

## PATTERN OF OCCURRENCE OF SINGLE AND CONCURRENT DISEASES ASSOCIATED WITH MORTALITY IN COMMERCIAL CHICKENS IN BANGLADESH

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### ABSTRACT

The high mortality rate of commercial poultry has been encountered as a major problem which discourage farmers and entrepreneurs in this industry in Bangladesh. This study was carried out to determine the role of single and concurrent infections associated with mortality in 1751 commercial chickens during one year period from January to December 2002. Diagnosis of diseases was made on the basis of history, necropsy findings, isolation and identification of causative bacteria and other laboratory tests. The etiological investigations of 1751 dead chickens showed that about 39.81% bacterial, 22.73% viral, 13.65% mycoplasmal, 1.54% fungal, 10.11% parasitic, 31.64% systemic, 3.43% nutritional deficiency and 1.77% other diseases were associated with these mortality. Salmonellosis ( 21.99% ), Colibacillosis ( 8.40% ), Fowl cholera ( 6.52% ), Avian mycoplasmosis ( 13.65% ), Infectious bursal disease ( 11.20% ), Newcastle disease ( 10.34% ) and coccidiosis ( 6.23% ) were recognized as major diseases associated with mortality in commercial chickens in Bangladesh. About 32 diseases were recorded, of which both single ( 76.30% ) and mixed infections as two ( 21.53% ), three ( 1.83% ) and four ( 0.34% ) types were associated with mortality of chickens. Significantly (  $p < 0.01$  ) highest proportionate mortality rate was recorded in > 20 weeks old adult layer ( 45.52% ) in comparison to > 2 to 8 weeks old grower ( 24.04% ), > 8 to 20 weeks old pullet ( 18.16% ) and up to 2 weeks old brooding ( 12.28% ) chickens. Seasonal influence showed highest mortality rate during Summer ( 43.06% ) in comparison to Rainy ( 27.81% ) and Winter ( 29.13% ) seasons. It may be concluded from this study that both the single and concurrent infections are associated with high mortality rate in commercial chickens in Bangladesh. Therefore, the interactions of different pathogens in naturally occurring diseases should be considered during diagnosis and evaluation of vaccination.

**Key words:** Occurrence, concurrent, mortality, diseases, chickens

### INTRODUCTION

Generally, only one pathogen is considered as the sole cause of the poultry mortality without further investigation into the interactions of concurrent infections. But mixed infections have been recognized as a frequent problem in commercial poultry and may be caused by a combination of different microorganisms or parasites ( Rao and Rao, 1992 ; Line *et al.*, 1997 ; El-Tayeb and Hanson, 2002 ). The interactions between two or more agents can be synergistic or antagonistic and this interrelationship often determines the severity of the disease. The effects of experimental concurrent infections of *Eimeria tenella* with some bacteria and viruses in broiler chickens have been reported from Bangladesh ( Talukder *et al.*, 2000 ) but reports on natural interactions of pathogens associated with mortality in poultry are very limited in inland literature ( Samad, 2000 ). Therefore, the objective of this study was to examine the nature of interaction of pathogens associated with mortality in commercial chickens in Bangladesh.

### MATERIALS AND METHODS

This study was conducted on to determine the interactions of etiological agents associated with mortality in 1751 commercial dead chickens which were submitted for diagnosis at the BRAC Poultry Disease Diagnostic Centre ( PDDC ), Nagapara, Gazipur during one year period from January to December 2002. This poultry disease diagnostic centre has been established with modern diagnostic facilities for commercial services on the diagnosis of poultry diseases, and two experienced veterinarians are working in the diagnostic laboratory. Detail descriptions of each of the submitted birds like date, age, types ( layer, broiler, breeder ) etc. were recorded.

Diagnosis of each of the recorded disease in chickens was made on the basis of clinical history, characteristic post-mortem lesions, isolation and identification of bacteria as described by Calnek *et al.* (1997). To assess the influence of age on the occurrence of diseases, birds were grouped into brooding ( up to 2 weeks ), grower ( > 2 to 8 weeks ), pullets ( > 8 to 20 weeks ) and adult layer ( > 20 weeks ). The seasonal influence on the occurrence of diseases was assessed by dividing the year into three main seasons viz. Summer ( March to June ), Rainy ( July to October ) and Winter ( November to February ). Results of single and concurrent pathogens with age and seasons were analyzed by using the Chi-square test for significance ( Gupta, 1982 ).

