

Occurrence of *Salmonella* Species In Raw Chicken Livers Purchased From Retail Shops In Gaborone, Botswana

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Abstract: In this study, we investigated the occurrence of *Salmonella* species in chicken livers sold in supermarkets and butcheries in Gaborone, Botswana. One hundred and fourteen livers were cultured for *Salmonella* and the isolates were identified biochemically and serologically. Overall, 35% (40/114) of the livers were positive for *Salmonella typhimurium* as the sole serovar identified. This *Salmonella* serotype has commonly been implicated as a cause of foodborne infections which can be severe in individuals that are immunocompromised such as those with HIV/AIDS. We conclude that there is a need to institute/enforce guidelines and laws to ensure hygienic practices in the production, slaughtering, processing and storage of poultry products in Botswana.

Key words: Poultry livers, *Salmonella typhimurium*, HIV

INTRODUCTION

Chicken livers are a comparatively cheap source of protein compared to other animal proteins to many people in Botswana and possibly other parts of sub-Saharan Africa. *Salmonella* is one of the major bacterial agents that cause foodborne infections (Salmonellosis) in humans worldwide (Acheson and Homann, 2001; Cogan and Humphrey, 2003; Humphrey, 2000). Poultry and poultry products, which are often contaminated with these organisms, have been implicated as a major source of human salmonellosis (Humphrey, 2000; Baiely *et al.*, 2001). Poultry which are infected with *Salmonella* but show no clinical illness may be important in the spread of infection between flocks and as a source of human food poisoning (Cogan and Humphrey, 2003; Carli *et al.*, 2001). *Salmonella typhimurium* and *Salmonella enteritidis* have emerged as the commonest cause of non-typhoidal salmonellosis in humans (Acheson and Homann, 2001; Petter, 2001).

Although primarily intestinal bacteria, salmonellae are widespread in the environment and are commonly found in the farm effluent (Humphrey, 2003). Live poultry carry large numbers of many different microorganisms on the skin, among feathers and in the alimentary canal (Rusul *et al.*, 1996). During the slaughter process, a high number of these organisms will be removed, but further contamination can occur at any stage and significant

effects on the surface micro-flora will result from scalding, plucking, evisceration (removal of intestinal organs) washing, chilling and freezing. More organisms can be acquired from aerosols, process water, equipment and the hands of the operators (Logue *et al.*, 2003). *Salmonella* species have been recovered frequently from a number of different animals, and their incidence in various parts of the animals have been shown to vary (Jay, 2000). They are sometimes found in the spleen, liver, bile and other organs including the body cavity (Cooper, 1994). Our studies were prompted by the importance of possible contamination of poultry livers with *Salmonella* and the fact that information about poultry as a source for microbial entrance into food is still lacking in Botswana. In this study we investigated the prevalence of *Salmonella* species in chicken livers sold in supermarkets and butcheries in Gaborone.

MATERIALS AND METHODS

Sample collection, isolation and identification of *Salmonella*: Over a period of three months during January to March 2004, we purchased 114 chicken livers in supermarkets and butcheries in Gaborone. Duplicate swabs were taken from the interior of all the liver samples with sterile clinical swabs. All swab samples were then immersed in 10ml of buffered peptone water (Oxoid) with a pH 7 in universal bottles and incubated for 37°C for

24 h, after which 0.1 mL of the peptone water culture was transferred to 10 mL of Rappaport-Vassiliadis medium (Oxoid) and incubated at 42°C for 24 h.

From each broth culture, a swab was used to subculture on xylose lysine deoxycholate (XLD) agar (Oxoid) and the plates were incubated at 37°C for 24 h. Typical *Salmonella* colonies on XLD (pink colonies with black centres) gave a presumptive positive result. Isolates were tentatively confirmed to be *Salmonella* by reaction in Triple sugar iron (Oxoid) and Urea agar (Oxoid). The isolates were further characterized biochemically using API 20E system (Biomérieux, France). *Salmonella* species were confirmed serologically with *Salmonella* somatic O and flagella antisera following the International Standard ISO 6579E (11) *Salmonella typhimurium* ATCC 13311 was used for reference purposes.

RESULTS AND DISCUSSION

We purchased 114 different liver chicken samples from four different retail outlets A, B, C and D supplied by different farm butcheries.

Overall 40/114 livers (35.1%) were positive for *Salmonella typhimurium* as the sole serovar identified (Table 1). All the 40 samples from Farm C were positive for salmonellae.

Animals for slaughter tend to harbour bacteria which may contaminate the carcass during the various processes (skinning, evisceration, splitting) (Rusul *et al.*, 1996; Cooper, 1994).

