DETECTION OF MATERNALLY DERIVED ANTIBODIES (MDA) TITER AND COMPARISON OF INTERMEDIATE AND INTERMEDIATE PLUS (GM-97 STRAIN) VACCINES OF INFECTIOUS BURSAL DISEASE VIRUS

Mirza Mienur Meher1, Md. Taimur Islam2, Dipali Rani Gupta1, Md. Golam Haider3*

Address(es):
1 Department of Microbiology and Public Health, Faculty of Veterinary Medicine and Animal Science, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh. ORCID: https://orcid.org/0000-0001-8811-8940.
2 Department of Pathobiology, Faculty of Veterinary Medicine and Animal Science, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, 1706, Bangladesh.
3 Institute of Biotechnology and Genetic Engineering, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, 1706, Bangladesh.

*Corresponding author: gh aider@bsrmrau.edu bd https://doi.org/10.55251/jmbsf.5844

ARTICLE INFO

Received 16. 2. 2022
Revised 4. 11. 2022
Accepted 4. 11. 2022
Published 1. 12. 2022

Abstract

The Infectious Bursal disease (IBD) is an important devastating disease among the infectious diseases of poultry in Bangladesh. Hence, this study was designed to determine the MDA titer and compare the two commercially available vaccines strains of IBVD (“GM-97 strain Intermediate plus” and “Intermediate type strain”). In this study, a total of 1500 layer birds were equally allocated into three groups (group-A, group-B and control). The Group-A and Group-B were vaccinated by “GM-97 strain Intermediate plus” and “Intermediate type strain” of IBVD vaccine, respectively and control was unvaccinated. Blood samples were collected prior to vaccination (1- and 7-days old birds), as well as 7, 14, and 21 days after vaccination. The antibody titer was measured by iELISA test. The highest MDA mean titer was 6227.69±327.63 in day-old birds. The group-A birds had the significantly (p<0.01) higher antibody mean titer than group-B and control. The highest antibody mean titer was 9121.94±657.05 at the age of 39 days in group-A. The MDA titer at 1 days-old had the higher effect size (4.10; CI:4675.36-6072.01; n=16). In group-A, the highest effect size (4.49; CI:5953.80-7556.08; n=16) was in 32 days-old (14 d.p.v.) and the group-B had the highest effect size (3.35; CI:6861.04-6702.59; n=16) was in 32 days-old (14 d.p.v.). Significantly (p<0.01) higher histopathological-lesion scores were 4.75±0.25 and 3.5±0.65 in 32- and 39-days-old respectively in group-A. In brief, the protective level of IBDV MDA titer may remain up to 1 week of post-hatching and the Intermediate plus vaccine can generate higher antibody titer than the intermediate type.

