Sero-Prevalence and Associated Risk Factors of Mycoplasma Gallisepticum, Mycoplasma Synoviae and Salmonella Pullorum / Gallinarium in Poultry

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ABSTRACT

In the present study, a total of 1667 sera samples were collected from breeder, broiler and layer birds to determine sero-prevalence of Mycoplasma gallisepticum (MG), Mycoplasma synoviae (MS), Salmonella pullorum and Salmonella gallinarium (SPG) infections. Serum Plate Agglutination (SPA) test was used to determine the presence of antibodies against commercial MG, MS and SPG antigens. The overall sero-prevalence of MG, MS and SPG in case of broilers was 7.14, 10 and 5.35%, in the layer birds was 44.9, 42.6 and 51.32% and in broiler breeders was 59.6, 50.13 and 44.1% respectively. The study shows that sero-prevalence of MG and MS was higher in breeder as compared to that of layers and broilers. However, for SPG the prevalence was found highest in layers. The sero-prevalence of MG was higher in female birds while of MS and SPG higher in males. The highest prevalence for all pathogens was found in the period from October to December.

INRODUCTION

Infectious diseases have been a continuous threat in poultry production systems (Naqvi et al., 2017; Mahmood et al., 2018; Rehman et al., 2018; Abbas et al., 2017, 2019a, 2019b; Zhang et al., 2020). Likewise, Mycoplasmosis and Salmonellosis are diseases of paramount importance in every type of chicken. Two main pathogens that cause mycoplasmosis in poultry birds are Mycoplasma gallisepticum (MG), Mycoplasma synoviae (MS). Chronic respiratory disease (CRD) in chickens is caused by MG (Shah, 2018). Young birds are more susceptible to MG although birds of all age are prone to this pathogen (Seifi and Shirzad, 2012). MG is transmitted vertically by trans-ovarian method or horizontally by direct or indirect contact (Shah, 2018). Respiratory sounds, nasal and ocular discharge, coughing, conjunctivitis and drop in egg production are major clinical signs of MG infection (Shah, 2018).

MS causes upper respiratory tract infection leading to damage to air sacs and bed for other respiratory pathogens (Kleven, 2003; Seifi and Shirzad, 2012). MS infection causes chronic or acute synovitis if infection becomes systemic. Along with respiratory signs, birds infected by MS show joint abnormalities and egg shell and production losses. Layer flocks infected with MS show sharp decrease in egg production. MS may be transmitted both by horizontal or vertical means and may persist in flock as sub clinical form (Heleili et al., 2012). MS may be detected on basis of clinical signs, epidemiological findings and serology followed by culture and isolation (Luciano et al., 2011). Fowl typhoid and pullorum disease are two most important bacterial diseases of chickens caused by Salmonella gallinarium and Salmonella pullorum (Ansari et al., 2017). Pullorum disease and fowl typhoid has become a wide spread problem due to expansion in poultry farming. Both these diseases show similar clinical signs and are of serious concern in all types of young and adult chickens. These diseases are vertically transmitted through egg to embryos. Salmonella pullorum and Salmonella gallinarium are frequently diagnosed by culturing and serological tests. Infected flocks are detected by serum agglutination test and used to find prevalence of infection in the flock (Sarkar et al., 2005).
Keeping in view of the economic importance of MG, MS and SPG, this study is designed to determine sero-prevalence of all four pathogens in different types of chickens.

MATERIALS AND METHODS

A total of 1667 serum samples were taken randomly from broiler (n=280), layer (n=657) and broiler breeder (n=730) from the poultry farms located in the different regions of Rawalpindi during 2016-2017. Blood (1.5-2.0 mL) was collected from wing vein aseptically in sterile disposable plastic syringes and kept at room temperature for 1-2 hours. Sera samples were separated and stored in sterile vials at 4°C until further usage.

MG, MS and SPG antigen: Standard MG antigen (code SL 212, inactivated coloured antigen), MS antigen (code SL 222, inactivated coloured antigen) and SPG antigen (code SL 242, inactivated coloured antigen) from Soleil diagnostics France were purchased for detecting antibodies in sera by serum plate agglutination test (SPA).

Serum plate agglutination (SPA) test: The SPA test was performed by placing serum by side by side 20 μl of serum and 20 μl of antigen on glass slide with help of micropipette. Antigen and serum were mixed properly with help of stirrer and results were recorded within two minutes. Samples were considered positive where agglutination or granule formation occurred, otherwise samples were marked negative. Positive samples were graded (+) to (++++) according to extent of agglutination. The test was performed in similar way for detection of MG, MS and SPG antibodies in the serum samples. Known positive and negative control sera were used for validating evaluation of SPA test.

Statistical analysis: Chi-square test was performed to test the significance of the prevalence results.

