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Article

Prevalence of multidrug resistant (MDR) food-borne pathogens in raw chicken meat in Dhaka city, Bangladesh: an increasing food safety concern

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Abstract: The present study was performed to investigate the prevalence of multidrug resistant (MDR) food-borne pathogens in raw chicken meat in Dhaka city, Bangladesh: an increasing food safety concern. A total of 100 meat samples (05 from each market) were collected from randomly selected 20 retail markets of Dhaka city using sterile polythene bags in a view to prevent extraneous contamination. The collected meat samples were then processed and inoculated onto nutrient broth and nutrient agar plates for isolation. The isolated organisms were identified based on staining, motility, cultural and biochemical properties according to standard laboratory methods. The isolated bacteria were also subjected to characterize their antibiotic sensitivity. In the present study, it was revealed that 100% of samples were contaminated by at least one species of bacteria belonging to 5 genera such as *Staphylococcus*, *Escherichia coli*, *Salmonella*, *Enterobacter* and *Bacillus*. Out of total 100 meat samples, 56% were contaminated with *Escherichia coli* whereas 42% were contaminated with Coagulase positive *Staphylococcus* and 36% were *Salmonella* species followed by 20%, 14% and 10% were contaminated with *Enterobacter* species, Coagulase negative *Staphylococcus* and *Bacillus* species respectively. A total of 174 bacteria were isolated and identified from raw chicken meat samples inspected of which 29.89% were *Escherichia coli*, 24.14% were Coagulase positive *Staphylococcus*, 20.69% were *Salmonella* species, 11.49% were *Enterobacter* species, 8.05% were Coagulase negative *Staphylococcus* and 5.75% were *Bacillus* species. The antimicrobial sensitivity tests showed that 96.15% of *Escherichia coli* (50 out of 52), 95.24% of Coagulase positive *Staphylococcus* (40 out of 42) and 86.11% of *Salmonella* (31 out of 36) isolates displayed multidrug resistance phenotypes (resistant to more than two antimicrobial agents). All most all the isolates of *E. coli*, coagulase positive *Staphylococcus* and *Salmonella* were more resistant to tetracycline, amoxicillin, ampicillin and streptomycin whereas less resistant to Ceftriaxone and Cefotaxime. The resistance patterns against azithromycin, ciprofloxacin, chloramphenicol, gentamycin, nalidixic acid and kanamycin were fluctuated from 25% to 71.43% among the isolates. This increasing development of multidrug resistance is alarming for the poultry industry and an increasing food safety concern for human.

Keywords: prevalence; multidrug resistant; food-borne pathogens; raw chicken meat; food safety

1. Introduction

Microbial food safety is an increasing public health concern worldwide. Food-borne illnesses occur following recent consumption of a particular food or drink contaminated with pathogens. Each year around one-third of the world population is affected by food-borne pathogens especially in developing countries. Even in developed nation like US, billions are spent in treatment of food-borne diseases caused by major pathogens. Each year 48 million people are affected in US with food-borne illness (Scallan *et al.*, 2011; CDC, 2013). *Salmonella*, *Campylobacter*, *Escherechia coli*, *Staphylococcus*, *Clostridium*, *Yersisnia*, *Listeria*, *Arcobacter*,

Mycobacterium, *Taenia*, *Trichinella*, *Sarcocystis*, *Toxoplasma gondii* and *Cryptosporidium parvum* are the important zoonotic food-borne pathogens of animal origin (Dhama *et al.*, 2011; Dhama *et al.*, 2013).

Global use of antimicrobial agents in human and veterinary medicine, agriculture and aquaculture has promoted both the survival of resistant microorganisms and the elimination of susceptible ones in the resulting antibiotic containing environments (Levy and Marshall, 2004). In modern agriculture, production of meat, milk, and eggs has attained industrial dimensions, animals being kept on species-specific farms in large numbers for the various stages of production (breeding, raising, fattening, milk, and egg production) (FAO, 1995). Globally, about 48 billion animals (cattle, pigs, sheep, goats, chickens, and turkeys) are slaughtered and kept in stock annually, most of these animals live on species specific farms and are potential consumers of drugs and antibiotics (FAO, 1995). Since the early 1950s, antimicrobial agents have been used in livestock farming to treat infections and improve growth and feed efficiency. In 1997, the World Health Organization published its first report on the medical impact of the use of antimicrobials in food animals (WHO, 1997). The main threats identified were: (i) an increase in the prevalence of resistant bacteria in animals; (ii) the transfer of resistant pathogens to humans via direct contact with animals, or through the consumption of contaminated food or water; (iii) the transfer of resistance to human bacteria; (iv) an increase in the incidence of human infections caused by resistant pathogens; and (v) potential therapeutic failures in animals and humans (WHO, 1997).

