SALMONELLOSIS - A POTENTIAL THREAT TO POULTRY:
A MINI REVIEW

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Abstract: Salmonella is the chief causative agent to cause mortality and reduced production in poultry industry. Fowl typhoid and pullorum disease are the two main bacterial diseases which is caused by Salmonella gallinarum and Salmonella pullorum respectively and having zoonotic importance. Enteritis, bacteremia, reduced egg production, diarrhea, inappetance are the main signs and symptoms caused by them. Diagnosis is possible through identification and isolation of the organism through culture and some serological tests such as ELISA, PCR etc. Preventive measures, Vaccination and proper antibiotic treatment can reduce the mortality and chance of occurrence of the disease.

Key words: Salmonella, Poultry, Fowl typhoid

INTRODUCTION

Salmonellosis is a disease which affects both man and animals [1]. Salmonella is one of the major food borne causes of gastroenteritis and is frequently associated with contaminated poultry meat [2]. The genus Salmonella consists of more than 2500 serovars [3]. Salmonellosis in poultry causing heavy economic losses through mortality and reduced production [4,5]. Avian Salmonella infection may occur in poultry either acute or chronic form by one or more member of genus Salmonella, under the family Enterobacteriaceae [6]. The two main bacterial diseases which occurs in poultry through genus Salmonella are fowl typhoid and pullorum disease which is caused by S. gallinarum and S. pullorum respectively [7,8]. Out of several serotypes of Salmonella, only about 10% of these have been isolated from poultry [9]. Apart from chicken S. gallinarum and S. pullorum infection have also been reported in turkeys, guinea fowl, quail and pheasants [10].

Age wise prevalence of avian salmonellosis showed highest infection rate in adult layers (53.2%) in comparison to brooding (14.55%), growing (16.10%) and pullet (16.10%) chickens [11]. Fowl typhoid and pullorum disease are distributed in many countries of the world [12-14].

Transmission and pathogenesis: Humbert et al. [15] stated that the pathogenesis of Salmonella depends on the invasive properties and the ability of the bacteria to survive and multiply within the cells, particularly macrophases. After multiplying the bacteria in the digestive tract the organisms are engulfed by macrophages and spread to the reticuloendothelial tissues rich organ like liver and spleen through blood stream which are the main sites of multiplication [16]. Pullorum disease manifests
itself predominantly as an enteric disease of chickens where as fowl typhoid shows signs of septicemic disease [7]. Both biovars can cause septicemic infections which may be acute or chronic but unlike *Salmonella pullorum* and *Sujatha Prasanna*

*Salmonella gallinarum* is capable of producing peracute infection and hemolytic anemia in both young and adults [17]. *Salmonella gallinarum* is extremely pathogenic to young broiler chicks [18].

The main route of infection is the oral route. Besides oral route nasal and cloacal route are also having important role in the transmission of *Salmonella* infection in newly hatched chicks. Lutful Kabir [19] stated that chicks may carry infection in ovaries, oviduct and eggs during the passage through the cloacal faeces in infected or carrier hens.

**Signs and symptoms:** Pullorum disease occurs in chicks during their first few days of life and causes severe enteritis and bacteremia [20]. Fowl typhoid is a disease of mature chickens and causes either acute enteritis with greenish diarrhea or a chronic disease of the genital tract that reduces egg production [21]. Other signs include ruffled feathers, inappetance, thirst, yellow diarrhea, dejection and reluctant to move.

**Pathological changes:** The organs which show pathological changes mainly include lungs, liver, heart, kidney, intestine, pancreas, bursa of fabricius. In lungs red hepatization, haemorrhages, congestion, pneumatic lesions, seroribinized exudates in alveoli has been reported by several workers [10, 22]. They also reported spleenomegaly along with multiple necrotic foci, reticulo endothelial cell hypoplasia and depletion of lymphoid cells in spleen. Liver shows bronze discoloration, congestion, hepatitis and degenerative changes as reported by Sujatha et al. [23] and Prasanna et al. [24] where as congestion, haemorrhage, fibrinous pericarditis, degeneration and fragmentation of myocardial muscle fibres in heart has been noticed [22,25]. Enlarged kidney, degenerative changes in renal tubular epithelium and congested bursa of fabricius with interfollicular fibrosis has also been reported [22]. The lesions in proventriculus include mucosal degeneration, congestion, degeneration of proventricular glands [26]. Catarrhal enteritis, degeneration and desquamation of mucosal villi and hyperplastic goblet cells in intestine were noticed [27,28]. Congested and hemorrhagic pancreas along with leucocytic infiltration in acinar cells and interlobular connective tissue were noticed several workers [22,24,29].