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**RESULTS AND DISCUSSION**

Necropsy and laboratory methods were used to diagnose the diseases in 1751 dead birds which were submitted to the BRAC Poultry Disease Diagnostic Centre, Gazipur during one year period from January to December 2002.

Etiological analysis on the disease prevalence in commercial chickens showed highest infection rate with bacterial diseases ( 39.81% ), followed by systemic disorders ( 31.64% ), viral diseases ( 22.73% ), avian mycoplasmosis ( 13.65% ), parasitic diseases ( 10.11% ), nutritional disorders ( 3.43% ), others ( 1.77% ) and lowest with fungal diseases ( 1.54% ). These results support the report of Al-Sadi *et al.* (2000) who reported highest incidence of bacterial diseases ( 50.91% ), followed by viral diseases ( 19.27% ) in poultry elsewhere.

The age-wise analysis on the overall occurrence of disease in 1751 commercial chickens showed significantly (  $p < 0.01$  ) highest infection rate in adult ( > 20 weeks old ) layers ( 45.52% ), followed by >2 to 8 weeks old grower ( 24.04% ), >8 to 20 weeks old pullets ( 18.16% ) and lowest in up to 2 weeks of brooding ( 12.28% ) chicks (Table 1).

Table 1. Age and seasonal influence on the occurrence of single and mixed diseases associated with mortality in commercial chickens