Poultry meat is a good source of animal protein, appealing to consumers very easily due to its sensorial attributes. Antibiotics are used for control and treatment of bacterial diseases in poultry. There is growing scientific evidence that the use of antibiotics in food animals leads to the development of resistant pathogenic bacteria that can reach humans through the food chain (Van Looveren *et al.*, 2001). Recent reports have shown that different types of food and environmental sources harbor bacteria that are resistant to one or more antimicrobial drugs used in human or veterinary medicine and in food-producing animals (Anderson *et al.*, 2003; Schroeder *et al.*, 2004).

Annual cost of treating infections caused by antibiotic-resistant bacteria is estimated to be $4 to $5 billion (McGowan, 2001). International and US public health agencies have targeted antibiotic resistance as an emerging public health concern (Barza and Travers, 2002) and one of the most pressing public health needs. Contaminated food of animal origin is one source of human bacterial infections; therefore, the presence of antibiotic-resistant strains in food animals such as poultry has raised concerns that the treatment of human infections will be compromised. So, considering the above facts the present study is designated as "Prevalence of multidrug resistant (MDR) food-borne pathogens in raw chicken meat in Dhaka city, Bangladesh: an increasing food safety concern".

2. Materials and Methods

The whole study was conducted in the laboratory of the department of Microbiology and Parasitology, Sher-e-Bangla Agricultural University (SAU), Dhaka-1207 during the period from August, 2016 to July, 2017.

2.1. Collection and transportation of samples

A total of 100 meat samples (05 from each market) were collected from randomly selected 20 retail markets of Dhaka city using sterile polythene bags in a view to prevent extraneous contamination. The collected meat samples were then transferred into the laboratory immediate after collection using ice box.

2.2. Isolation and identification of food-borne pathogens

At first, meat with hard pieces or bony samples was trimmed with sterile knife aseptically. Samples (25 g) were transferred to 225 mL of buffered peptone water (BPW) and macerated in a mechanical blender as per recommendation of International Organization for Standardization (ISO, 1995). The mixture samples were incubated at 37 °C for 18-24 h. Part of inoculated BPW was then transferred to nutrient agar plate for primary isolation. The subculture technique was followed up to obtaining pure culture (Cheesbrough, 2006). Stock cultures were maintained in both Agar slant and 20% sterile buffered glycerin (Merchant and Packer, 1967). The isolated organisms were identified based on gram's staining, motility by hanging drop techniques, cultural characteristics with colony morphology on different selective medias and available biochemical tests such as sugar fermentation test, Catalase test, Methyl red test, Voges-Proskauer test and Indole test according to standard laboratory methods (Cheesbrough, 2006).

2.3. Antibiotic sensitivity tests

Antibiotic sensitivity tests were done by using disc diffusion test following the method described by Kirby-Bauer (Bauer *et al.*, 1966). In brief, 1-2 ml of freshly growing broth culture were poured on NA and

spread uniformly. Antibiotic discs were placed apart onto the surface of the inoculated plates aseptically with the help of a sterile forceps and incubated at 37°C for 24 hours. After incubation, the plates were examined and the diameters of the zone of inhibition were measured. Then these diameters were interpreted with the standard diameters of NCCLS (1999) and were recorded as sensitive (S), intermediate (I) and resistant (R). The following antibiotics will be used for disc diffusion test: ceftriaxone (CTR), 30 μg; cefotaxime (CTX), 30 µg; azithromycin (AZM), 15 µg; ciprofloxacin (CIP), 5 µg; tetracyclin (TE), 30 µg; amoxicillin (AML), 10 µg; ampicillln (AMP), 10 µg; chloramphenicol (C), 30 μg; gentamycin (GEN), 10 µg; nalidixic acid (NAL), 30 μg; kanamycin (KAN) 30 μg and streptomycin (STR), 10 µg.