RESULTS AND DISCUSSION

Overall sero-prevalence of MG, MS and SPG: In broiler breeders the overall Sero-prevalence of MG and MS was found the highest as compared to layers and broilers. For SPG highest sero-prevalence was found in layer birds. Sero-prevalence of MG, MS and SPG in layer birds was found to be 44.9, 42.60 and 51.32% respectively (Table 1).

According to the present study sero-prevalence of MG in case of broiler breeder was 59.6% while in broilers it was 7.14%. The overall sero-prevalence of MG in chicken on average was 45.96%. Earlier studies conducted show that over all sero-prevalence of MG in chicken on average was 48.8% by Junior et al. (2017). The incidence of MG by SPA was found to be 44.9% whereas by Islam et al. (2014) it is less than 53.61%. The sero-prevalence of MG in breeder flock is 58.9% by Sarkar et al. (2005) which is also in line with the results of present study. The incidence of MG in broiler breeder was shown to be 14.2% in 2002, 21.4% in 2003, 10.3% in 2004, 3.9% in 2005 and 2.5% in 2017 (Seifi and Shirzad, 2012; Alavinia et al., 2017). The study that there was variation in the incidence of MG in the different years. The variation in sero-prevalence findings of MG in chicken in different studies may be due to difference in management practices, treatment regime and bio-security measures (Junior et al., 2017).

The overall sero-prevalence of MS in all types of chickens was found to be 40.43%. The sero-prevalence of MS in chickens was found to be 66.33% by Helelli et al. (2012) which is higher than results of present study. The incidence of the MS was highest in the broiler breeder (50.14%) and lowest in broiler (10%), while in case of layer incidence of MS was found to be 42.60%. In another study by Michiels et al. (2016) the MS was found very low in broilers (12.9%). The low prevalence of MS in broilers is may be due to short life span of broilers and extensive antibiotic treatment (Michiels et al., 2016).

The overall sero-prevalence of SPG was found to be 41.8% in all types of chickens. The sero-prevalence of SPG in case of broiler was very low i.e. 5.36% as compared to that of the El-Sharkawy et al. (2017). A total of 45% of the sampled 1-week-old broiler flocks and 38% of the 5-week-old broiler flocks tested positive for SPG (El-Sharkawy et al., 2017). The sero-prevalence of SPG in broiler was two to four times less as compared to layers. This difference might be due to longer life of layers and breach in the managemental conditions during their longer life span. The incidence of SPG in layers was reported to be 63.5% (Rahman et al., 2013). This finding is discordant with the present study in which incidence of SPG in layers is 51.32%. These reports show different incidence than current study and it may be due to difference in geographical variation and difference in management conditions.

Sero-prevalence of MG, MS and SPG and effect of age: Sero-prevalence of the pathogens was compared in the different groups based on age in the case of layers and broiler breeders (Table 2). The sero-prevalence of all the three pathogens was more in case of birds which were older than 20 weeks. The highest prevalence of MG was 73.94% in broiler breeders, whereas, in layers it was 33.15% at the age of 20 weeks. The prevalence of MS was highest in layers (54.09%) as compared to broiler breeders (48.04%) at the age 21 weeks above. The highest prevalence of SPG was found in broiler breeders (54.52%) at the age 21 weeks and above (Table 2). Mukhtar et al. (2012) showed the highest sero-prevalence of MG in case of pullets than adults and laying birds. Similar results are also reported by Hossain et al. (2010) and Sarkar et al. (2005). In model breeder poultry farms the sero-prevalence of MG was found to be 71% at 18 week of age and 50% at 49 week of age (Sarkar et al., 2005). It has also been seen that that prevalence of MG in the breeder was decreased with increase in age. According to Sarkar et al. (2005) it was recorded 73% in the 20 week old birds and 60% in the 42 week old birds. Higher prevalence in the younger birds might be due to the vertical transmission of the disease.

Sero-prevalence of MG, MS and SPG and effect of gender: Sero-prevalence of MG, MS and SPG pathogens was compared in different groups based on sex of birds in case of broiler breeder. Gender wise prevalence revealed higher in females; MG (52%) and SPG (24%) was in case of female birds while MG (46%) and SPG (15%) in case of male birds.
There is more predisposition of birds to these pathogens when temperature is low. The study has shown that sero-prevalence of MG and MS was higher in breeder than layers and for SPG prevalence was highest in layers. A very high sero-prevalence of MG, MS and SPG requires strict biosecurity measures for control of these pathogens in poultry.

Conclusions: The study has shown that sero-prevalence of MG and MS was higher in breeder than layers and broilers and for SPG prevalence was highest in layers. A very high sero-prevalence of MG, MS and SPG requires strict biosecurity measures for control of these pathogens in poultry.