Hygiene practices on the different farms during rearing the chickens, and the slaughtering and sanitation practices may have contributed to contamination of the chickens, the carcasses and their viscera with salmonellae. *Salmonella* has been isolated more frequently from the body cavities and liver of slaughter chickens (Mead, 1995). Cross contamination of the livers with salmonellae could have occurred during the evisceration of the carcass during slaughter. Also contamination of the hands of the butchers may contribute to high prevalence of *Salmonella* in chicken livers (Cooper, 1994). Only one serotype, *Salmonella typhimurium* was isolated from the livers. This finding might suggest a common source of this serotype on the poultry farm for example water sources, drinking pans or even poultry feeds.

Table 1: Distribution of *Salmonella* species in chicken livers sold in retail shops in Gaborone

Retail shop	Farm of origin	No. of livers examined	No. of positive livers (%)
1*	A	12	Nil
2*	B	32	Nil
3	C	40	40(100)**
4	D	30	Nil
Total		114	40/114(35.1)

*Butchery, ***Salmonella typhimurium*, * 2,3,4; Supermarkets

Salmonella typhimurium was classified as one of the ten most frequently isolated serotype from human sources reported by the United States Centre for Disease Control and Protection (Mandall *et al.*, 2001). The organism also causes a more serious illness than other non-typhoid salmonellae. *S. typhimurium* can enter and hide in the cells of the body such as macrophages that are supposed to defend us against these organisms. Once they enter the cells they become very resistant to antibiotics (Lim *et al.*, 2001).

Although, our sample size was small, the data obtained points to a high prevalence of *Salmonella* species in the chicken livers analysed. This readily available chicken product could be a source of food poisoning for humans in Botswana most likely through cross contamination between foods that are eaten raw with the contaminated livers.

CONCLUSION

Present study indicates that *Salmonella* species were present in raw chicken livers sold in retail shops in Gaborone. There is need to enforce laws and guidelines for on farm raising, slaughtering, processing handling and storage of poultry and their products to reduce the contamination of finished products sold to the consumer.

ACKNOWLEDGEMENT

The funds for the study were provided by the University of Botswana.

REFERENCES

- Acheson, D. and E.L. Homann, 2001. Nontyphoidal Salmonellosis. *Clin. Infect. Dis.*, 32: 1058-1067.
- Cogan, T.A. and T.J. Humphrey, 2003. The rise and fall of *Salmonella* Enteritidis in the UK. *J. Applied Microbiol.*, 94: 114-122.
- Humphrey, T.J., 2000. Public Health Aspect of *Salmonella* Infections, In: Wray, C. and A. Wray, (Eds.), *Salmonella* in Domestic Animals. Wallingford, United Kingdom: CABI Publishing, CAB International.
- Bailey, J.S., N.J. Stern, P. Fedorka-cray, N.A. Craven, D.E. Cosby, S. Laden and M.T. Musgrove, 2001. Sources and movement of *Salmonella* through integrated poultry operation: A multistage epidemiological investigation. *J. Food Prot.*, 64: 1690-1697.
- Carli, K.T., A. Eyigor and V. Caner, 2001. Prevalence of *Salmonella* serovars in chickens in Turkey. *J. Food Prot.*, 64: 1832-1835.

- Guard-Petter, J., 2001. The chicken, the egg and *Salmonella enteritidis*. *Environ. Microbiol.*, 3: 421-430.
- Rusul, G., J. Khair, S. Radu, C.T. Cheah and R. Yassin, 1996. Prevalence of *Salmonella* in broilers at retail outlets, processing plants and farms in Malaysia. *Int. J. Food Microbiol.*, 33: 183-19.
- Logue, C.M., S.S. Sherwood, P.A. Olah, L.M. Elijah and R. Dockter, 2003. The incidence of antimicrobial-resistant *Salmonella* sp. on freshly processed poultry from US Midwestern processing plants. *J. Applied Microbiol.*, 94: 16-24.
- Jay, J.M., 2000. *Modern food microbiology*, (6th Edn.), Aspen publishers, Inc, Maryland.
- Cooper, G.L., 1994. Salmonellosis- infection in man and the chicken: Pathogenesis and the development of a live vaccine-a review. *Vet. Bull.*, 64: 123-143.
- International standard-ISO 6579 E, 1993. *Microbiology-General Guidance on Methods for the Detection of Salmonella*, 3rd Edn., Int. Organisation for Standardization, Switzerland.
- Mead, G.C., 1995. *Processing of Poultry*, Chapman and Hall, Britain.
- Mandell, G.L, J.E. Bennet and R. Dorling, 2000. *Mandell, Douglas and Bennet's-Principles of Practice of Infectious Diseases*, (5th Edn.), Vol. 2, Churchill Livingstone Publications, New York, USA.
- Lim, E., W.H. Koh, S.F. Loh, M.S. Lam and H.S. Howe, 2001. Non-typhoidal salmonellosis in patients with systemic lupus erythematosus. A study of fifty patients and a review of the literature. *Lupus*, 10: 87-92.