3. Results and Discussion

3.1. Prevalence of food-borne pathogens in raw chicken meats

Contaminated raw chicken meat is one of the main sources of foodborne illnesses and a potential risk of the transmission of zoonotic infections. In the present study, it was revealed that 100% of samples were contaminated by at least one species of bacteria belonging to 5 genera such as *Staphylococcus*, *Escherichia coli*, *Salmonella*, *Enterobacter* and *Bacillus*. In the prevalence study, out of total 100 meat samples, 52% were contaminated with *Escherichia coli* whereas 42% were contaminated with Coagulase positive *Staphylococcus* and 36% were *Salmonella* species followed by 20%, 14% and 10% were contaminated with *Enterobacter* species, Coagulase negative *Staphylococcus* and *Bacillus* species respectively (Table 1 and Figure 1). A total of 174 bacteria were isolated and identified from raw chicken meat samples inspected based on morphological, cultural and biochemical characterization and their overall prevalence were presented in Table 2 and Figure 2. The present study is in close agreement with the findings of Bhaisare *et al.* (2014) who revealed that the Indian chicken meat contains pathogenic bacteria like *Salmonella* spp. (33.16%), *Campylobacter* spp. (95%), *Escherichia coli* (70.22%), *Clostridium* spp. (13.88%), *Listeria monocytogenes* (15%) and *Staphylococcus aureus* (11.25%). These findings also supported with some of the previous study (Javadi and Saeid, 2011 and Al-Salauddin *et al.,* 2015). Javadi and Saeid (2011) were performed bacteriological analysis on 80 fresh chicken meat samples, marketed in Tabriz in Iran, results demonstrated the presence of *S. aureus* (65%), *Cl. perfringens* (83%), *Streptococcus* (100%) and Coliforms (100%) whereas Al-Salauddin *et al.* (2015) reported *E. coli* was isolated from 50 (83.33%) broiler meat samples and *Salmonella* spp. from 18 (31.66%) samples from some selected areas of Bangladesh. Owuna *et al.* (2015) observed that 72.5% (29 out of 40) of fresh poultry meat samples, obtained from different location in keffi metropolis of Nigeria, were contaminated with *S. aureus*. Osman *et al.* (2015) observed 100% chicken meat samples were contaminated with *Staphylococcus* species in Egypt where as other studies have reported that the rates varies from 6% to 100% in Spain (Alvarez-Astorga *et al.*, 2002), Japan (Kitai *et al.*, 2005), Italy (Normanno *et al.*, 2007), Nigeria (Achi and Madubuike, 2007), Jordan (Al-Tarazi *et al.*, 2009), Korea (Lim *et al.*, 2010), United States (Waters *et al.*, 2011), Turkey (Citak and Duman, 2011), India (Arul and Saravanan, 2011), China (Wang *et al.*, 2013), EFSA (2013), Egypt (EI-Jakee *et al.*, 2013), and Thailand (Akbar and Anil, 2013). In Crotia, bacteriological analysis was performed on 66 samples of fresh, retail-cut chicken meat (21 samples of chicken breasts without skin - "fillet", and 19 samples of chicken breasts with skin) and 26 samples of frozen ground chicken meat and found the presence of *Salmonella* spp. (10.60%), *S. aureus* (30.30%), *L. monocytogenes* (3.03%), *Enterobacteria* spp. (34.84%) and sulphite-reducing Clostridia (1.50%) (Kozacinski *et al.,* 2006). The variation of prevalence is may be due to geographic location, management practices in poultry farms, slaughter house hygiene practices, etc.

3.2. Results of antibiotic sensitivity test of some selected bacteria isolated from raw chicken meats

Considering pathogenicity all the isolated *Escherichia coli,* Coagulase positive *Staphylococcus* and *Salmonella* spp. were exposed to different antibiotics and its antimicrobial drug response were studied. The results of antibiotic sensitivity and resistant patterns as well as the resistance phenotypes of the above isolates were presented in Table 3-8 and Figure 3-5. The antimicrobial sensitivity tests showed that 96.15% of *Escherichia coli* (50 out of 52), 95.24% of Coagulase positive *Staphylococcus* (40 out of 42) and 86.11% of *Salmonella* (31 out of 36) isolates displayed multidrug resistance phenotypes (resistant to more than two antimicrobial agents). Emerging drug resistance in the foodborne bacterial isolates is a great public health concern. In the present study, *E. coli* showed highest resistance against tetracycline (100%) followed by amoxicillin, ampicillin and streptomycin which were 96.15%, 94.23% and 76.92% respectively. On the other hand, lowest resistances were found against both cefriaxone and cefotaxime which was 7.69%. The resistance against azithromycin, ciprofloxacin, chloramphenicol, gentamycin, nalidixic acid and kanamycin varies from 25% to 55.77%. Similar findings also observed in earlier study conducted by Al-Salauddin *et al.* (2015) who showed most of the *E. coli* and *Salmonella* isolates were resistant to amoxicillin, erythromycin, and tetracycline. Out of all the isolates, 5

isolates of *E. coli* and 3 isolates of Salmonella were found multidrug resistant.