Keywords: IBD, ELISA, Antibody Titer, MDA, Vaccine

INTRODUCTION

Poultry is one of the faster growing and important subsectors that has generated huge employment opportunity, playing a vital role in the reduction of poverty, and malnutrition in both urban and rural areas of Bangladesh (Hamid et al., 2016). There are several constraints that hinder the development process in poultry sector; among them, disease is the major one. The flourishing poultry industry is incurring a series of problems due to outbreak of infectious and non-infectious diseases, resulting the high mortality which brings huge economic losses in Bangladesh (Hossain et al., 2015). Among the infectious diseases of poultry, the Infectious Bursal disease (IBD) is one of the important overwhelming diseases in Bangladesh (Rahman and Samad, 2005). IBD, a highly contagious acute viral disease that affects growing chickens and commonly known as Gumboro disease (Infectious bursal disease), mainly characterized by severe changes in the bursa of Fabricius and the mortality of young chicks of both domestic (chickens and turkeys) and wild birds (guinea fowl, quail, ducks, and pheasants) (Daodu et al., 2018). However, for the control of this infectious viral diseases of poultry, vaccination strategies are essentials. At present, live attenuated, killed, immune complex, and vector vaccines of IBD are commercially available (Ettroudossi and Saif, 2020). Moreover, live attenuated vaccines are categorized into Mild, intermediate, and intermediate-plus or hot vaccines (Olesen et al., 2018). In contrast with mild vaccines, the intermediate and intermediate-plus vaccines give better immunity against IBVD. Although “intermediate” and “intermediate plus” or “hot” vaccines are much more effective and may overcome greater levels of maternally derived antibodies (MDA), but they can also result in moderate to serious bursal lesions and, as a result, cause appropriate concentration of immunosuppression (Müller et al., 2012). The MDA are those antibodies which are transferred from mother to offspring’s and protect neonates and newborns during the time of their maturation of immune system. The massive common of maternal antibodies are of the IgG isotype (Niewiesk, 2014). Consequently, the efficient of a vaccine, depends on the time of vaccination, which can be affected by residual MDA levels (Jackwood, 2017). Flocks are IBD-vaccinated between 1 day before, at, or up to 3 days after the estimated optimal time point because, in this period the humoral immunity will be developed and detectable which remain up to 14 days of post vaccination (Block et al., 2007). Basically, the optimal vaccination time depends upon the MDA level of the chicks (Block et al., 2007). Because, the high titer of maternal antibodies interferes with the multiplication of live vaccine’s virus and diminish the level of immunity that could be produced in the chicks. The application of live vaccines during the 1st week of hatch in chicks against diseases whose MDA still persist in the body of the chick will result in defusing of antigen and active immunity may not be delivered by the vaccine (Pitcovski et al., 2003). Different serological methods are available to detect the maternal antibody and the antibody provided by the vaccine. Among the different methods, enzyme linked immunosorbent assay (ELISA) is used most commonly as it is sensitive, specific and quantitative. Commercial ELISA kits are available to detect antibodies to IBVD from sera samples (Martinez-Torrecreudrada et al., 2000; Wang et al., 2008). Though the several studies on the detection of IBVD antibodies were performed in Bangladesh (Khan et al., 2009; Meher et al., 2017), but limited number of studies on the detection of MDA for IBVD and screening of antibody titer were developed after the vaccination. Additionally, the real-time information of humoral response to vaccination is essential to develop and incorporate the mapping tools for veterinary services to control and prevent IBD (Garcia et al., 2021). Hence, this study was designed to determine the MDA titer and compare the two commercially available vaccines strains of IBVD (one is “GM-97 strain Intermediate plus” and another one is “Intermediate type strain”) in terms of antibody titer in layer chickens.

MATERIALS AND METHODS

Ethical approval

The study was performed in line with the research ethics and strategies as well as the animal care followed by the Department of Microbiology and Public Health, Faculty of Veterinary Medicine and Animal Science, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh. Therefore, the use of animal for research is in accordance with the Bangladesh Animal Welfare Act, 2009. All the animals were maintained in the poultry farm of the Bangladesh Agricultural University, Gazipur, Bangladesh. The blood samples were collected from the wing vein of the birds using 2 ml disposable syringes. The blood samples were collected from the wing vein of the birds using 2 ml disposable syringes. The blood samples were collected from the wing vein of the birds using 2 ml disposable syringes. The blood samples were collected from the wing vein of the birds using 2 ml disposable syringes. The blood samples were collected from the wing vein of the birds using 2 ml disposable syringes. The blood samples were collected from the wing vein of the birds using 2 ml disposable syringes. The blood samples were collected from the wing vein of the birds using 2 ml disposable syringes. The blood samples were collected from the wing vein of the birds using 2 ml disposable syringes. The blood samples were collected from the wing vein of the birds using 2 ml disposable syringes. The blood samples were collected from the wing vein of the birds using 2 ml disposable syringes. The blood samples were collected from the wing vein of the birds using 2 ml disposable syringes.
Antibody titer for BV: \( \log (\text{titer}) = 1.0 \times \log \frac{\text{S/P}}{\text{Titer}} + 3.63; \)
\[ \text{Titer} = 10^{-\log (\text{titer})} \]

**Interpretation of results**

| S/P Value | ELISA Antibody Titer | IBD Immune Status |
|-----------|-----------------------|-------------------|
| ≤ 0.2     | Titer ≤ 853           | Negative          |
| > 0.2     | Titer > 853           | Positive          |

**Bursa of Fabricius: body weight (BF:BW) ratio, BF:BW index and histopathological lesions score (HLS)**

The BF:BW ratio and BF:BW index were calculated by the following formula,
\[ BF: BW \text{ ratio } = \frac{\text{Bursa of Fabricius weight (gm)}}{\text{Body weight (gm)}} \times 1000 \]

| BF: BW index |
|--------------|
| = BF:BW ratio of un vaccinated birds (control group) |

