant (*p* ≤0.01) increased level of TG (mg/dl) was found after the infection exposure in different treated groups comparing to control group (Table 5). It was also observed that, the variation on garlic group was highly significant than other treated groups along the different phases of the study.

**High Density Lipoprotein (HDL)**

In the current study, reduced level of HDL (mg/dl) was observed through the infection exposure and during the treatment stage (Table 5). On both periods there had no significant (*p* >0.05) distinction was recorded. But increased level of HDL was found after the treatment phase that was highly significant (*p* ≤0.01) than the previous two episode across the study. Moreover, significant variation was prevailed on neem and 0.1% CuSO4 groups on different observational periods of this study.

**Low Density Lipoprotein (LDL)**

In this study, the level of LDL (mg/dl) was quite opposite to the level of HDL. While HDL level was increased after the treatment intervention, LDL level was decreased on that period (Table 5), though the variation was not significant (*p* >0.05). Conversely, on the period of infection exposure LDL level was insignificantly higher than other two observational phases of this study. Moreover, on garlic group, LDL level was significantly (*p* ≤0.05) varied compared to other treated and control group.

**Table 5: Effects of onion, garlic, neem, tulsi, 0.1% CuSO4 and Nystatin Sulphate on lipid profiles in broilers affected with aspergillosis**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Para-meters** | **Periods** | **Groups** | | | | | | | ***p*** |
| **T0** | **T1** | **T2** | **T3** | **T4** | **T5** | **T6** |
| Chole-sterol | D-1 (Mean ± SD) | 137.6 ± 46.7 | 99.7 ± 13.4 | 107.5 ± 8.9 | 132.8 ± 25.3 | 111.3 ± 56.8 | 104.3 ± 27.4 | 101.3 ± 32.2 | 0.35 |
| D-2 (Mean ± SD) | 69.3 ± 3.4 | 98.4 ± 27.8 | 103.6 ± 18 | 75.6 ± 15.9 | 90.3 ± 15.6 | 69.2 ± 22.8 | 89.3 ± 13.3 | 0.49 |
| D-3 (Mean ± SD) | 124.3 ± 15.5 | 115.9 ± 6.3 | 138 ± 21.5 | 131.4 ± 13.6 | 112 ± 21.1 | 132.7 ± 27.7 | 103.2 ± 5.2 | 0.42 |
| ***p*** | **0.03** | 0.21 | 0.57 | 0.70 | 0.22 | 0.96 | 0.11 |  |
| Tri-glycer-ides | D-1 (Mean ± SD) | 233 ± 57.6 | 181.9 ± 74 | 245.9 ± 0.8 | 237.5 ± 56 | 178 ± 15.3 | 172.4 ± 9.9 | 211.5 ± 10 | **0.001** |
| D-2 (Mean ± SD) | 130.3 ± 11 | 207 ± 35.7 | 223.6 ± 43 | 146 ± 44.5 | 175 ± 16.1 | 143.1 ± 33 | 151.4 ± 25 | 0.66 |
| D-3 (Mean ± SD) | 154 ± 17.4 | 175 ± 11 | 181.2 ± 43 | 154 ± 63.3 | 102 ± 11.5 | 111.3 ±15 | 135.3 ± 15 | 0.11 |
| ***p*** | 0.11 | 0.11 | **0.01** | 0.91 | 0.91 | 0.31 | 0.52 |  |
| HDL | D-1 (Mean ± SD) | 32.4 ± 10.2 | 21.4 ± 5.8 | 21.9 ± 3.5 | 31 ± 9.4 | 27.5 ± 22.5 | 27 ± 10.4 | 23 ± 12.8 | 0.40 |
| D-2 (Mean ± SD) | 16 ± 2.1 | 19.1 ± 7.4 | 19.2 ± 5.6 | 16.2 ± 4.2 | 17.4 ± 5.5 | 12 ± 2.3 | 21.4 ± 3.5 | 0.68 |
| D-3 (Mean ± SD) | 57.8 ± 17.2 | 61.2 ± 1.8 | 49.8 ± 0.8 | 49.8 ± 0.8 | 65.3 ± 19 | 65.6 ± 29.1 | 58.4 ± 6.2 | **0.006** |
| ***p*** | 0.09 | 0.28 | 0.34 | **0.05** | 0.28 | **0.03** | 0.28 |  |
| LDL | D-1 (Mean ± SD) | 58.7 ± 29 | 42 ± 5.2 | 36.4 ± 5.7 | 54.3 ± 9.6 | 48 ± 34.4 | 42.8 ± 15 | 36 ± 21.3 | 0.17 |
| D-2 (Mean ± SD) | 27.2 ± 4.2 | 37.9 ± 15.6 | 39.7 ± 5 | 30.1 ± 14.6 | 37.9 ± 9.7 | 28.6 ± 17.5 | 37.6 ± 18.6 | 0.50 |
| D-3 (Mean ± SD) | 35.7 ± 9.6 | 19.7 ± 5.6 | 40.7 ± 27.8 | 50.8 ± 4.7 | 26.2 ± 10.1 | 44.9 ± 15.4 | 17.7 ± 12.1 | 0.30 |
| ***p*** | 0.08 | 0.28 | **0.05** | 0.41 | 0.17 | 0.98 | 0.78 |  |

D-1= After infection exposure (at day 18), D-2= During treatment period (at day 25), D-3= Post treatment period (at day 30);

T0= Control group, T1= Onion group, T2= Garlic group, T3= Neem group, T4= Tulsi group, T5= 0.1% CuSO4 group and T6= Nystatin Sulphate group;

SD= Standard Deviation;

Significant variation (*p* ≤0.05) and Highly significant variation (*p* ≤0.01)