

CASE REPORT

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# Multidrug resistant *E. coli* recovered from household reared female budgerigar pet bird (*Melopsittacus undulatus*) in Ibadan, Oyo State Nigeria: a case report

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## Abstract

**Background:** Pet birds are housed and reared exclusively for ornamental use. These include psittaciformes (parrots, parakeets, budgerigars, love birds) and passeriformes (e.g. canaries, finches, sparrows, also called songbirds). *E. coli* is a Gram negative bacterium. In birds, it is called Avian Pathogenic *E. coli* and is a causative agent of avian colibacillosis. Antimicrobial resistance is the process through which bacteria evade the activity of antibiotics. According to WHO (World Health Organization), antibiotic resistance is the result of indiscriminate use of these drugs which are used both in Veterinary and human medicine.

**Case presentation:** A one and half year old yellow female budgerigar pet bird (*Melopsittacus undulatus*) with patches of black and white on wings and back, kept as companion (one out of four) was presented dead at the avian clinic section of the Veterinary Teaching Hospital, University of Ibadan, Nigeria. It was reported to have presented signs of anorexia and diarrhea for two days before death. Provisional diagnosis was colibacillosis. Intestinal samples were sent for microbial culture and sensitivity. The samples yielded growth of *E. coli*. Antimicrobial susceptibility revealed that the organism showed resistance to all tested antibiotics.

**Conclusions:** Multidrug-resistant *Escherichia coli* constitutes a major public health concern. The constant interaction between household companion birds and humans gives room for disease transmission. Wild birds kept as pets or companions harbor pathogenic and zoonotic pathogens, hence a threat to public health.

**Keywords:** Colibacillosis, *Melopsittacus undulatus*, Multidrug resistant *E. coli*, Case report

## Background

Companion birds are considered the third most common pets after cats and dogs. As close friends of humans, they play an important role in human life (Cong et al. 2014). They are kept in confinement and reared for ornamental use. These birds include psittaciformes (parrots, parakeets, budgerigars, love birds) and passeriformes (e.g. canaries, finches, sparrows, also called songbirds) (Tully

2009). Most caged birds have been reported to belong to order Passeriformes which include canaries, finches, and order Psittaciformes which include parrots, parakeets, and lovebirds (Boseret et al. 2013). *Melopsittacus undulatus* is popularly called a *parakeet* in America. It has a greenish body, yellow head and wings speckled with black. It can be easily trained to “talk.” Budgerigars are often presented with digestive problems because they regurgitate their seed or a white pasty substance (Nigel 2009). Antimicrobial resistance is a public health issue (Argudín et al. 2017). Household pets are of zoonotic importance and carry multidrug-resistant (MDR)

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bacteria. As many authors have emphasized, there can be transmission of antimicrobial resistant genes from animals to man and vice versa. This can be via contact, contaminated food or the environment (Damborg et al. 2016; Argudín et al. 2017; Pomba et al. 2017). Indiscriminate use of antibiotics may increase existing populations of microorganisms that are antimicrobial resistant. These microorganisms contaminate environment, soil, food and aquatic environment as they are shed in faeces. Migrating and non-migrating wild birds with existing bacteria of potential zoonotic importance pose a great threat to public health. Many pathogenic bacteria species have been isolated from wild birds. Migrating and non-migrating wild birds can also act as reservoirs of coliform bacteria, such as *E. coli*. The organisms are carriers of antimicrobial-resistance genes (Shobrak et al. 2014). Clinically, *E. coli* is an important Gram-negative bacterium which has potential of causing serious diseases such as urinary tract infections (UTIs), pyelonephritis and bacteremia (Jacobsen et al. 2008).

Wild birds (Migrating and non-migrating) or general wild animals could therefore serve as reservoirs of resistant bacteria and genetic factors of antimicrobial resistance (Dolejska et al. 2009). Several workers have reported isolation of multidrug resistant of *E. coli* from companion birds (Borges et al. 2017; Belgi et al. 2019). This current case reports recovery of multidrug resistant *E. coli* from budgerigar pet bird (*Melopsittacus undulatus*).

