Indian J. Anim. Hlth. (2017), 56(1) : 77-84

Research Article

SEROPREVALENCE OF SALMONELLA IN BREEDER FLOCKS IN DIFFERENT PARTS OF INDIA

S. BAKSI*, N. RAO, V. JOGANI, D. PATEL AND D. RAVAL

Hester Biosciences Limited
Ahmedabad, Gujarat, India
Pin- 380 006

Fowl typhoid is a contagious and septicaemic disease of poultry. It affects breeder and broiler chickens and is highly prevalent in most of the countries. India has a significant role in poultry industry and fowl typhoid affects majorly egg production and chicken quality. Several states of India were considered for the seroprevalence study after collection of blood samples from commercial breeder flocks. Rapid serum agglutination test (RST) was performed to detect presence of antibodies. Overall seroprevalence of 14.69% was found in all 490 samples. Highest seroprevalence was found in Karnataka state with 21.73%, while it was observed lowest in Haryana state (8.86%). Birds ageing more than 45 weeks were found most seropositive for antibodies against *Salmonella* (21.51%). It was also observed that fowl typhoid spreads and infects the birds highest in monsoon season (20.83%), whereas it was found least in winter (7.42%). Appropriate biosecurity measures, cleaning and disinfection processes can prevent the occurrence, and improve egg quality and production. The study can be extended with data of other states and with isolation and identification of bacteria.

Key words: Breeders, Fowl typhoid, India, Poultry, Seroprevalence

Fowl typhoid (FT) is septicaemic disease primarily of chickens and turkeys, caused by gram negative bacteria *Salmonella* Gallinarum, *Salmonella* Pullorum and *Salmonella* Enteritidis. Chickens are normal hosts of the bacteria, but they also infect turkeys, guinea-fowls, quails, pheasants, parrots and sparrows. FT transmits through number of ways, i.e., infected birds, infected eggs, faeces, feed contamination, water contamination and contact transmission (Nilukshi *et al.*, 2016) The disease is often characterized by rapid spread and having high morbidity and mortality (OIE, 2012). It varies with age and strain of birds, nutritional status, cleanliness and concurrent infections (Wong *et al.*, 1996). It occurs in all ages of birds and causes symptoms like diarrhoea, depression, dehydration, ruffled feathers, somnolence and anorexia. This results into

*Corresponding Author

severe drop in egg production (Johnson *et al.*, 1992).

FT was first recognised by Klein in 1888. It is almost eradicated from developed nations like USA, Canada, Australia and UK. It is found prevalent in African and Indian subcontinent and some European countries. In India also, it is reported to be prevalent in some states (Prakash *et al.*, 2005 and Nazir *et al.,* 2012).

Poultry industry plays a significant role in Indian economy as many small and big farmers are associated with egg and chicken production (Shivaprasad, 2000). Present study was aimed to investigate the presence of fowl typhoid antibodies in seven states (Haryana, Tamil Nadu, Karnataka, Telangana, Maharashtra, Madhya Pradesh and West Bengal) of India. For the study, blood samples were collected and presence of antibodies against Salmonella antigen was detected. Rapid serum agglutination test (RST) was performed as per method described by OIE.

MATERIALS AND METHODS

Sample Collection: Total 490 sera samples were collected from seven states of India (Haryana, Tamil Nadu, Karnataka, Telangana, Maharashtra, Madhya Pradesh and West Bengal) and stored at -20 °C. All birds had no clinical signs during collection.

Testing method: Rapid serum agglutination test (RST) was performed as per guidelines of OIE, 2012 to evaluate the serum samples. Serum samples were allowed to gain room temperature before testing. Clean white tile marked into squares of 3x3 cm was used, which contained 12 squares for testing. One drop (about 0.02 mL) of crystal violet stained antigen (procured from Venkateshwara Hatcheries Pvt. Ltd.) was added in each square first. One drop of serum sample of same size was placed into each square. Both antigen and serum samples were mixed with sterile fine glass rod. Care was taken to prevent mixing of components of two squares. The samples were agitated gently for two minutes.

Data analysis: Positive reaction was indicated by clumping of antigen within two minutes. Samples were considered negative, if no clumping was observed within two minutes. Results were recorded as positive or negative. All data were entered into Microsoft Office Excel Worksheet (2013, Microsoft Corporation). The data were analyzed by single factor – analysis of variance method and $p < 0.05$ was considered as significant difference between the groups.