The coagulase positive *Staphylococcus* isolates were more resistant to Tetracycline (100%), Amoxycillin (95.24%), Chloramphenicol (95.24%), Streptomycin (95.24%), Ampicillln (90.48%) and Gentamycin (71.43%) whereas less resistant to Kanamycin (38.10%), Nalidixic acid (35.71%), Azithromycin (26.19%), Ciprofloxacin (16.67%), Ceftriaxone (9.52%) and Cefotaxime (7.14%). This is in agreement with Otalu *et al.* (2011), Waters *et al.* (2011) and Heo *et al.* (2008). Otalu *et al.* (2011) reported 100% resistance in *S. aureus* isolates from poultry meat against tetracycline and 61.5% against methicillin in Nigeria. Waters *et al.* (2011) reported 46.2% and 15.4% resistance against chloramphenicol and ciprofloxacin whereas, 38.5% against gentamicin and sulfamethoxazole/trimethoprim. They also reported multidrug resistant *S. aureus* several times. Heo *et al.* (2008) reported 92.9% and 50% resistance of tetracycline and ampicillin respectively. The *S. aureus* isolates were more susceptible to Perfloxacin (86.2%), Gentamycin (82.8%), Ciprofloxacin (82.7%) and Streptomycin (79.3%). Also the isolates were less susceptible to Cotrimoxazole (48.3%), Ceftriaxone (44.8%), Erythromycin (41.4%), Ampiclox (17.8%), Amoxicillin (13.8%) and Cefuroxime (3.5%) respectively (Owuna *et al.,* 2015). Extensive uses of these antibiotics are thought to be the major cause of drug resistance in food-borne pathogens (Otalu *et al.,* 2011).

In case of *Salmonela* spp., the most commonly identified resistance phenotypes were against Tetracycline (100%), Ampicillin (86.11%), Amoxycillin (83.33%), Streptomycin (72.22%), Chloramphenicol (55.56%), Gentamycin (50%), Kanamycin (44.44%), Nalidixic acid (38.89%), Ciprofloxacin (33.33%), Azithromycin (27.78%), Cefotaxime (11.11%) and Ceftriaxone (8.33%). This present study was strongly supported by Minami *et al.* (2010) who reported majority of *Salmonella* isolates exhibit resistance to tetracycline and streptomycin, and a number of multi-drug resistant *Salmonella* were reported, showed resistance to ampicillin, tetracycline, streptomycin, gentamicin, chloramphenicol and kanamycin. Dione *et al.* (2009) revealed that high rate of *Salmonella* resistance was counted against sulfamethoxazole/trimethoprim (75.9%), tetracycline (74.7%) and streptomycin (73.9%). Ellerbroek *et al.* (2010) reported 27% and 34.8% resistance against kanamycin and gentamicin respectively to *Salmonella* isolates in a similar study which is in compliance of our study. Extensive use of antibiotic in animals contributed to increase the resistance against antibiotics in different bacterial strains over the last 30 years.

Table 1. Name and percentage of samples positive for bacterial isolates.

Name of samples collected	No. of samples collected	Name of isolated bacteria	No. of samples positive for bacteria	% of samples positive for bacteria
Raw chicken meats	100	*Escherichia coli*	52	52
		Coagulase positive *Staphylococcus*	42	42
		Salmonella spp.	36	36
		Enterobacter spp.	20	20
		Coagulase negative *Staphylococcus*	14	14
		Bacillus spp.	10	10

Legends: No. = Number and % = Percentage

Table 2. Overall prevalence of bacteria isolated from raw chicken meats.