| S/N Single diseases       |                                   | Types of chickens     |                       |                        |                     | Seasons         |                |                 | Total<br>No. ( % ) |
|---------------------------|-----------------------------------|-----------------------|-----------------------|------------------------|---------------------|-----------------|----------------|-----------------|--------------------|
|                           |                                   | Brooding<br>(0-2 wks) | Growing<br>(>2-8 wks) | Pullets<br>(>8-20 wks) | Layers<br>(>20 wks) | Summer<br>(M-J) | Rainy<br>(J-O) | Winter<br>(N-F) |                    |
| I                         | II                                | III                   | IV                    | V                      | VI                  | VII             | VIII           | IX              | X                  |
| 1.                        | Salmonellosis ( SA )              | 54                    | 051                   | 37                     | 124                 | 121             | 077            | 068             | 266 (15.19)        |
| 2.                        | Colibacillosis ( C )              | 27                    | 038                   | 07                     | 027                 | 042             | 018            | 039             | 099 (05.65)        |
| 3.                        | Fowl cholera ( FC )               | -                     | 007                   | 02                     | 079                 | 042             | 021            | 025             | 088 (05.03)        |
| 4.                        | Staphylococcosis ( STP )          | 01                    | -                     | 01                     | 004                 | -               | 005            | 001             | 006 (00.34)        |
| 5.                        | Gangrenous dermatitis ( GD )      | -                     | 002                   | 10                     | -                   | 012             | -              | -               | 012 (00.69)        |
| 6.                        | Necrotic enteritis ( NE )         | -                     | 004                   | 11                     | 001                 | 016             | -              | -               | 016 (00.91)        |
| 7.                        | Infectious coryza ( IC )          | -                     | -                     | 01                     | 003                 | 002             | -              | 002             | 004 (00.23)        |
| 8.                        | Infectious bursal disease ( IBD ) | 03                    | 119                   | 09                     | 013                 | 060             | 047            | 037             | 144 (08.22)        |
| 9.                        | Newcastle disease ( ND )          | 03                    | 008                   | 45                     | 029                 | 037             | 019            | 029             | 085 (04.85)        |
| 10.                       | Infectious bronchitis ( IB )      | -                     | -                     | -                      | 006                 | 004             | -              | 002             | 006 (00.34)        |
| 11.                       | Avian leukosis ( AL )             | -                     | -                     | 04                     | 001                 | 001             | -              | 004             | 005 (00.29)        |
| 12.                       | Fowl pox ( FP )                   | -                     | -                     | 02                     | -                   | 002             | -              | -               | 002 (00.11)        |
| 13.                       | Avian mycoplasmosis ( AM )        | 01                    | 006                   | 07                     | 093                 | 047             | 032            | 028             | 107 (06.11)        |
| 14.                       | Aspergillosis ( AP )              | 01                    | 006                   | 02                     | 001                 | 005             | 005            | -               | 010 (00.60)        |
| 15.                       | Mycotoxocosis ( MT )              | -                     | -                     | 01                     | 002                 | 002             | 001            | -               | 003 (00.17)        |
| 16.                       | Ascariasis ( AS )                 | -                     | 001                   | 15                     | 009                 | 009             | -              | 016             | 025 (01.43)        |
| 17.                       | Tapeworm infestation ( TWI )      | -                     | -                     | 04                     | 002                 | 001             | 002            | 003             | 006 (00.34)        |
| 18.                       | Coccidiosis ( CO )                | 01                    | 033                   | 30                     | 006                 | 026             | 016            | 028             | 070 (04.00)        |
| 19.                       | Omphalitis ( OM )                 | 86                    | 002                   | -                      | -                   | 021             | 014            | 053             | 088 (05.03)        |
| 20.                       | Enteritis ( ET )                  | 04                    | 038                   | 18                     | 029                 | 039             | 020            | 030             | 089 (05.08)        |
| 21.                       | Pneumonia ( PN )                  | 03                    | 005                   | -                      | 002                 | 001             | 002            | 007             | 010 (00.57)        |
| 22.                       | Egg peritonitis ( EP )            | -                     | -                     | 03                     | 020                 | 007             | 008            | 008             | 023 (01.31)        |
| 23.                       | Egg bound ( EB )                  | -                     | -                     | 01                     | 030                 | 020             | 008            | 003             | 031 (01.77)        |
| 24.                       | Salpingitis ( SP )                | -                     | -                     | 02                     | 003                 | 004             | -              | 001             | 005 (00.29)        |
| 25.                       | Malabsorption syndrome (MAS)      | -                     | -                     | 03                     | -                   | -               | 002            | 001             | 003 (00.17)        |
| 26.                       | Ascities ( A )                    | -                     | 006                   | -                      | 001                 | 003             | 001            | 003             | 007 (00.40)        |
| 27.                       | Visceral gout ( VG )              | -                     | 002                   | 05                     | 001                 | 001             | 005            | 002             | 008 (00.46)        |
| 28.                       | Neoplastic diseases ( NPD )       | -                     | -                     | 11                     | 008                 | 010             | 007            | 002             | 019 (01.09)        |
| 29.                       | Hydropericardium-hepatitis (HHS)  | -                     | 001                   | -                      | 001                 | -               | -              | 002             | 002 (00.11)        |
| 30.                       | Big liver & spleen disease (BLS)  | -                     | -                     | 01                     | -                   | 001             | -              | -               | 001 (00.06)        |
| 31.                       | Fatty liver-haemorrhagic syndrome | -                     | -                     | 01                     | 004                 | 001             | 003            | 001             | 005 (00.29)        |
| 32.                       | Poisoning ( P )                   | -                     | 002                   | -                      | 003                 | 001             | 004            | -               | 005 (00.29)        |
| 33.                       | Cannibalism ( CB )                | -                     | -                     | -                      | 003                 | 003             | -              | -               | 003 (00.17)        |
| 34.                       | Nutritional disorders ( NDO )     | 17                    | 015                   | 11                     | 016                 | 020             | 024            | 015             | 059 (03.37)        |
| 35.                       | Others                            | 06                    | 006                   | 06                     | 006                 | 007             | 007            | 010             | 024 (01.37)        |
| <b>Total single types</b> |                                   | <b>207</b>            | <b>352</b>            | <b>250</b>             | <b>527</b>          | <b>568</b>      | <b>348</b>     | <b>420</b>      | <b>1336</b>        |
| <b>( % )</b>              |                                   | <b>(96.28)</b>        | <b>(83.61)</b>        | <b>(78.62)</b>         | <b>(66.12)</b>      | <b>(75.33)</b>  | <b>(71.46)</b> | <b>(82.35)</b>  | <b>(76.30)</b>     |