RESULTS

Total 490 sera samples were tested using Rapid serum agglutination test (RST). Out of them, 72 samples were found positive for Salmonella antibodies (Overall occurence-14.69%). The samples were from seven different states of India (Haryana, Tamil Nadu, Karnataka, Telangana, Maharashtra, Madhya Pradesh

and West Bengal). The presence of antibodies was found highest in Karnataka (21.73%), which was significantly higher than that of Haryana state (8.86%) with lowest seropresence (Table 1).

The samples were also divided into four age groups i.e., <15, 15-30, 30-45 and >45 weeks. In present study, antibodies were found highest in birds ageing more than 45 weeks (21.51%). The data were significantly higher than that of age group of 15-30 weeks (9.41%, Table 2).

Effect of season was also studied on seroprevalence of Salmonella. It was found highest in monsoon season (20.83%). The infection was found least prevalent in winter season (7.42%).

Table 1. State-wise seroprevalence of Salmonella

State	No. of Samples	No. of Positive Samples	Prevalance*(%)
Haryana	79	7	8.86^{b}
Tamil Nadu	51	9	17.64^{ab}
Karnataka	46	10	21.73^{a}
Telangana	86	17	19.76^{ab}
Maharashtra	105	10	9.52^{ab}
Madhya Pradesh	75	11	14.66^{ab}
West Bengal	48	8	16.66^{ab}
Total	**490**	**72**	**14.69**

* $p < 0.05$, means having different superscript in the same column differ significantly

Table 2. Age-wise seroprevalence of Salmonella

Age group (Weeks)	No. of samples	No. of positive samples	Prevalence* (%)
≤15	101	10	9.90^{ab}
15-30	85	8	9.41^{b}
30-45	132	17	12.87^{ab}
≥ 45	172	37	21.51^{a}
Total	**490**	**72**	**14.69**

* $p < 0.05$, means having different superscript in the same column differ significantly

DISCUSSION

Fowl typhoid is a septicaemic disease prevalent in many countries throughout the world. It is eradicated from many developed countries like USA, Canada, Australia, Japan and many countries of Europe (Bouzoubaa and Nagaraja, 1984 and Shivaprasad, 2000). The disease is still common in Mexico, Central and South America, Africa and Indian subcontinent (Bhattacharyya *et al.*, 1984; Lucio *et al.*, 1984; Silva, 1984; Chishti *et al.*, 1985; Siddique *et al.*, 1987; Javed *et al.*, 1990; Majid *et al.*, 1991; Barrow *et al.*, 1992; Nabbut, 1993; Mayahi *et al.*, 1995, Hoop and Albicker, 1997; Hoque *et al.*, 1997 and Sato *et al.*, 1997). In India also, seroprevalence was found in birds in different states. In present study, overall seroprevalence of 14.69% was found in India in breeder birds, while other researchers found 2.6%, 2.7% and 12.28% in Tamil Nadu, Haryana and Uttarakhand respectively in broilers (Arora *et al.*, 2015 and Murugadas *et al.*, 2015). The prevalence study was carried out in Nigeria (19.3%), Ethiopia (0.8%), Argentina (23.9%), Bangladesh (46.2%) and Tanzania (28%) (Okwori *et al.*, 2007; Kassaye *et al.*, 2010; Xavier *et al.*, 2011; Rahman *et al.*, 2011 and Bura *et al.*, 2014). Overall seroprevalence was found in different percentage in different regions of world as well as India. Researchers used agglutination test as a method to evaluate presence of Salmonella antibodies (Okwori *et al.*, 2007; Xavier *et al.*, 2011 and Rahman *et al.*, 2011). This test method is simple, rapid and accurate to perform as per guidelines of OIE (2012) and USDA (1996).

Age is also significant factor for incidence of fowl typhoid in breeder birds. Researchers have found that birds of highest age groups in respective studies were infected more than lower age groups (Sikder *et al.*, 2005; Akter *et al.*, 2007; Hossain *et al.*, 2010 and Salihu *et al.*, 2014). In agreement to this, in present study, birds ageing more than 45 weeks showed highest seroprevalence (21.51%). One research suggests that chicken starting laying eggs come under physical stress which makes them prone to infections (Saidu *et al.*, 1994). As the retention time of birds in the farms increases, chances of them to be infected increases. This can be prevented with proper cleaning and disinfection of drinking water. Once the birds are infected, they will produce infected eggs and thus infected birds, which continues the recirculation of infection (Shivaprasad, 2003).