**Diagnosis:** By bacterioculture methods *Salmonella can* be identified as gram negative non-sporogenic rods 1 to 2.5 im in length with 0.3 to 1.5 im in width and considered to be non-motive under normal condition but inducement of flagellar proteins and motility has been shown in some strains of *S. Pullorum* when grown in special media [30]. The standard culture methods for detecting *Salmonella* species in poultry include non-selective pre-enrichment and plating on selective and differential agars [31]. Detection of *Salmonella* by bacteriologic method is known to be time consuming [32]. Rapid detection of *Salmonella* from poultry by Real-Time Polymerase Chain Reaction with Fluorescent Hybridization Probes has the potential for use in routine monitoring and detection of *Salmonella* in infected flocks and carcasses [33]. Serological methods have increasingly been used for the detection of invasive *Salmonella* serotypes including enteritidis in poultry. Different types of ELISA, particularly indirect or double antibody-blocking assays using a variety of antigens such as lipopolysaccharide, flagella and SEF14 fimbrial antigen are used as part of control programmes in a number of countries [34]. Fecal sample also serve as a diagnostic tool for detection of salmonella. In floor systems boot swabs are the preferred method for the collection of faeces [35]. The positive results with high sensitivity has been obtained in detection of Salmonella in chicken faeces through tetraphosphate broth (TTB) enrichment, capillary PCR and capillary gel electrophoresis [36].

**Treatment:** Treatment of infected birds is required to decrease the rate of mortality and its spread in a flock. To combat the dehydration loss due to diarrhoea fluid and electrolyte therapy is the first line of treatment for the affected birds. Antibiotics therapy either in intravenous or oral route are recommended for reducing the infection. Antimicrobial therapy using antibiotics should be done after conducting Antimicrobial susceptibility test as R-plasmids are common in coding for multiple resistance in Salmonellae spp. [37]. The sensitivity of antibiotics depends on strain, place and the duration of treatment in a particular place. The
species are sensitive to antibiotics like nitrofurantoin, ciprofloxacin and polymixin-B [22,38-40].

**Antibiotic resistance:** In *Salmonella* Antibiotic resistance is due to improper use and mostly occurs in commercial chickens [41]. The world-wide increase of food borne infections with antibiotic resistant pathogen is of growing concern and is designated by the WHO as an emerging public health problem [42, 43]. Salmonellosis is the major cause of food borne infections and the second most common food borne illness after Campylobacter [44]. Manie et al. [45] found several strains of multiple antibiotic-resistant *Salmonella* in chickens. Besides the increasing resistance to commonly used antibiotics in animal and humans, there is a concurrent increase in multiple resistant *Salmonella* isolates [46-47].

**Prevention and control:** Poultry meat is more popular in the consumer market due to easy digestibility and acceptance by the majority of people [48] and it is also considered that poultry meat is still the primary cause of human food poisoning [49]. A number of *Salmonella* outbreaks reported in the world are a result of injudicious introduction of infected birds [50]. The poultry industry is facing great setbacks due to frequent outbreaks of salmonellosis [51]. Control of fowl typhoid is difficult [52] due to endemicity of the disease, vertical and horizontal transmission [53,54] presence of carrier stage and multiple drug resistance. The widespread and indiscriminate use of antibiotics in the treatment of poultry diseases has lead to an increase in the number of resistant *Salmonella* strains isolated [55]. Antimicrobial resistance is a global public health concern [56]. The principal management procedures should include chicks free from infections and the chicks should be placed in a cleaned, sanitized and *S. gallinarum* and *S. pullorum* free environment with strict biosecurity measures [57]. Special programmes have been for surveillance of poultry, swine and cattle and include the surveillance of healthy animals that may be subclinical carriers of *Salmonella* organisms. Cross-contamination during food processing is also monitored as contamination by healthy food handlers can occur [58]. Other preventive measures include:

- Poultry should be tested before adding them to a flock.
- Wild birds and rodents should be excluded and there should be control on flies and poultry mites.
- Infected flocks should be quarantined where there is no history of fowl typhoid and pullorum disease.
- The premises and equipments should be cleaned and disinfected regularly.
- Uses of vaccines, probiotics and antibiotics can reduce the mortality but do not eliminate the infections from the flock.
- The dead birds need to be well disposed.
- Poultry meats and eggs should be cooked thoroughly.
- Person’s having contact with raw meat or eggs and animal’s faeces should wash their hands immediately with soap.
- Cross-contamination of foods should be avoided.
- Wider use of pasteurized egg in restaurants, hospitals is an important preventive measure.

**CONCLUSION**

The presence of organisms like *Salmonella* in meat and meat products is of prime concern for zoonotic importance. Only preventive measures and control can check the morbidity, mortalities and reduced production in poultry industry. There are several biosecurity programmes initiated to protect the consumers from Salmonellosis. The proper uses of antibiotic can reduce the antibiotic resistance so that it can improve the economic status of poultry farmers by reducing morbidity and mortality costs.

**REFERENCES**


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