Name of isolated bacteria	No. of isolated bacteria	% of isolated bacteria
Escherichia coli	52	29.89
Coagulase positive *Staphylococcus*	42	24.14
Salmonella spp.	36	20.69
Enterobacter spp.	20	11.49
Coagulase negative *Staphylococcus*	14	8.05
Bacillus spp.	10	5.75
Total	**174**	**100**

Legends: No. = Number and % = Percentage

Table 3. Resistance phenotypes of isolated *Escherichia coli*.

No. of Isolates	Resistance phenotypes	No. of isolates	Resistance phenotypes
1	AZM, CIP, TE, AML, AMP, NAL	27	CIP, TE, AML, AMP, C, KAN, STR
2	CTR, CTX, TE, AML, AMP, C, GEN, NAL, KAN	28	TE, AML, AMP, GEN, KAN, STR
3	CIP, TE, AML, AMP, GEN, NAL, KAN, STR	29	TE, AML, AMP, C, GEN, KAN, STR
4	AZM, TE, AML, AMP, NAL, STR	30	TE, AML, AMP, C, KAN, STR
5	CTR, CTX, AZM, TE, AML, AMP, STR	31	CTR, CTX, TE, AML, AMP, GEN
6	TE, AML, AMP, GEN, KAN, STR	32	CIP, TE, AML, AMP, C, GEN, KAN, STR
7	CIP, TE, AML, AMP, STR	33	TE, AML, AMP, C,, NAL, KAN, STR
8	AZM, TE, AML, AMP, STR	34	CIP, TE, AML, AMP, STR
9	TE, AML, AMP, C, GEN, STR	35	TE
10	AZM, TE, AML, AMP, NAL, STR	36	AZM, TE, AML, AMP, GEN, STR
11	TE, AML, AMP, GEN, NAL, KAN, STR	37	TE, AML, AMP, C, GEN, STR
12	CTR, CTX, TE, AML, AMP, NAL, KAN, STR	38	CIP, TE, AML, AMP, STR
13	TE, AML, AMP, GEN, STR	39	TE
14	AZM, TE, AML, AMP, GEN, KAN	40	CIP, TE, AML
15	TE, AML, AMP, GEN, NAL, KAN, STR	41	TE, AML, AMP, C, STR
16	AZM, TE, AML, AMP, KAN, STR	42	TE, AML, AMP, C, NAL, KAN, STR
17	TE, AML, AMP, GEN, KAN	43	TE, AML, AMP, KAN, STR
18	CIP, TE, AML, AMP, NAL, KAN	44	TE, AML, AMP, GEN, KAN
19	TE, AML, AMP, GEN, NAL, KAN, STR	45	AZM, TE, AML, AMP, KAN, STR
20	TE, AML, AMP, GEN, NAL, KAN, STR	46	TE, AML, AMP, C, GEN, NAL, KAN, STR
21	CIP, TE, AML, AMP, GEN, STR	47	TE, AML, AMP, C, GEN, KAN
22	TE, AML, AMP, KAN, STR	48	CIP, TE, AML, AMP, STR
23	AZM, TE, AML, AMP, C, KAN, STR	49	CIP, TE, AML, AMP, NAL, KAN, STR
24	TE, AML, AMP, GEN, STR	50	TE, AML, AMP, C, NAL, KAN, STR
25	TE, AML, AMP, C, KAN, STR	51	AZM, CIP, TE, AML, AMP, STR
26	TE, AML, AMP, GEN, STR	52	AZM, TE, AML, AMP, GEN, NAL

Legends: No.= Number; CTR= ceftriaxone; CTX= cefotaxime; AZM= azithromycin; CIP= ciprofloxacin; TE= tetracycline; C= chloramphenicol; AML= amoxicillin; AMP= ampicillln; GEN= gentamycin; NAL= nalidixic acid; KAN= kanamycin and STR= streptomycin

Table 4. Resistance phenotypes of isolated Coagulase positive *Staphylococcus*.