It is also observed that fowl typhoid infection is more prevalent in monsoon season all over the world (Mbuko *et al.*, 2009 and Salihu *et al.*, 2014). Similar observations were found in present study, where 20.83% birds were found seropositive in monsoon season, whereas it was 16.32% in summer. Outbreaks of fowl typhoid are mostly observed when the

air is moist in rainy season. The rainy weather is responsible for infection and spread of the disease. Furthermore, it is the season when the egg production is higher. This results in production of infected eggs, hence infected chicks. This leads to high seroprevalence of Salmonella in birds.

Fowl typhoid can be prevented if proper biosecurity measures are taken at poultry farms of India. Awareness of cleaning and disinfection procedures in small farmers can help in prevention of infection to flocks. Care should be taken in feed and water supply as the disease spreads mainly through contaminated feed, water and surfaces. Further investigation can be done in breeder farms of other states of India and isolation and identification of pathogens.

REFERENCES

Akter MR, Choudhury KA, Rahman MM and Islam MS, 2007. Seroprevalence of salmonellosis in layer chickens with isolation, identification and antibiogram study of their causal agents. Bangl J Vet Med, 5 (1 & 2): 39–42

Arora D, Kumar S, Jindal N, Narang G and Kapoor PK *et al.*, 2015. Prevalence and epidemiology of *Salmonella* enterica serovar Gallinarum from poultry in some parts of Haryana, India. Vet Wld, 8(11): 1300-1304

Barrow PA, Berchieri A Jr and Al-Haddad O, 1992. Serological response of chickens to infection with *Salmonella* Gallinarum S. Pullorum detected by enzyme linked immunosorbent assay. Avian Dis, 36: 227-236

Bhattacharyya HM, Chakraborty GC, Chakraborty D, Bhattacharyya D and Goswami UN *et al.,* 1984. Broiler chick mortality due to pullorum disease and brooder pneumonia in West Bengal. Ind J Anim Hlth. 23: 85-88

Bouzoubaa K and Nagaraja KV, 1984. Epidemiological studies on the incidence of salmonellosis in chicken breeder/hatchery operations in Morocco. In Proc Int Sym on Sal: 337

Bura QT, Magwisha HB and Mdegela RH, 2014. Seroprevalence and risk factors for *Salmonella* Gallinarum infection in small holder layers in Mwanza City, Tanzania. Livest Res Rur Dev, 26: 10

Chishti MA, Khan UZ and Siddique M, 1985. Incidence of salmonellosis in chicken in and around Faisalabad. Pak Vet J, 5:79-82

Hoop RK and Albicker-Rippinger P, 1997. The infection with *Salmonella*

Gallinarum-Pullorum in poultry: experience from Switzerland. Sch Arch Tier, 139: 485-489

Hoque MM, Biswas HR and Rahman L, 1997. Isolation, identification and production of *Salmonella* pullorum coloured antigen in Bangladesh for the rapid whole blood test. Asi Aust J Ani Sci, 10: 141-146

Hossain KMM, Hossain MT and Yamato I, 2010. Seroprevalence of Salmonella and *Mycoplasma* Gallisepticum Infection in Chickens in Rajshahi and Surrounding Districts of Bangladesh. Int J Biol, 2: 2

Javed T, Hameed A and Siddique M, 1990. Status of salmonella in indigenous (domestic) chickens in Pakistan.Vet Arh, 60: 251

Johnson DC, David M and Goldsmith S, 1992. Epizootiological investigation of an outbreak of pullorum disease in an integrated broiler operation. Avi Dis, 36: 770-775

Kassaye A, Lencho T and Mesele A, 2010. Prevalence of Salmonella infection in Intensive Poultry Farms in Hawassa and Isolation of Salmonella species from sick and dead chickens. Ethiop Vet J, 14(2): 115-124

Lucio B, Padron M and Mosqueda A, 1984. Fowl typhoid in Mexico. In Proc Int Sym on Salmonella, 382-386

Majid A, Siddique M and Khan MZ, 1991. Prevalence of Salmonellosis in commercial chicken layers in and around Faisalabad. Pak Vet J, 11: 37-41

Mayahi M, Sharma RN and Maktabi S, 1995. An outbreak of blindness in chicks associated with *Salmonella* Pullorum infection. Ind Vet J, 72: 922-925