Table 1. Continued

| I   | II                | III | IV | V  | VI  | VII | VIII | IX | X          |
|-----|-------------------|-----|----|----|-----|-----|------|----|------------|
| 1.  | SA + AM           | -   | 02 | 09 | 34  | 28  | 10   | 07 | 45 (02.57) |
| 2.  | SA + ND           | -   | -  | 04 | 22  | 15  | 10   | 01 | 26 (01.48) |
| 3.  | SA + CO           | -   | -  | 08 | -   | 03  | 02   | 03 | 08 (00.46) |
| 4.  | SA + EB           | -   | -  | -  | 09  | 03  | 02   | 04 | 09 (00.51) |
| 5.  | SA + AS           | -   | -  | 03 | 03  | 02  | 02   | 02 | 06 (00.34) |
| 6.  | SA + C            | -   | -  | -  | 03  | 03  | -    | -  | 03 (00.17) |
| 7.  | SA + VG           | -   | -  | -  | 03  | -   | 03   | -  | 03 (00.17) |
| 8.  | SA + MT           | -   | 01 | -  | -   | -   | 01   | -  | 01 (00.06) |
| 9.  | SA + TWI          | -   | -  | -  | 01  | -   | 01   | -  | 01 (00.06) |
| 10. | SA + AP           | 02  | -  | -  | -   | -   | -    | 02 | 02 (00.11) |
| 11. | SA + IBD          | -   | 08 | -  | -   | 07  | -    | 01 | 08 (00.46) |
| 12. | C + AM            | -   | 06 | 02 | 11  | 06  | 09   | 04 | 19 (01.09) |
| 13. | C + ND            | -   | -  | 03 | 02  | -   | 03   | 02 | 05 (00.29) |
| 14. | C + CO            | -   | -  | -  | 03  | 03  | -    | -  | 03 (00.17) |
| 15. | C + EB            | -   | -  | -  | 02  | 01  | -    | 01 | 02 (00.11) |
| 16. | C + AS            | -   | -  | 01 | -   | -   | -    | 01 | 01 (00.06) |
| 17. | C + Capillariasis | -   | 01 | -  | -   | 01  | -    | -  | 01 (00.06) |
| 18. | C + IBD           | 02  | 04 | -  | 02  | 03  | 01   | 04 | 08 (00.46) |
| 19. | C + EP            | -   | -  | 01 | 01  | 01  | 01   | -  | 02 (00.11) |
| 20. | FC + AM           | -   | -  | 02 | 03  | 02  | -    | 03 | 05 (00.29) |
| 21. | FC + ND           | -   | -  | -  | 03  | 03  | -    | -  | 03 (00.17) |
| 22. | FC + CO           | -   | -  | 01 | 01  | 01  | -    | 01 | 02 (00.11) |
| 23. | FC + EB           | -   | -  | -  | 08  | 01  | 07   | -  | 08 (00.46) |
| 24. | FC + EP           | -   | -  | -  | 01  | -   | -    | 01 | 01 (00.06) |
| 25. | FC + NPD          | -   | -  | -  | 05  | 03  | 02   | -  | 05 (00.29) |
| 26. | NE + CO           | -   | 02 | -  | -   | -   | -    | 02 | 02 (00.11) |
| 27. | NE + ND           | -   | -  | -  | 03  | 03  | -    | -  | 03 (00.17) |
| 28. | GD + IBD          | -   | 05 | -  | -   | 05  | -    | -  | 05 (00.29) |
| 29. | IBD + ND          | -   | 05 | -  | -   | 01  | 02   | 02 | 05 (00.29) |
| 30. | IBD + CO          | -   | 03 | 02 | -   | -   | 01   | 04 | 05 (00.29) |
| 31. | IBD + EB          | -   | -  | -  | 01  | 01  | -    | -  | 01 (00.06) |
| 32. | IBD + FL          | -   | 01 | -  | -   | 01  | -    | -  | 01 (00.06) |
| 33. | IBD + ET          | -   | 03 | 01 | -   | 02  | 01   | 01 | 04 (00.23) |
| 34. | IBD + AP          | -   | 02 | -  | -   | 02  | -    | -  | 02 (00.11) |
| 35. | IBD + AS          | -   | 02 | -  | -   | -   | 02   | -  | 02 (00.11) |
| 36. | IBD + VG          | -   | 01 | -  | -   | -   | 01   | -  | 01 (00.06) |
| 37. | IBD + Dermatitis  | -   | 05 | -  | -   | 05  | -    | -  | 05 (00.29) |
| 38. | ND + CO           | -   | 02 | 06 | 03  | 06  | 02   | 03 | 11 (00.63) |
| 39. | ND + EB           | -   | -  | -  | 07  | 03  | 04   | -  | 07 (00.40) |
| 40. | ND + ET           | -   | 01 | 01 | 01  | 01  | -    | 02 | 03 (00.17) |
| 41. | ND + AM           | -   | 02 | 01 | -   | -   | 02   | 01 | 03 (00.17) |
| 42. | ND + AL           | -   | -  | 01 | -   | -   | 01   | -  | 01 (00.06) |
| 43. | ND + AS           | -   | -  | 03 | 04  | -   | 03   | 04 | 07 (00.40) |
| 44. | ND + NPD          | -   | -  | -  | 01  | 01  | -    | -  | 01 (00.06) |
| 45. | ND + EP           | -   | -  | -  | 06  | 04  | 02   | -  | 06 (00.34) |
| 46. | IB + EB           | -   | -  | -  | 01  | 01  | -    | -  | 01 (00.06) |
| 47. | AS + CO           | -   | -  | 03 | -   | 02  | -    | 01 | 03 (00.17) |
| 48. | AS + EB           | -   | -  | -  | 04  | 03  | -    | 01 | 04 (00.23) |
| 49. | AS + AM           | -   | 02 | -  | 04  | 05  | -    | 01 | 06 (00.34) |
| 50. | AS + EP           | -   | -  | -  | 01  | 01  | -    | -  | 01 (00.06) |
| 51. | AS + Heat stress  | -   | -  | -  | 01  | 01  | -    | -  | 01 (00.06) |
| 52. | AS + Volvulus     | -   | -  | -  | 01  | 01  | -    | -  | 01 (00.06) |
| 53. | AM + D            | -   | -  | 04 | -   | 04  | -    | -  | 04 (00.23) |
| 54. | AM + NPD          | -   | -  | -  | 01  | -   | -    | 01 | 01 (00.06) |
| 55. | AM + ET           | -   | -  | 01 | 01  | -   | 01   | 01 | 02 (00.11) |
| 56. | AM + EB           | -   | -  | -  | 015 | 02  | 09   | 04 | 15 (00.86) |