### Case presentation

A one and half year old yellow female budgerigar pet bird (*Melopsittacus undulatus*) with patches of black and white on wings and back, kept as companion (one out of four) was presented dead at the avian clinic section of the Veterinary Teaching Hospital (VTH), University of Ibadan, Nigeria. History revealed that the owner acquired the four birds four months earlier. Two of the birds had died 3 weeks post arrival without the owner notifying a Veterinary facility. The owner maintains an aviary consisting of parrots which include African grey parrots, Senegal parrots, canaries, love birds and pea fowls. All the different species are housed separately in cages within the living room with the exception of the pea fowls that are housed beside the main building.

The bird was noticed to have shown signs of anorexia and diarrhea for a period of two days prior death. Ethical approval was obtained for this case from Ethical Committee of the University of Ibadan with the IRB Number: UI/EC/21/0438.

### Post Mortem lesions

There was pasted vent with yellowish diarrhea; there was moderate dehydration of the carcass with empty crop.

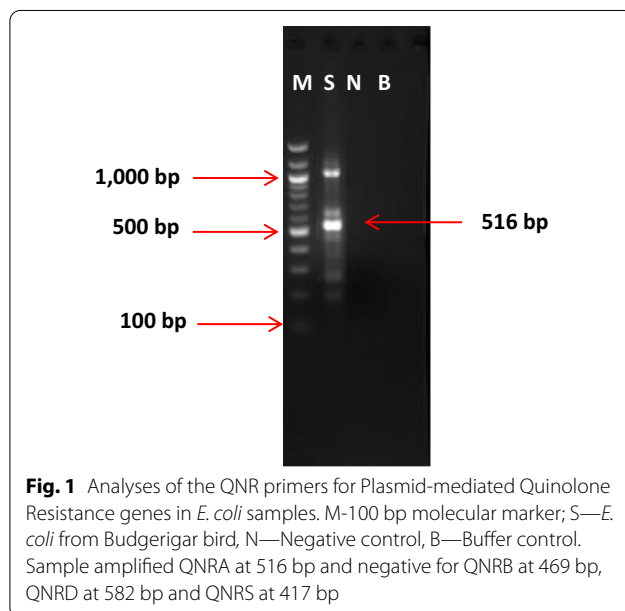
The liver was observed to be slightly swollen and congested. The small intestine contained moderate quantity of whitish mucoid fluid while there were impacted dry fecal materials occluding a substantial portion of the colon and the cloaca. The kidneys appeared moderately pale with prominent ureter. Intestinal samples (both small and large) were sent to the laboratory for microbial culture and sensitivity. Duodenal and colon parts of the intestine were cultured on blood agar and incubated for 24 h at 37 °C. Suspected colonies were then inoculated onto MacConkey agar and incubated for 24 h at 37 °C. Lactose fermenters were stained with Gram's staining, tested with indole reaction and motility was carried out. Gram's reaction showed a Gram negative rod shaped organism, indole positive and actively motile. Colonies that appeared pinkish were subcultured onto Eosine Methylene blue agar (EMB) and incubated for 24 h at 37 °C. Colonies that have greenish metallic sheen colouration on EMB agar were considered for API (Analytic Profile Index) identification. The *E. coli* was finally confirmed from the result of API 20 E kit. Seven digit profile number (6 440 552) was generated indicating *E. coli*. The same *E. coli* strains were recovered from the samples. Antibiogram of the isolate was determined by Kirby-Bauer disk diffusion method using the following antibiotics: septrin 30 µg, chloramphenicol 30 µg, sparfloxacin 10 µg, ciprofloxacin 10 µg, amoxicillin 30 µg, augumentin 30 µg, gentamycin 10 µg, pefloxacin 30 µg, tarivid 10 µg and streptomycin 30 µg. Results were analysed based on 2021 CLSI guidelines. It was interesting to note that the recovered *E. coli* showed resistance to all the listed antibiotics. Further to this, DNA extraction and PCR were carried out on the isolate using Plasmid-mediated Quinolone Resistance gene primers; A, B, D and S. (Table 1). The *E. coli* sample amplified QNRA and negative for others. This shows the presence of quinolone resistant gene in the isolate (Fig. 1). The isolate was then sent for partial sequencing. The nucleotide sequences determined have been deposited in the Genbank and the assigned accession number was –MZ618641.

