



## RESEARCH ARTICLE

### STRATEGIC MEASURES TO CONTROL SALMONELLA FROM POULTRY IN HUMAN FOOD CHAIN

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#### ABSTRACT

Poultry sector is major thriving area contributing significantly to Indian economy. Poultry meat can become contaminated with *Salmonella* throughout the entire poultry production chain (breeder farms, fattening farms, transportation, slaughterhouse and retail). Fresh poultry slaughtered in local shops is generally preferred by consumers in India. However, due to changes in lifestyle & modernization, fresh chilled and frozen ready-to-cook (RTC) poultry products have become readily available in retail high end shops and supermarkets in major cities. The cross-contamination between meats and personnel and equipment used during a day in processing of meats due to improper and ineffective cleaning and disinfection particularly with chopping boards, knives and tables are the risk factors for *Salmonella* contamination. The level of prevalence can be reduced by adopting hygienic practices during poultry slaughter to ensure food safety. *Salmonella* prevention and control may be achieved by adopting Good Agricultural Practices and Hazard Analysis Critical Control Point (HACCP) principles, and general measures.

#### INTRODUCTION

Foodborne diseases, illness that result from ingestion of contaminated food are an important public health problem worldwide and have an important impact on travel, trade, and development (Christine, 2017). Pathogenic microorganisms cause infectious diseases which are the highest cause of death in animals and humans. Poultry sector is major thriving area contributing significantly to Indian economy (Antunes, 2015). Poultry meat can become contaminated with *Salmonella* throughout the entire poultry production chain (breeder farms, fattening farms, transportation, slaughterhouse and retail) (Marin, 2022). Slaughtering process followed at slaughter houses is an unorganized procedure as most of them don't follow the hygiene practices leading to contamination in the food chain causing foodborne diseases (Antunes, 2015). *Salmonella* is a natural inhabitant in the gastrointestinal tract of many animals, including birds, reptiles and livestock (Huanli Liu, 2018). The main sources of infection for humans include meat products, including the consumption of contaminated poultry meat (Antunes, 2015). Fresh poultry slaughtered in local shops is generally preferred by consumers in India however due to changes in lifestyle & modernization, fresh

chilled and frozen ready-to-cook (RTC) poultry products have become readily available in retail high end shops and supermarkets in major cities (Raj Kamal Gautam, 2017). *Salmonella* is a serious economic problem to livestock in countries where measures of control are not efficient or in those where the climatic conditions favors the environmental spread of these microorganisms. India qualifies for both of the above descriptions (Ramachandranpillai Rajagopal, 2013). *Salmonellae*, a group of pathogenic bacteria belonging to the family Enterobacteriaceae, cause multiple enteric diseases in humans including typhoidal illness and nontyphoidal salmonellosis. Typhoid fever is caused primarily by *S. enterica* serovar *Typhi* and *S. enterica* serovar *Paratyphi* (A and B), whereas non-typhoidal illnesses are caused by a variety of other *Salmonella* serovars collectively known as non-typhoidal *Salmonellae* (NTS). Self-limiting diarrheal disease is the most frequent clinical manifestation due to NTS infection (7). Poultry populations, in particular chicken, are frequently colonized with *Salmonella* without detectable symptoms (sub-clinical infections/healthy carriers) by horizontal and vertical transmission at primary production level & its presence in healthy poultry animals is suggested as the main risk factor as it allows bacteria to easily transmit in table eggs and poultry meat to humans (Barrow, 2012). In most cases, the birds are not sick and the production is not affected. It is mainly in very young chickens aged up to two weeks that salmonella can cause disease and death. The symptoms may vary and include weakness, loss of appetite and poor growth.