Pattern of occurrence of poultry diseases

Table 1. Continued

| I                                 | II | III        | IV         | V          | VI               | VII              | VIII           | IX         | X                 |
|-----------------------------------|----|------------|------------|------------|------------------|------------------|----------------|------------|-------------------|
| 57. AM + A                        |    | -          | -          | -          | 001              | -                | -              | 01         | 01 (00.06)        |
| 58. AM + Hepatitis                |    | -          | -          | -          | 001              | -                | 01             | -          | 01 (00.06)        |
| 59. AM + EP                       |    | -          | 01         | -          | 008              | 01               | 06             | 02         | 09 (00.51)        |
| 60. AM + MT                       |    | -          | -          | 01         | -                | 01               | -              | -          | 01 (00.06)        |
| 61. AM + VG                       |    | -          | -          | -          | 001              | 01               | -              | -          | 01 (00.06)        |
| 62. AP + MT                       |    | -          | 03         | -          | -                | -                | 03             | -          | 03 (00.17)        |
| 63. ET + EB                       |    | -          | -          | 04         | 044              | 23               | 18             | 07         | 48 (02.74)        |
| 64. ET + D                        |    | -          | -          | 01         | -                | 01               | -              | -          | 01 (00.06)        |
| 65. ET + VG                       |    | -          | -          | 01         | -                | -                | -              | 01         | 01 (00.06)        |
| 66. ET + EP                       |    | -          | -          | -          | 02               | -                | 02             | -          | 02 (00.11)        |
| 67. ET + HPHS                     |    | -          | 02         | -          | -                | -                | -              | 02         | 02 (00.11)        |
| 68. EB + FL                       |    | -          | -          | -          | 02               | 01               | 01             | -          | 02 (00.11)        |
| 69. EB + NDO                      |    | -          | -          | -          | 01               | -                | 01             | -          | 01 (00.06)        |
| 70. EB + VG                       |    | -          | -          | -          | 01               | -                | 01             | -          | 01 (00.06)        |
| 71. EB + Vent picking             |    | -          | -          | -          | 02               | 02               | -              | -          | 02 (00.11)        |
| 72. EP + SP                       |    | -          | -          | -          | 02               | 02               | -              | -          | 02 (00.11)        |
| 73. EP + Cloacal prolapses        |    | -          | -          | -          | 01               | -                | -              | 01         | 01 (00.06)        |
| 74. EP + A                        |    | -          | -          | -          | 01               | 01               | -              | -          | 01 (00.06)        |
| 75. A + Perihepatitis             |    | -          | -          | -          | 01               | -                | 01             | -          | 01 (00.06)        |
| 76. A + Right ventricular failure |    | -          | 01         | -          | -                | 01               | -              | -          | 01 (00.06)        |
| 77. OM + PN                       |    | 04         | -          | -          | -                | -                | -              | 04         | 04 (00.23)        |
| <b>Total two types</b>            |    | <b>08</b>  | <b>65</b>  | <b>64</b>  | <b>240</b>       | <b>175</b>       | <b>119</b>     | <b>83</b>  | <b>377</b>        |
| ( % )                             |    | (03.72)    | (15.44)    | (20.13)    | (30.11)          | (23.21)          | (24.44)        | (16.27)    | (21.53)           |
| 1. SA + AM + IB                   |    | -          | -          | -          | 02               | -                | -              | 02         | 02 (00.11)        |
| 2. SA + AM + NPD                  |    | -          | -          | -          | 01               | 01               | -              | -          | 01 (00.06)        |