### Discussions

*Escherichia coli* is responsible for bloodstream infections worldwide (Kern and Rieg 2020). It resides in the gut and causes no harm, but can cause severe and life-threatening infections when there is weakened immune system. The current case of multidrug resistant *E. coli* shows similarity with the work of Siquerira et al. (2017) who recovered *E. coli* from intestine of nine *Melopsittacus undulatus* in Brazil. Marietto-Gonçalves et al. (2017) also described avian colibacillosis in a pet *Amazona aestiva* from which *E. coli* was isolated from many organs. Since early 2000s, there has been a steady increase of antibiotic resistance

**Table 1** Primers for Quinolone Resistant genes A, B, D and S

| Primers   | Expected band size (bp) | Annealing temperature (°C) | References             |
|---|-------------------------|----------------------------|------------------------|
| QNRA-F ATTTCTCACGCCAGGATTTG<br>R GATCGGCAAAGGTTAGGTCA   | 516                     | 55                         | Robicsek et al. (2006) |
| QNRB-F GATCGTGAAAGCCAGAAAGG<br>R-ACGATGCCTGGTAGTTGTCC   | 469                     | 49                         | Robicsek et al. (2006) |
| QNRD-F-CGAGATCAATTTACGGGGAATA<br>R-AACAAGCTGAAGCGCCTG   | 582                     | 53                         | Pribul et al. (2017)   |
| QNRS-F – ACGACATTCTGCAACTGCAA<br>R -TAAATTGGCACCTGTAGGC | 417                     | 53                         | Robicsek et al. (2006) |



in *E. coli* despite attempts to control it. Resistance to multiple antibiotics is on the increase as far as *E. coli* is concerned (Satlin et al. 2018). *E. coli* becomes a multidrug resistant isolate when found to be non-susceptible to more than two different antimicrobial agent classes. Multidrug *E. coli* isolated from budgerigar bird in this case was found to be resistant to all antibiotics tested. This phenomenon may be attributed to abuse of antibiotics use in avian medicine. Plasmids carrying *qnr* genes have been known to transmit quinolone resistance (Martinez-Martinez et al. 1998). The geographical distribution of *qnrA* genes has been found to be wide (Nordmann and Poirel 2005), while those of the newer *qnr* types, *qnrB* (Jacoby et al. 2006) and *qnrS* (Hata et al. 2005), have not been studied. Detection of *qnrA* in this case study supports the findings of Robicsek et al. (2006) who also detected *qnrA* in *E. coli* isolates and reported absence of *qnrS*.

The multidrug resistant *E. coli* reported in this case also raises a public health concern in as much as the birds

interact with their owner and other humans within the household and in market shops in some cases. Children and immunocompromised patients are at a very high risk of infection if they come in contact with secretions or droppings from this type of birds. Findings from this case suggest that with constant human interaction with budgerigars reared in households, there can be contamination of food, water and environment since they have been found to harbor pathogenic organisms especially the multidrug resistant strains.

## Conclusions

This case has corroborated earlier reports that wild birds kept as pets or companions harbor pathogenic and zoonotic pathogens. With this, unregulated movements of birds could be a factor in introducing zoonotic pathogens and their vectors in non-endemic countries. We recommend provision of adequate information and prevention tools by the bird breeders to those they sell or give their birds to. Also, there is need for better enlightenment by veterinarians on dangers of infectious bird diseases. If an uncommon sign of infection or sudden death occurs, the owners should quickly report to their avian veterinarian.

## Abbreviations

APEC: Avian pathogenic *Escherichia coli*; WHO: World Health Organisation; VTH: Veterinary Teaching Hospital; MDR: Multidrug resistant; AMR: Antimicrobial resistance; EMB: Eosine methylene blue; API: Analytic Profile Index; CLSI: Clinical laboratory standard institute; DNA: Deoxyribonucleic acid; PCR: Polymerase chain reaction; QNR: Quinolones resistance.

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## Authors' contributions

EOO carried out the postmortem examination and contributed in writing the manuscript, OAO carried out the laboratory analysis and prepared the manuscript while OAO supervised the case as consultant. Final manuscript was read by all authors and approved for publication. All authors read and approved the final manuscript.

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**Availability of data and materials**

Not applicable.

**Declarations****Ethics approval and consent to participate**

Ethical approval was obtained from the University of Ibadan Ethical Committee with IRB Number: UI/EC/21/0438.

**Consent for publication**

Written consent to publish the case was obtained from the pet owner.

**Competing interests**

The authors declare that they have no competing interests.

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