No. of isolates	Resistance phenotypes	No. of isolates	Resistance phenotypes
1	AZM, TE, AML, AMP, C, GEN, NAL, STR	22	TE, AML, AMP, C, GEN, STR
2	CIP, TE, AML, AMP, C, GEN, KAN, STR	23	CIP, TE, AML, AMP, C, GEN, STR
3	TE	24	CIP, CTR, CTX, AZM, TE, AML, AMP, C, GEN, STR
4	CTR, CTX, AZM, TE, AML, AMP, C, GEN, NAL, STR	25	TE, AML, AMP, C, GEN, KAN, STR
5	TE, AML, AMP, C, GEN, KAN, STR	26	TE, AML, AMP, C, GEN, STR
6	TE, AML, AMP, C, NAL, KAN, STR	27	TE, AML, AMP, C, GEN, STR
7	TE, STR	28	TE, AML, C
8	AZM, TE, AML, AMP, C, GEN, KAN, STR	29	TE, AML, AMP, C, STR
9	TE, AML, C, GEN, NAL, KAN, STR	30	AZM, TE, AML, AMP, C, KAN, STR
10	CIP, TE, AML, AMP, C, GEN, STR	31	TE, AML, AMP, C, GEN, KAN, STR

No. of isolates	Resistance phenotypes	No. of isolates	Resistance phenotypes
11	CTR, CTX, TE, AML, AMP, C, NAL, KAN, STR	32	CIP, TE, AML, AMP, C, GEN, STR
12	TE, AML, AMP, C, GEN, NAL, STR	33	TE, AML, AMP, C, GEN, STR
13	AZM, TE, AML, AMP, C, GEN, KAN, STR	34	AZM, TE, AML, AMP, C, GEN STR,
14	TE, AML, AMP, C, NAL, KAN, STR	35	AZM, TE, AML, AMP, C, GEN, STR
15	AZM, TE, AML, AMP, C, GEN, NAL, STR	36	TE, AML, AMP, C, NAL, STR
16	TE, AML, AMP, C, GEN, KAN, STR	37	TE, AML, AMP, C, GEN, NAL, STR
17	TE, AML, AMP, C, GEN, KAN, STR	38	TE, AML, AMP, C, GEN, STR
18	CIP, TE, AML, AMP, C, GEN, NAL, KAN, STR	39	AZM, TE, AML, AMP, C, GEN, NAL, STR
19	TE, AML, AMP, C, GEN, NAL, KAN, STR	40	TE, AML, AMP, C, GEN, NAL, STR
20	TE, AML, AMP, C, NAL, KAN, STR	41	AZM, TE, AML, AMP, C, STR
21	CTR, TE, AML, AMP, C, GEN, STR	42	CIP, TE, AML, AMP, C, STR

Legends: No.= Number; CTR= ceftriaxone; CTX= cefotaxime; AZM= azithromycin; CIP= ciprofloxacin; TE= tetracycline; C= chloramphenicol; AML= amoxicillin; AMP= ampicillln; GEN= gentamycin; NAL= nalidixic acid; KAN= kanamycin and STR= streptomycin

Table 5. Resistance phenotypes of isolated *Salmonella* species.

No. of isolates	Resistance phenotypes	No. of isolates	Resistance phenotypes
1	AZM, CIP, TE, AML, AMP, GEN, NAL, KAN, STR	19	TE, AML, AMP, C, GEN, NAL, KAN, STR
2	AZM, TE, AML, AMP, C, GEN, NAL, KAN, STR	20	CIP, TE, AML, AMP, C, GEN, NAL, KAN, STR
3	TE	21	CTR, CTX, AZM, CIP, TE, AML, AMP, C, NAL, KAN, STR
4	CIP, TE, AML, AMP, C, GEN, NAL, KAN, STR	22	TE, AML, AMP, C, GEN, NAL, KAN, STR
5	TE, AMP	23	CIP, TE, AML, AMP, C, GEN, KAN,
6	CTX, AZM, TE, AML, AMP, C, GEN, KAN, STR	24	TE, C, GEN
7	TE, AML, AMP, C, GEN, NAL, KAN, STR	25	TE, AML, AMP, C, STR
8	TE	26	AZM, CIP, TE, AML, AMP, C
9	TE, AML, AMP, C, GEN, NAL, KAN, STR	27	TE, AML, AMP, C
10	CTR, CTX, AZM, TE, AML, AMP, GEN, STR	28	TE, AML, AMP, C, STR
11	CIP, TE, AML, AMP, NAL, KAN, STR	29	AZM, CIP, TE, AML, AMP, STR
12	TE, AML, AMP, C, GEN, NAL, KAN, STR	30	TE, AML, AMP, STR
13	TE, AML, AMP, C, GEN, NAL, KAN, STR	31	CIP, TE, AML, AMP, C, STR
14	AZM, TE, AML, AMP, GEN, NAL, KAN, STR	32	TE, AML, AMP, C, STR
15	CIP, TE, AML, AMP, GEN, STR	33	AZM, TE, AML, AMP, STR
16	TE, AML, AMP, C, GEN, NAL, KAN, STR	34	TE
17	TE	35	CIP, TE, AML, AMP, STR
18	CTR, CTX, AZM, TE, AML, AMP, GEN,	36	CIP, TE, AML, AMP, STR