| 3. SA + AM + FL                   |    | -          | -          | -          | 02               | 02               | -              | -          | 02 (00.11)        |
| 4. SA + AM + AS                   |    | -          | -          | -          | 01               | -                | -              | 01         | 01 (00.06)        |
| 5. SA + ND + AS                   |    | -          | -          | 01         | -                | -                | 01             | -          | 01 (00.06)        |
| 6. C + AM + AS                    |    | -          | -          | -          | 01               | -                | 01             | -          | 01 (00.06)        |
| 7. C + AM + EB                    |    | -          | -          | -          | 01               | -                | 01             | -          | 01 (00.06)        |
| 8. C + AS + IBD                   |    | -          | -          | -          | 01               | -                | 01             | -          | 01 (00.06)        |
| 9. C + A + IBD                    |    | -          | 01         | -          | -                | -                | 01             | -          | 01 (00.06)        |
| 10. NE + AM + ND                  |    | -          | -          | -          | 02               | 02               | -              | -          | 02 (00.11)        |
| 11. NE + AM + HS                  |    | -          | -          | 01         | -                | 01               | -              | -          | 01 (00.06)        |
| 12. IBD + ND + CO                 |    | -          | 03         | -          | -                | -                | 03             | -          | 03 (00.17)        |
| 13. ND + AM + EB                  |    | -          | -          | -          | 01               | -                | -              | 01         | 01 (00.06)        |
| 14. ND + AP + CO                  |    | -          | -          | -          | 02               | -                | 02             | -          | 02 (00.11)        |
| 15. ND + ET + EB                  |    | -          | -          | -          | 03               | -                | 03             | -          | 03 (00.17)        |
| 16. ND + AS + TWI                 |    | -          | -          | -          | 01               | -                | 01             | -          | 01 (00.06)        |
| 17. FP + Marek's disease          |    | -          | -          | 02         | -                | -                | -              | 02         | 02 (00.11)        |
| 18. H + ET + EB                   |    | -          | -          | -          | 02               | 02               | -              | -          | 02 (00.11)        |
| 19. AM + EB + ET                  |    | -          | -          | -          | 02               | -                | 01             | 01         | 02 (00.11)        |
| 20. AM + A + EP                   |    | -          | -          | -          | 01               | 01               | -              | -          | 01 (00.06)        |
| 21. ET + EB + HS                  |    | -          | -          | -          | 01               | -                | 01             | -          | 01 (00.06)        |
| <b>Total three types</b>          |    | -          | <b>04</b>  | <b>04</b>  | <b>24</b>        | <b>09</b>        | <b>16</b>      | <b>07</b>  | <b>32</b>         |
| ( % )                             |    | -          | (00.95)    | (01.26)    | (03.01)          | (01.19)          | (03.29)        | (01.37)    | (01.83)           |
| 1. FC + ND + IB + P               |    | -          | -          | -          | 02               | 02               | -              | -          | 02 (00.11)        |
| 2. AM + EB + FL + ET              |    | -          | -          | -          | 02               | -                | 02             | -          | 02 (00.11)        |
| 3. AM + EB + FL + P               |    | -          | -          | -          | 02               | -                | 02             | -          | 02 (00.11)        |
| <b>Total ( Four types, % )</b>    |    | -          | -          | -          | <b>06 (0.75)</b> | <b>02 (0.27)</b> | <b>4(0.82)</b> | -          | <b>06 (00.34)</b> |
| <b>Overall</b>                    |    | <b>215</b> | <b>421</b> | <b>318</b> | <b>797</b>       | <b>754</b>       | <b>487</b>     | <b>510</b> | <b>1751</b>       |
|                                   |    | (12.28)    | (24.04)    | (18.16)    | (45.52)          | (43.06)          | (27.81)        | (29.13)    |                   |

