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Salmonella Yeerongpilly in a Chinese Owl (*Columba livia domestica*) in Jamaica

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Authors' contributions

This work was carried out in collaboration between all authors. Author SC designed the study, did the laboratory work, authors SC and AAJV managed the literature searches, wrote the protocol, and wrote the first draft of the manuscript. All authors managed the analysis of the study, read, corrected and approved the final manuscript.

Original Research Article

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ABSTRACT

Salmonella infection in bird species in Jamaica was studied. This revealed that very low prevalence of salmonellosis was found (0.32 %). *Salmonella* Yeerongpilly (newly reported in the country) was isolated from a bird collected at a bird aviary. This study showed that there was the presence of this S*almonella* serovar in a Chinese owl (*Columba livia domestica*) in Jamaica. There were not published reports from Caribbean Islands of the presence of this serovar. *Salmonella* Yeerongpilly belongs to serogroup E1 and by molecular serotyping random amplification of polymorphic DNA (RAPD) fingerprinting belongs to A20, B17 and C21. This strain was isolated in Queensland Australia in the 1960s before the successful *Salmonella* eradication campaign. This study suggests that a larger investigation in pet birds as *Salmonella* carriers should be carried out in Jamaica. Mandatory screening or quarantine of birds entering the country should be institutionalized.

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1. INTRODUCTION

The role of free-flying and exotic birds as potential sources of infection is clearly documented [1-3]. It was reported that the nationwide outbreak of salmonellosis in Norway was originally linked to contaminated chocolate bars. Five years after the outbreak an increased number of isolated cases for the same strain of *Salmonella* was detected. By close analysis, it was discovered that avian wild life including Passerine birds were acting as reservoir for the epidemic *Salmonella* strain [4].

Salmonellosis was reported to be associated with exotic birds in Germany [5]. An estimated 3 to 5% of all cases of salmonellosis in humans are associated with exposure to exotic pets. *Salmonella* serovars that were isolated from patients with salmonellosis were also associated with exotic pets [6]. Salmonella *was* isolated from nine of 60 free-flying sparrows [7]. *Salmonella* Amager was isolated from nestling free-flying peregrine falcons (*Falco peregrinus*) in Sweden in 2000 [8]. A low prevalence of salmonellosis was reported in free-flying avian species in Trinidad [9], and this is the only report of birds that are carriers of *Salmonella* in the Caribbean. This work addresses the issue of prevalence of *Salmonella* in Jamaican exotic bird species.

2. MATERIALS AND METHODS

2.1 Bird Specimens

Cloacal swabs and faeces from 31 different species of bird species were investigated for *Salmonella* infection including: Green-naped Lory (*Trichoglossus haematodus*), Chinese owl Pigeon (*Columba livia domestica*), Peach-faced Lovebird (*Agapornis roseicollis*), Black-masked Lovebird (*Agapornis personatus*), Black-capped Lory (*Lorius lory*), Stella's Lorikeet (*Charmosyna papou stellae*), Blue Streaked Lory (*Eos reticulata*), Golden-mantled Rosella Parakeet (*Platycercus eximius*), African Grey Parrot (*Psittacus erithacus*), Eclectus Parrot (*Eclectus roratus*), Cockatiel (*Nymphicus hollandicus*), Budgerigars (*Melopsittacus undulates*), Common Mynah Bird (*Acridotheres tristis*), Sun Conures (*Aratinga solstitialis*), White-winged Dove (*Zenaida asiatica*), Mountain Witch Dove (*Geotrygon versicolor)*, Red-legged Partridge (*Alectoris rufa*), White-crowned Pigeon (*Patagioenas leucocephala*), Pea Dove (*Leptotila wellsi*), Long-Tail Ground Dove (*Uropelia campestris*), American Giant Runt Pigeon (*Columba livia domestica)*, Little owl (*Athene noctua*), Oriental Frill (*Columba livia domestica)*, Southern Dutch Frill Canary (*Serinus canaria domesticus)*, Birmingham Rollers (*Columba livia domestica)*, Damascene Pigeon (*Columba livia domestica)*, Tumbler Pigeon (*Columba livia domestica)*, and Eastern Kingbird (*Tyrannus tyrannus*).

2.2 Isolation of *Salmonella* from Specimens

The isolation of *Salmonella* was carried out using previously described procedures [10]. The specimens from the birds were collected at a bird aviary in Jamaica that sells exotic pets. The exterior of the cloaca of the birds was first cleaned with sterilized moistened cotton balls prior to application of the moistened cotton tips of each swab applicator. The swabs were immediately placed in sterile screw cap test tube containing 9 ml of universal pre-enrichment broth. The swab was completely submerged in the broth to ensure optimal recovery of the

organism. At least 25 g of each type of specimen was dissolved in 250 ml of universal pre-enrichment broth (buffered peptone water 1%, Difco).

The inoculated universal pre-enrichment broth was incubated at 37°C for 24 hours following this incubation the pre-enrichment broth was thoroughly mixed using a vortex mixer. A 1 ml aliquot of the pre-enrichment broth was added to 9 ml of enrichment broth (Selenite broth, Selenite cystein broth, and Tetrathionate broth) and further incubated at 37°C for 24 hours. After vortexing 0.5 ml and a 3 mm loopful of inoculums were used to inoculate differential plating media such as MacConkey agar, *Salmonella-Shigella* agar selective media Bismuth Sulphite and Brilliant green agar and incubated at 37°C for 24-48 hour.