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REFERENCES
Abbas A, Iqbal Z, Abbas RZ, et al., 2017. In vivo anticoccidial effects of Beta vulgaris (sugar beet) in broiler chickens. Microb Path 111:139-44.
Abbas A, Abbas RZ, Khan MK, et al., 2019a. Anticoccidial effects of Trachyspermum ammi (Ajwain) in broiler chickens. Pak Vet J 39:301-4.
Abbas RZ, Abbas A, Raza MA, et al., 2019b. In vitro anticoccidial activity of Trachyspermum ammi (Ajwain) extract on oocysts of Eimeria species of chicken. Adv Life Sci 7:44-7.
Alavinia SJ, Marandi MV, Bahonar A, et al., 2016. Serological survey of Mycoplasma gallisepticum infection in broiler breeder farms in Mazandaran province by using RSPA and ELISA (through 2013). J Vet Res 71:351-7.
Ansari F, Pourjafar H, Bokaie S, et al., 2017. Association between poultry density and salmonella infection in commercial laying flocks in Iran using a kernel density. Pak Vet J 37:299-304.
Bachayas HA, Abbas RZ, Raza MA, et al., 2015. Existence of coccidiosis and associated risk factors in broiler chickens in Southern Punjab, Pakistan. Pak Vet J 35:81-4.
El-Sharkawy H, Tahoun A, El-Gohary AEGA, et al., 2017. Epidemiological, molecular characterization and antibiotic resistance of Salmonella enterica serovars isolated from chicken farms in Egypt. Gut Pathog 9:8.
Heleili N, Ayachi A, Mamache B, et al., 2012. Seroprevalence of mycoplasma synoviae and mycoplasma gallisepticum at batna commercial poultry farms in Algeria. Vet World 5:709-12.
Hossain KMM, Hossain MT and Yamato I, 2010. Seroprevalence of salmonella and mycoplasma gallisepticum infection in chickens in Rajshahi and surrounding districts of Bangladesh. Inter J Biol 2:74-80.
Islam M, Hassan J and Khan RSM, 2014. Seroprevalence of mycoplasma gallisepticum infection in backyard and commercial layer chickens in Bhola District, Bangladesh. J Adv Vet Anim Res 1:1-5.
Júnior MA, Taunde P, Zandamela AF, et al., 2017. Serological screening suggests extensive presence of Mycoplasma gallisepticum and Mycoplasma synoviae in backyard chickens in Southern Mozambique. J Vet Med 4:1-4.
Luciano RL, Cardoso SP and Stoppa GF, et al., 2011. Comparative study of serological test of Mycoplasma synoviae diagnosis in commercial poultry breeders. Vet Med Int 5:1-5.
Mahmood MS, Amir HW, Abbas RZ, et al., 2018. Evaluation of antiviral activity of Azadirachta indica (Neem) bark extract against Newcastle disease virus. Pak Vet J 38:25-8.
Michiels T, Welby S, Vanrobaeys M, et al., 2016. Prevalence of Mycoplasma gallisepticum and Mycoplasma synoviae in commercial poultry, racing pigeons and wild birds in Belgium. Avian Pathol 45:244-52.
Mukhtar M, Awais MM and Anwar et al., 2012. Sero-prevalence of Mycoplasma gallisepticum among commercial layers in Faisalabad, Pakistan. J Basic Appl Sci 8:183-6.
Naqvi MAH, Khan MK, Iqbal Z, et al., 2017. Prevalence and associated risk factors of haemoparasites, and their effects on hematological profile in domesticated chickens in District Layyah, Punjab, Pakistan. Prev Vet Med 143:49-53.
Rehman SU, Saleemi MK, Khan MZ, et al., 2018. Molecular epidemiology and pathology of chicken infectious anemia in day old broiler chicks in Faisalabad, Pakistan. Int J Agric Biol 20:57-61.
Sarkar SK, Rahman MB, Rahman M, et al., 2005. Sero-prevalence of Mycoplasma gallisepticum infection in chickens in model breeder poultry farms of Bangladesh. Int J Poult Sci 4:32-5.
Seifi S and Shirzad MR, 2012. Seroprevalence and risk factors of Mycoplasma gallisepticum infection in Iranian broiler breeder farms. Int J Anim Vet Adv 4:45-8.
Shah AH, 2018. Seroprevalence of Mycoplasma gallisepticum and Mycoplasma synoviae in Commercial Broilers and Backyard Poultry in Five Districts of Khyber Pakhtunkhwa-Pakistan. Pak Vet J 38:149-52.
Zhang K, Li X, Na C, et al., 2020. Anticoccidial effects of Camellia sinensis (green tea) extract and its effect on Blood and Serum chemistry of broiler chickens. Pak Vet J 40:77-80.