These results support the reports of Ghodasara *et al.* (1992) who reported higher mortality rate in layers ( 49.21% ) as compared to brooder chicks ( 26.23% ) and grower ( 24.56% ), and Kamal and Hossain (1992) who reported higher prevalence rate of diseases in chickens more than 13 weeks of age. However, these results slightly contradict with the earlier report of Talha *et al.* (2001) who reported higher percentage of cases on the age group of >2 to 8 weeks ( 60.37% ), followed by > 20 weeks age group ( 21.00% ), 0 to 2 weeks age group ( 11.55% ) and lowest in >8 to 20 weeks. Higher mortality in layer chickens recorded in this study might be due to the longer age range of one year compared to shorter age range of brooder and grower chickens. Overall analysis of the data on the season-wise occurrence of diseases showed significantly (  $p < 0.01$  ) highest incidence rate during Summer ( 43.06% ) in comparison to Rainy ( 27.81% ) and Winter ( 29.13% ) seasons ( Table 1 ).

Analysis of pathogens associated with mortality in chickens showed that 76.30% had single, 21.53% had two, 1.83% had three and only 0.34% had four types of infections ( Table 1 ). Most of the brooding chicks died due to single infection ( 96.28% ) and only 3.72% had dual infection ( Table 1 ). Grower and pullet birds died due to single ( 83.61% & 78.62% ), two ( 15.44% & 20.13% ) and three ( 0.95% & 1.26% ) types of diseases, respectively ( Table 1 ). But the mortality of layer birds caused by single ( 66.12% ), two ( 30.11% ), three ( 3.01% ) and four ( 0.75% ) types of diseases ( Table 1 ). This indicates that the rate of concurrent infection increased with the increase of age of birds.

Salmonellosis ( 21.99% ), Colibacillosis ( 8.40% ), Fowl cholera ( 6.52% ), Avian mycoplasmosis ( 13.65% ), Infectious bursal disease (11.20%), Newcastle disease (10.34%) and Coccidiosis ( 6.23% ) were recorded as a major diseases associated with mortality in commercial chickens in Bangladesh. These diseases were recorded both as single as well as concurrent infections ( Table 1 ). It appears from the results of this study that single occurrence of diseases could be the cause of death of commercial poultry birds but concurrent infections might have enhanced effects to cause death of these birds. Primary infections with respiratory viruses are commonly believed to increase the susceptibility of the respiratory tract to subsequent bacterial infection ( Gross, 1957 ; Nakamura *et al.*, 1994 ). On the other hand, viral infections may induce immunosuppression in the infected host, and this may lead to a synergistic effect when a second pathogen become involved ( Gross, 1957 ; Naeem *et al.*, 1995 ). However, it was not possible to demonstrate any synergism or antagonism in these natural mixed infection. In addition, the interaction in mixed infection is complex and controversial. The significant effect of the timing of exposure of the chickens to concurrent pathogens can increase or decrease host defense mechanisms and consequently affect the outcome of the concurrent infections as well as evaluation of vaccines.

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