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The animals are crowded close to heat sources and sit with drooping wings and their eyes closed. Watery diarrhoea may also occur. In adult poultry, disease is rarely seen even if they have bacteria in the blood (*Salmonella*, 2020). Many contamination cases are being reported in India. Food processing methods adopted by poultry industries are insufficient to produce microbiologically safe products. According to a study conducted by the food technology division of Bhabha Atomic Research Centre, raw meat and ready-to-cook chicken that are kept above freezing point are likely to be contaminated by *Salmonella*. The state-run institute collected and analyzed 87 samples from departmental stores and supermarkets in Mumbai. Contamination was found in over 50% of the 48 of the raw and minimally processed meat samples that were kept at 8-10 degrees Celsius (Raj Kamal Gautam, 2017). Another survey conducted by Bihar Veterinary College, Patna, showed that out of 228 chicken meats collected from the local markets of Patna, 23.7% were found positive for *Salmonella* indicating high prevalence of *Salmonella* in raw chicken meat due to poor hygienic practices and therefore emphasizing the need for adopting hygienic practices (Purushottam Kaushik). Food contaminated with *Salmonella* or other harmful germs usually looks, tastes, and smells normal that's why it's important to understand how to prevent infection (*Salmonella*). The cross-contamination between meats and personnel and equipment used during a day in processing of meats due to improper and ineffective cleaning and disinfection particularly with chopping boards, knives and tables are the risk factors for *Salmonella* contamination. The level of prevalence can be reduced by adopting hygienic practices during poultry slaughter to ensure food safety (Balakrishnan, 2018).

**Source of infection:** *Salmonella* infections in poultry occur at various ages and through various routes, with transmission routes being both vertical and horizontal. There are numerous sources by which *Salmonella* can be introduced into poultry flocks. Insect and animal vectors are the major sources of *Salmonella* contamination in feed, poultry and humans. Cockroaches and lesser mealworms act as carriers in poultry farms. Flies, fleas, bread beetles and ticks can transmit *Salmonella* in feed. Hen-house rodents play a vital role in *Salmonella* multiplication. Contaminated feces may reach birds through contaminated bedding, feed and water. Contaminated feed may act as a source of *Salmonella* infection either through insect and animal vectors or can directly infect the poultry flocks. *Salmonella* can spread via trading infected animals across and within countries and via trading. Reports by the National Veterinary Institute (NVI) in Sweden and the World Health Organization suggested that salmonella in poultry is mainly transmitted via infected parental stocks (7).

### Strategic measures of prevention & control

- *Salmonella* prevention and control may be achieved by adopting Good Agricultural Practices and Hazard Analysis Critical Control Point (HACCP) principles, and general measures (13).
- Hygiene and biosecurity should be part of the overall management of the farm. Incoming poultry must have a high health status and must be purchased from reliable suppliers that have quality-assured breeding and hatchery facilities. (14).
- Preventing the entry of *Salmonella* into the farm can be done by limiting people who enter the farm, wearing

protective clothing, and wearing boots that have been disinfected (14).

- Workers must know basic hygienic principles, such as keeping hands and feet clean (14).
- The management of the whole farm, cleaning and disinfection must be carried out regularly. The success of disinfection of chicken farms needs to be tested by taking samples on floors, walls, drinking water, eating places, and the environment (14).
- Public awareness that antimicrobial agents should not be used to control infection with *Salmonella* in poultry as the effectiveness of the treatment is limited, may mask the infection at sampling, has the potential to produce residues in meat and eggs and can contribute to the development of antimicrobial resistance (13).
- Integrated surveillance with collaboration between human health, food safety and animal health and One Health approaches and contamination strategies including livestock, retail, catering and consumers to minimize contamination and reduce transmission of *Salmonella* (14).
- Follow the clean, separate, cook guidelines for safety from salmonella infection at home i.e. washing utensils with hot soapy water, keep raw meat, eggs etc. Separate from other foods, use separate cutting boards & plates for procedure, cook poultry at 165°F (11).
- To avoid buying contaminated supermarket foods, make sure you read the label of the product you are buying for the 'Use by' and 'Expires by' date, check the produce for punctured skin & also check the temperature of meat in the refrigerator is at 35°F and if it is not as cold then it can up the risk of contamination (15).

### Conclusion

*Salmonella* has been a major health concern that occurs worldwide. The main sources of infection for humans are the consumption of contaminated poultry meat & infection from farm to folk level leads to severe complications as improper hygiene practices followed at poultry farms & industries causing contamination in the food chain. Frozen & RTC poultry products are readily available & are at high demand but also unsafe to consume. Customers should be aware about the basic steps of food safety & the level of prevalence can be reduced by adopting hygienic practices during poultry slaughter to ensure food safety.

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