Following incubation the cultures were examined. Non-lactose fermenting colonies were selected and used to inoculate Kligler iron agar and urea agar slants. After a further 24 hours incubation period at 37°C colonies, which gave the typical *Salmonella/Shigella* agar reaction were further investigated for confirmation, using slide agglutination with somatic "O" and flagella "H" antigens of *Salmonella*. Serological typing was performed to determine the *Salmonella* serovar [11].

2.3 Identification by Slide Agglutination

Presumption *Salmonella* isolates were stored on tryptose agar a room temperature until confirmation as previously described (Kauffman-White Schema, Difco, Laboratory, Detroit, and Michigan U.S.A). For each 2 loopfuls of the growth on tryptose agar was emulsified in one drop of normal saline solution (0.9%) on a clean microscope slide. The preparation was examined for autoagglutination.

If the organism was not self-agglutinating one drop of either "H" antiserum or "O" antiserum was added to each spot. After mixing the slide was agitated by gently rocking back and forth for 2 to 3 minutes. The slide was examined for agglutination (Kauffman-White Schema, Difco, Laboratory, Detroit, and Michigan U.S.A). Identification of *Salmonella* serovar was performed in the *Salmonella* reference laboratory, Department of Microbiology, Faculty of Medical Sciences, The University of the West Indies.

2.4 Antibiotic Susceptibility Test

All *Salmonella* isolates tested were investigated for their antibiotic susceptibility with the disc diffusion test using the following discs (Difco): gentamicin (10 µg), kanamycin (30 µg), ampicillin (10 µg), amikacin (30 µg), trimethoprim/sulfamethoxazole (1.25/23.75 µg), chloramphenicol (30 µg), cefazolin (30 µg), cephalothin (30 µg), cefepime (30 µg), cefotaxime (30 µg), streptomycin (10 µg), ceftazidime (30 µg), cefoxitin (30 µg), nalidixic acid (30 µg), ciprofloxacin (5 µg), norfloxacin (10 µg), tetracycline (30 µg) and imipenem (10 µg).

3. RESULTS AND DISCUSSION

The prevalence of *Salmonella* infection in bird species in Jamaica was 0.32%, only one bird was confirmed as *Salmonella* carrier (1 out of 311 birds tested). The *Salmonella* carrier was a Chinese owl (*Columba livia domestica*). The isolate was investigated for its antibiotic susceptibility with the disc diffusion test. The *Salmonella* isolated was susceptible to the entire panel of antibiotics tested including penicillins, cephalosporins, carbapenems, quinolones, aminoglycosides and tetracyclines.

The isolate proved to belong to the *Salmonella* Yeerongpilly serovar that was not previously identified in Jamaica. These preliminary findings of the prevalence of *Salmonella* found in pet birds and free-flying bird's species in this study are in keeping with previous reports from other countries. In various studies from European countries extremely low prevalence was reported. Several authors have emphasized the role of various exotic and wild bird species in the transmission of *Salmonella* [12-15].

Salmonella Yeerongpilly was differentiated from a total of 57 strains of *Salmonella spp* by molecular biology techniques including random amplification of polymorphic DNA (RAPD) fingerprinting using three different primers (OPL-03, primer 1, and primer A); and by Enterobacterial Repetitive Intergenic Consensus (ERIC) fingerprinting. *Salmonella* Yeerongpilly belongs to serogroup E1 and by molecular serotyping RAPD belongs to A20, B17 and C21 [16]. It has been suggested that a combination of RAPD (primer 1 or primer A) and ERIC should be useful for the differentiation of field-isolated *Salmonella* strains and epidemiological studies [16-18].

There were no published reports from any Caribbean Island of the presence of *Salmonella* Yeerongpilly. This strain was isolated in Queensland Australia in the 1960s before a successful *Salmonella* eradication campaign. This strain was probably imported to our island since there is presently no mandatory screening or quarantine of birds entering the country. Scientific evidence has shown that *Salmonella* was the most common bacteria isolated from quarantined imported birds in Canada [19]. Approximately 3 to 5% of all cases of salmonellosis in humans are associated with exposure to exotic bird pets [5].

4. LIMITATION OF THE STUDY

The limitation of this study is in the small number of pet and free-flying birds tested, totaling 311 birds, but these preliminary results would be of much benefit for future epidemiological studies of Salmonella carriers in birds. The results demonstrated the presence of a new strain of *Salmonella* in Jamaica (*S*.Yeerongpilly*).* In a recent epidemiological study of salmonellosis in poultry and poultry environments in Jamaica we demonstrated the presence of two new strains of *Salmonellae* in chickens: *Salmonella* Austenborg and *Salmonella* Kentucky that were new to the island and to the region [20]. However, the results of the present research set a precedent in the study of *Salmonella* carriers among exotic birds in Caribbean Islands, and also draws the attention of its existence to the public health authorities in the moreover make aware to public health authorities in the country.

5. CONCLUSION

This study showed that there was the presence of S*almonella* Yeerongpilly in a Chinese owl (*Columba livia domestica*) among 311 birds in Jamaica. This revealed that very low prevalence of salmonellosis was found (0.32 %). This study suggests that a larger investigation in pet birds as *Salmonella* carriers should be carried out in the island and it should be advised mandatory screening or quarantine of birds entering the country.

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CONSENT

No applicable.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the ethics committee of the University of the West Indies, Mona campus, Jamaica.

COMPETING INTERESTS

The authors declared that no competing interests exist.

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