**Detection of pre and post vaccinated antibody titer by serological test (indirect ELISA)**

The quantitative test for the detection of specific antibodies from serum samples. The commercially available ELISA test kit (ID Screen® IBVD Indirect, ID, Vet, Grabels, France) containing IBVD antigen-coated plates were used to measure the antibody titer. This study strictly followed the manufacturer’s instructions to perform the iELISA test. Briefly, the protocol suggested to dilute the serum samples such that the mean effect among the different ages. All the individual samples of group-A, group-B and control were considered to perform one sample t test to compare the antibody mean titre of each group to the marginal level of protective antibody titre (>853). Before performing the statistical test, all assumption for the specific statistical test were assessed and found too good. The p value <0.05 were assumed to statistically significant. The effect size of one sample t test was calculated by using the following formula.
\[ E \text{ffect size } = \frac{t}{\sqrt{N}} \]

**RESULTS**

In this study, the antibody titers of layer birds were detected by the iELISA. Both, the group A and B showed, a significantly (p<0.01) upward tendency of antibody mean titer and the control group had a significantly (p<0.01) descending trend according to their age (Table 1). Surprisingly, the antibody mean titer of both groups (vaccinated) were significantly (p<0.01) increased than the MDA mean titer. The highest MDA mean titer of IBVD was 6227.69±327.63 observed at the age of 1 days and then gradually decreased to 2075.50±215.22 at the age of 7 days. After vaccination, both vaccinated groups had an upward trend of antibody mean titer and continued up to the age of 39 days (Figure 1). It is very clear from the Figure 1 that the group vaccinated by “GM-97 strain of Intermediate plus” (group-A) had higher trend of antibody mean titers than the group vaccinated by “Intermediate type” (group-B) for all estimated ages layer birds. The line graph of antibody mean titer of control group had the tendency to go down and below the protective level. The Table 1 also shows the significant difference between the groups for all estimated ages of layer birds, where the group-A birds had significantly (p<0.01) higher antibody mean titer than group-B and control. The highest antibody mean titer was 9121.94±567.05 at the age of 39 days in group-A layer birds. And the lowest antibody mean titer was 469.38±80.7 control group in the age of 39 days. The antibody titre range within the samples of same group, the highest (10219) was observed at the age of 39 days in group-A and the lowest (1019) in control group (Table 2).
after vaccination, 32 Days = 14 days after vaccination and 39 Days = 21 days after vaccination.

The antibody titer against Infectious Bursal Diseases (IBD) at different ages of Layer Birds in Group-A, 1 day old = MDA titer at 1 Day, 7 days = MDA titer at 7 days old, 25 days = 7 days after vaccination, 32 Days = 14 days after vaccination and 39 Days = 21 days after vaccination.

The antibody titer against Infectious Bursal Diseases (IBD) in vaccinated and Control group at different ages of Layer Birds in Group. 1 day old= MDA titer at 1 Day, 7 days = MDA titer at 7 days old, 25 days= 7 days after vaccination, 32 Days = 14 days after vaccination and 39 Days = 21 days after vaccination.

| Group level | MDA Titer | Vaccinated Titer | F value | P value | LS |
|-------------|-----------|------------------|---------|---------|----|
| Group -A    | 6227.69±327.63 | 2075.50±215.22 | 4657.38±423.52 | 7608.94±375.87 | 9121.94±657.05 | 37.56 | <0.001 | ** |
| Group -B    | 6227.69±327.63 | 2075.50±215.22 | 3120.94±351.34 | 6635.81±431.99 | 7648.75±511.58 | 45.16 | <0.001 | ** |
| Control     | 6227.69±327.63 | 2075.50±215.22 | 752.44±170.96  | 595.94±80.14   | 469.38±80.7    | 155.65 | <0.001 | ** |