Mbuko IJ, Raji MA, Ameh J, Saidu L and Musa WI *et al.*, 2009. Prevalence and seasonality of fowl typhoid disease in Zaria-Kaduna State, Nigeria J Bact Res, 1(1): 001-005

Murugadas V, Visnuvinayagam S, Purushothaman V, Prabhakar TG and Prabhahar P *et al.*, 2015. Prevalence of Chicken Host and Nonhost Adapted Salmonella in Retail Outlet of Chennai, India. Asian J Anim Vet Adv, 10(12): 885-893

Nabbut N, 1993. The Salmonella problem in Lebanon and its role in acute gastroenteritis. J Food Prot, 56: 270-272

Nazir S, Kamil SA, Darzi MM, Mir MS and Nazir K *et al.*, 2012. Pathology of spontaneously occurring Salmonellosis in commercial broiler chickens of Kashmir Valley. J World Poult Res, 2: 63-69

Nilukshi L, Palika SF, Roshan MA, Gayani KM and Wijewardena G *et al.*, 2016. Control of poultry Salmonellosis - detection of carrier status in grandparent farms in Sri Lanka. Int J Livest Res, 6(8): 1-5

Okwori AEJ, Hashimu GA, Adetunji JA, Okeke IO and Junaid SA, 2007. Serological Survey of *Salmonella gallinarum* antibody in chickens around Jos, Plateau State, Nigeria. Onl J Hlth Al Scs, 2: 2

Prakash B, Krishnappa G, Muniyappa L and Kumar BS, 2005. Epidemiological characterization of avian *Salmonella* Enterica serovar infections in India. Int J Poult Sci, 4: 388-395

Rahman MR, Shahinuzzaman ABM, Saha AK, Sufian MA and Rahman MH *et al.*, 2011. Prevalence of Salmonella infection in naturally infected layer birds in Bangladesh. The Bang Vet, 28(1): 8-18

Saidu L, Abdu PA, Umoh JU and Abudallah US, 1994. Diseases of indigenous chickens. Bull Anim Hlth Prod Africa, 42: 19-23

Salihu AE, Onwuliri F, Mawak J, Kalshingi H and Hassan D, 2014. Seroprevalence of *Salmonella* Gallinarum Infection in free-range chickens rearedin nasarawa state, Nigeria. Egypt Poult Sci, 34(3): 665-680

Sato Y, Sato G, Tuchili L, Pandy GS and Nakajima A, *et al.*, 1997. Status of *Salmonella* Gallinarum Pullorum infections in poultry in Zambia. Avi Dis, 41: 490-495

Shivaprasad HI, 2000. Fowl typhoid and pullorum disease. Rev Sci Tech Off Int Epiz, 19(2): 405-424

Shivaprasad HL, 2003. Pullorum disease and fowl typhoid. In: Saif YM, Barnes HJ, Glisson JR, Fadly AM, McDoughald LR *et al.* Diseases of Poultry, (10th edn). Lowa State University Press. Ames, I A, pp 568-579

Siddique M, Javed T and Sabri MA, 1987. Incidence and pathology of various poultry diseases prevalent in Faisalabad (Pakistan) and surrounding districts. Pak Vet J, 7: 148-154

Sikder AJ, Islam MA, Rahman MM and Rahman MB, 2005. Seroprevalence of Salmonella and *Mycoplasma* Gallisetpticum infection in the six model breeder poultry farms at Patuakhili district in Bangladesh. Int J Poult Sci, 4(11): 905-910

Silva EN, 1984. The *Salmonella* Gallinarum problem in Central and South America. In Proc Int Sym on Salmonella, 150-156

Unýted States Department of Agrýculture, 1996. Auxiliary Provisions on National Poultry Improvement Plan. Code of Federal Regulations, Title 9, Part 147, pp 717–727

Wong RA, Tellez GI, Valladares J and Hargis BM, 1996. Pathogenicity of *Salmonella* Gallinarum on an experimental infection of one-day-old broiler chicks. Poult Sci, 75: 44

Xavier J, Pascal J, Crespo E, Schell HL and Trinidad JA, *et al.*, 2011. Seroprevalence of Salmonella and Mycoplasma infection in backyard chickens in the state of Entre Ríos in Argentina. Poult Sci, 90: 746–751

Article received on 23.03.2017 and accepted for publication on 03.05.2017