In Table 2, the antibody titer range (Maximum - Minimum) at different age’s birds of Group-A, Group-B and Control is presented. The antibody titer range at different ages is shown in Figure 3. The individual samples antibody titer is presented in the Figure 2, 3 and 4 for the birds of Group-A, Group-B and Control respectively. The IBD antibody titer of control group’s birds showed that their titer at 25 days fluctuated rapidly within the samples than the antibody titer of intermediate and intermediate plus strain vaccinated groups at different ages. The MDA titer also fluctuated markedly with in the samples at the age of 1 days. The table 3 shows that the antibody mean titer and MDA mean titer were significantly (p<0.01) higher than the protective titer.
The MDA titer at 1 day of age had the higher effect size (4.10; CI: 4675.36-6072.01; n=16) and mean differences (5373.69) was than the 7 days. In case of group-A, the highest effect size (4.49; CI: 5953.80-7556.08; n=16) was at the age of 32 and 39 days and the highest mean differences (8267.94; CI: 6867.46-9668.41; n=16) was at the 39 days old birds. The layer birds of Group-B had the highest effect size (3.35; CI: 4861.04-6702.59; n=16) was at the age of 32 days. Interestingly, the birds of control group had the negative effect size at all the ages except their MDA. The bursa of Fabricius weight was increased according to the age of the birds of each group (Table 4).

| Variable | Test Value: > 853 |
|----------|------------------|
| Category | MDA              |
|          | 1 Day Old        |
|          | 7 Days           |
|          | 25 Days          |
|          | 32 Days          |
|          | 39 Days          |
|          | Group-A          |
|          | 1 Day Old        |
|          | 7 Days           |
|          | 25 Days          |
|          | 32 Days          |
|          | 39 Days          |
|          | Group-B          |
|          | 1 Day Old        |
|          | 7 Days           |
|          | 25 Days          |
|          | 32 Days          |
|          | 39 Days          |
|          | Control          |
|          | 1 Day Old        |
|          | 7 Days           |
|          | 25 Days          |
|          | 32 Days          |
|          | 39 Days          |
|          | 1 day old; MDA titer at 1 Day, 7 days = MDA titer at 7 days old, 25 days= 7 days after vaccination, 32 Days = 14 days after vaccination and 39 Days = 21 days after vaccination. |

The Bursa of Fabricius weight (Mean±SEM) at different age’s birds of different Groups

| Group level | Test Value: > 853 |
|-------------|------------------|
|             | Bursa of Fabricius weight (Mean±SEM) |
|             | F value | P value | LS |
|             | Group-A | 25 Days | 32 Days | 39 Days |
|             | 0.95±0.06 | 1.45±0.03 | 1.95±0.12 | 24.57 | 0.005 |
|             | Group-B | 0.79±0.03 | 1.35±0.05 | 1.77±0.04 | 94.86 | 0.000 |
|             | Control | 0.63±0.04 | 1.25±0.03 | 1.68±0.06 | 121.28 | 0.001 |
|             | F value | 12.83 | 1.77 | 2.64 |
|             | P value | 0.002 | 2.25 | 1.25 |
|             | LS | ** | NS |

The highest bursa mean weight was 1.95±0.12 found at the age 39 days in group-A birds vaccinated by GM-97 strain of Intermediate plus, but there was no significant difference with the control and group vaccinated by “Intermediate type” (Group- B). Only the significant difference was observed at the age of 25 days. None of the vaccines hamper the growth of birds’ which was reflected by the significantly (p<0.01) increased body weight according to their age. Even though, the highest growth rate was observed in birds vaccinated by GM-97 strain of Intermediate plus (group A) where the body weight was 534.5±18.98 at the age of 39 days (Table 5). The BF:BW ratios at 25 days of age were significantly (p<0.01) higher (7.53±0.28) in group A than others (Table 6). But in the other ages there was no significant difference among the groups in terms of the BF:BW ratios. Though the BF-BW index was highest (1.53±0.09) in group-A at 25 days, but at 39 days old the mean of BF:BW index was higher in group-B. There was no any significant (p<0.05) difference between the vaccinated group in contrast of BF:BW index.

The table 7 Shows that the mean of histopathological lesion scores (HLS) was gradually decreases according to increasing their (birds) ages. Interestingly, the mean of HLS was significantly (p<0.01) decreased up to 39 days of old only in the control group (non-vaccinated). At the age of 25 days, the HLS mean of the

Table 3 Comparison of mean antibody titer of each age of different groups birds with the positive antibody titer (>853)

| Variable | Test Value: > 853 |
|----------|------------------|
| Category | MDA              |
|          | 1 Day Old        |
|          | 7 Days           |
|          | 25 Days          |
|          | 32 Days          |
|          | 39 Days          |
|          | Group-A          |
|          | 1 Day Old        |
|          | 7 Days           |
|          | 25 Days          |
|          | 32 Days          |
|          | 39 Days          |
|          | Group-B          |
|          | 1 Day Old        |
|          | 7 Days           |
|          | 25 Days          |
|          | 32 Days          |
|          | 39 Days          |
|          | Control          |
|          | 1 Day Old        |
|          | 7 Days           |
|          | 25 Days          |
|          | 32 Days          |
|          | 39 Days          |
|          | 1 day old; MDA titer at 1 Day, 7 days = MDA titer at 7 days old, 25 days= 7 days after vaccination, 32 Days = 14 days after vaccination and 39 Days = 21 days after vaccination. |

Table 4 The Bursa of Fabricius weight (Mean±SEM) at different age’s birds of different Groups

| Group level | Test Value: > 853 |
|-------------|------------------|
|             | Bursa of Fabricius weight (Mean±SEM) |
|             | F value | P value | LS |
|             | Group-A | 25 Days | 32 Days | 39 Days |
|             | 126.25±4.64 | 210.25±3.2 | 534.5±18.98 | 423.72 | 0.00 |
|             | Group-B | 121.5±5.85 | 181.75±4.4 | 492.25±9.0 | 131.24 | 0.00 |
|             | Control | 127.5±4.73 | 192.25±5.98 | 472.5±4.17 | 173.91 | 0.00 |
|             | F value | 0.38 | 9.54 | 6.54 |
|             | P value | 0.692 | 0.006 | 0.18 |
|             | LS | NS | ** | |

Table 5 The Live Body weight (Mean±SEM) at different age’s birds of different Groups

| Group level | Test Value: > 853 |
|-------------|------------------|
|             | Live Body weight (Mean±SEM) |
|             | F value | P value | LS |
|             | Group-A | 25 Days | 32 Days | 39 Days |
|             | 7.53±0.28 | 6.88±0.53 | 3.66±0.29 | 1.53±0.09 | 1.07±0.11 | 1.03±0.09 |
|             | Group-B | 6.55±0.27 | 7.42±0.22 | 3.59±0.09 | 1.34±0.09 | 1.15±0.07 | 1.01±0.01 |
|             | Control | 4.95±0.29 | 6.33±0.33 | 3.56±0.11 | 1.25±0.09 | 1.15±0.07 | 1.01±0.01 |
|             | F/t value | 21.47 | 1.35 | 0.08 | 1.55 | 0.618 | 0.271 |
|             | P value | 0.000 | 0.530 | 0.921 | 0.383 | 0.560 | 0.796 |
|             | LS | ** | NS | NS | NS | NS |

Table 6 The Bursa of Fabricius: Live Body weight ratio and Index (Mean±SEM) at different age’s birds of different Groups

| Group level | Test Value: > 853 |
|-------------|------------------|
|             | Ratio (Mean±SEM) |
|             | Index (Mean±SEM) |
|             | 25 Days | 32 Days | 39 Days |
|             | 25 Days | 32 Days | 39 Days |
|             | Group-A | 7.53±0.28 | 6.88±0.53 | 3.66±0.29 | 1.53±0.09 | 1.07±0.11 | 1.03±0.09 |
|             | Group-B | 6.55±0.27 | 7.42±0.22 | 3.59±0.09 | 1.34±0.09 | 1.15±0.07 | 1.01±0.01 |
|             | Control | 4.95±0.29 | 6.33±0.33 | 3.56±0.11 | 1.25±0.09 | 1.15±0.07 | 1.01±0.01 |
|             | F/t value | 21.47 | 1.35 | 0.08 | 1.55 | 0.618 | 0.271 |
|             | P value | 0.000 | 0.530 | 0.921 | 0.383 | 0.560 | 0.796 |
|             | LS | ** | NS | NS | NS | NS |
vaccinated group was not significantly (p<0.01) differed with the control group. But at the age of 32 and 39 days only the HLS mean of group-A significantly (p<0.01) differed than the control group and had the highest HLS mean of 4.75±0.25 and 3.5±0.65 respectively.

### Table 7 The histopathological lesion scores (HLS) of the bursa of Fabricius at different ages birds of different Groups

| Group level | The HLS of the bursa of Fabricius (Mean±SEM) | F value | P value | LS |
|-------------|---------------------------------------------|---------|---------|----|
| Group-A     | 4.25±0.30.25                                | 1.96    | 0.248   | NS |
| Group-B     | 3.5±0.65                                    | 1.0     | 0.403   | NS |
| Control     | 2.75±0.48                                   | 10.33   | 0.49    |    |
| P value     | 2.38                                        | 3.90    |         |    |
| P value     | 0.148                                       | 0.007   | 0.047   |    |

|   | **column values with the same letters do not differ significantly;** | **row values with same letters do not differ significantly;** | **level of significance; SEM:** Standard Error of Mean; 25 days= 7 days after vaccination; 32 Days = 14 days after vaccination and 39 Days = 21 days after vaccination. |

### DISCUSSION

In this study, both the vaccines are capable to produce protective immunity increase at 39 days (3 w.p.v.), which was reflected by comparing with the non-vaccinated group (control). Similar observation also reported by other study where the IBD live-vaccinated birds showed a significant IBDV antibody titer increase at 42 days and the non-vaccinated group gradually decreased (Prandini et al., 2016). The author Prandini et al. (2016) also reported that the IBD-neutralizing antibody titer significantly (p<0.05) higher in the groups of bird that vaccinated by intermediate and the intermediate plus vaccines of IBD compared to the non-vaccinated group which is in line with the present study.

The maternally derived antibody (MDA) was in protective level with an increased amount. Specially, the offspring of the vaccinated breeders would have higher titers of passive immunity just after hatching (Michell et al., 2009). This immunity (MDA) may remain in protective level up to 7 days of post hatching. Some reports revealed that the passively immunized chicks (MDA) when vaccinated with an intermediate IBDV strain in the first day of age did not show an increase in antibody titers (Moraes et al., 2005). The authors Thonrongswannakij et al. (2021) suggested that the MDA of IBD had a downward tendency after the hatching and sharply decline to non-protective level after 1 week of age. This report has the similarities with the finding of the present study. This might be due to the 1st dose of vaccine was administered at the 7 days when the MDA start to go down the protective level. Because the high MDA at the time of IBDV vaccination may interfere with the vaccine response and neutralize the vaccine virus under laboratory conditions (Alam et al., 2002; Hair-Bejo et al., 2004; Moraes et al., 2005). In this study, the revaccination was done. Because the flocks vaccinated by 1st dose of IBD vaccine at the optimal time point, can develop the detectable humoral immunity and remain up to 14 days post vaccination (Block et al., 2007). Among the two vaccines of IBD (“GM-97 strain of Intermediate plus” and “Intermediate type”), the Intermediate type plus type increased the ELISA antibody titer within very short time than the Intermediate type. Because the Intermediate plus types are moderately attenuated whereas the Intermediate type is very attenuated. The authors Rautenschlein et al. (2005) reported that the Intermediate plus vaccine induced the ELISA antibody levels at 14 days of postvaccination (PV) whereas the intermediate type vaccines induced at 28 days of PV. For this reason, the current study found that the intermediate plus vaccine birds showed the higher immunity than the intermediate type vaccinated birds. However, another author Thonrongswannakij et al. (2021) reported that an intermediate type (M.B. vaccine) vaccinated broiler birds displayed significantly higher antibody titers than the V217 (intermediate plus vaccine) vaccinated broiler birds. The current study revealed that the highest IBD antibody mean titer was found in the 39 days old vaccinated birds. These findings agree with the other authors (Jukka et al., 2014; Prandini et al., 2016) who reported that the IBD live-vaccinated birds exhibited a significant IBD antibody titer increase at 42 days of post hatch. Though, the birds of all three groups have significantly increased their live body weight with age, but significant differences were between the groups at 32 and 39 days. The body weight was significantly higher in GM-97 intermediate plus type vaccinated birds. The findings of Thonrongswannakij et al. (2021) oppose to this result, where the authors reported that there were no significant differences between the group of broiler birds. The author Thonrongswannakij et al. (2021) also reported that the bursa weight was higher in vaccinated group up to 29 days old. In the current study, the bursa weight was higher in vaccinated group up to 39 days old. Similarly, the bursa weight was also high in the vaccinated group than the control group, which was also dissimilar with the findings of other author Thonrongswannakij et al. (2021). This variation might be due the differences in poultry species. The bursa lesions were high in vaccinated group specially vaccinated by intermediate plus type at 25 days and also had the significant differences at 32 and 39 days. The bursa live vaccines may have a significant depressive effect on B lymphocytes as displayed by histological lesions in bursa of fabrius after vaccination (Prandini et al., 2016). However, the bursal lesions may develop later than would be expected from this study in SPF layer-type chickens, due to residual levels of MDA (McCart et al., 2005; Rautenschlein et al., 2005). Though, the live vaccine can generate the antibody titer quickly, but the live IBD virus vaccine may be neutralized or break through the increased MDA and induce enduring damage to the young broiler chick’s immune response (Ray et al., 2021). The factors like vaccine manufacturers guidelines for storage, timing, and due dates, consult veterinarians and health status monitoring before vaccine administration to the birds (Fesseha, 2020).

### CONCLUSIONS

The results of this study indicate that the protective level of IBDV MDA titer may remain up to 1 week of post hatching. Both the intermediate type and intermediate plus (GM97 strain) are able developed the protective antibody and persists for more than 39 days. Comparatively, the Intermediate plus vaccine can generate higher antibody titer than the intermediate type. In addition, the intermediate plus strain induced significantly higher bursal lesions at 14 and 21 d.p.v., significantly higher bursa of Fabricius weight and BF:BW ratios at 7 d.p.v. Compared to the intermediate type vaccinated group. Finally, it needs to be remembered that only one intermediate and one intermediate plus type IBDV vaccine strain was tested in these field studies. Because the vaccine strain may differ in its efficacy and other characteristics from this intermediate and intermediate plus type IBDV vaccine strains. However, the findings of this study can be used to determine the IBD vaccination program for layer pullets in flocks where IBD live vaccines are applied. Therefore, the further study would be long-term monitoring of antibody titer as well as molecular characterization of vaccine virus strain from bursa of Fabricius after vaccination.

### Running (short) title: Comparative Antibody titer of Vaccines of IBDV

### Authors’ Contributions: M.G.H. and M.M.M. developed the concept and planned the experiments. M.G.H., M.M.M., M.T.I. and D.R.G. were involved to carry out the experiment. M.M.M. interpreted the result, analyzed data statistically and contributed to writing the manuscript. All authors read the article, provided critical feedback and approved the manuscript to be published.

### Acknowledgements: We would like to thanks the Diamond Egg Ltd, Birujuli, Tok, Kapasia, Gazipur and Sufian agro care Lab, Birujuli, Kapasia, Gazipur.

### Competing Interests: The authors declare that there is no conflict of interest.

### Abbreviations: IBDV= Infectious Bursal Disease Virus, MDA= Maternally Derived Antibody, IB= Infectious Bursal disease, BW= Body Weight, BF= Bursa of Fabricius , HLS= Histopathological Lesion Score, ELISA= Enzyme Linked Immunobound assay and OD= Optical Density.

### REFERENCES

Afrin, M., Sachi, M., Meher, M., & Jahan, N. (2021). Evaluation of optimum dietary inclusion level of probiotics for potential benefits on intestinal histomorphometry, microbiota, and pH in Japanese Quails. Journal of Advanced Biotechnology and Experimental Therapeutics, 4(3), 265. https://doi.org/10.5455/ajbet.2021.d127

Alam, J., Rahman, M. M., Sif, B. K., Khan, M. S. R., Giasuddin, & M. S. K. Sarker. (2002). Effect of Maternally Derived Antibody on Vaccination Against Infectious Bursal Disease (Gumboro) with Live Vaccine in Broiler. International Journal of Poultry Science, 1(4), 98–101. https://doi.org/10.3923/ijps.2002.98.101

Block, H., Meyer-Block, K., Rebeki, D. E., Scharl, H., de Wit, S., Rohn, K., & Rautenschlein, S. (2007). A field study on the significance of vaccination against infectious bursal disease virus (IBDV) at the optimal time point in broiler flocks with maternally derived IBDV antibodies. Avian Pathology, 36(3), 401–409.

Daoud, O. B., Oludairo, O. O., Ayiedu, J. O., Ambali, H. M., Kadir, R. A., Daoud, O. C., Oluorunshola, I. D., & Adah, A. (2018). Assessment of antibody assay methods in determination of prevalence of infectious bursal disease among local chickens and guinea fowls in Kwara state, North Central Nigeria. Veterinary