Legends: No.= Number; CTR= ceftriaxone; CTX= cefotaxime; AZM= azithromycin; CIP= ciprofloxacin; TE= tetracycline; C= chloramphenicol; AML= amoxicillin; AMP= ampicillln; GEN= gentamycin; NAL= nalidixic acid; KAN= kanamycin and STR= streptomycin

Table 6. Result of antibiotic sensitivity and resistance patterns of isolated *Escherichia coli*.

Name of antibiotics used	No. of isolates tested	Antibiotic sensitivity & resistant patterns					
		Sensitive		Intermediate sensitive		Resistant	
		No.	%	No.	%	No.	%
Ceftriaxone	52	48	92.31	0	0.00	4	7.69
Cefotaxime		47	90.38	1	1.92	4	7.69
Azithromycin		38	73.08	2	3.85	12	23.08
Ciprofloxacin		38	73.08	1	1.92	13	25.00
Tetracyclin		0	0.00	0	0.00	52	100.00
Amoxycillin		2	3.85	0	0.00	50	96.15
Ampicillln		3	5.77	0	0.00	49	94.23
Chloramphenicol		26	50.00	11	21.15	15	28.85
Gentamycin		20	38.46	8	15.38	24	46.15
Nalidix acid		20	38.46	6	11.54	16	30.77
Kanamycin		18	34.62	5	9.62	29	55.77
Streptomycin		8	15.38	4	7.69	40	76.92

Legends: No. = Number and % = Percentage

Table 7. Result of antibiotic sensitivity and resistance patterns of isolated coagulase positive *Staphylococcus*.

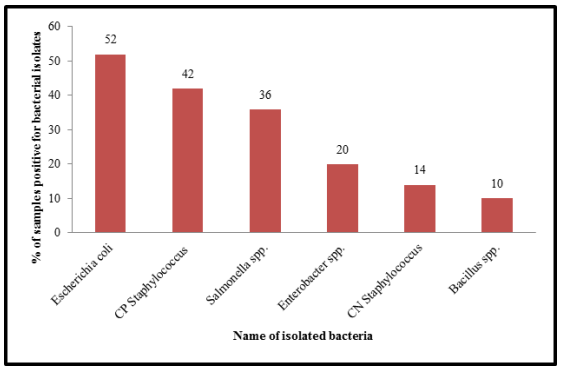
Name of antibiotics used	No. of isolates tested	Antibiotic sensitivity & resistant patterns					
		Sensitive		Intermediate sensitive		Resistant	
		No.	%	No.	%	No.	%
Ceftriaxone	42	37	88.10	1	2.38	4	9.52
Cefotaxime		36	85.71	3	7.14	3	7.14
Azithromycin		27	64.29	4	9.52	11	26.19
Ciprofloxacin		34	80.95	1	2.38	7	16.67
Tetracyclin		0	0.00	0	0.00	42	100.00
Amoxycillin		1	2.38	1	2.38	40	95.24
Ampicillln		1	2.38	3	7.14	38	90.48
Chloramphenicol		0	0.00	2	4.76	40	95.24
Gentamycin		6	14.29	6	14.29	30	71.43
Nalidix acid		15	35.71	12	28.57	15	35.71
Kanamycin		16	38.10	10	23.81	16	38.10
Streptomycin		0	0.00	2	4.76	40	95.24

Legends: No. = Number and % = Percentage

Table 8. Result of antibiotic sensitivity and resistance patterns of isolated *Salmonella* species.

Name of antibiotics used	No. of isolates tested	Antibiotic sensitivity & resistant patterns					
		Sensitive		Intermediate sensitive		Resistant	
		No.	%	No.	%	No.	%
Ceftriaxone	36	32	88.89	1	2.78	3	8.33
Cefotaxime		32	88.89	0	0.00	4	11.11
Azithromycin		24	66.67	2	5.56	10	27.78
Ciprofloxacin		23	63.89	1	2.78	12	33.33
Tetracyclin		0	0.00	0	0.00	36	100.00
Amoxycillin		3	8.33	3	8.33	30	83.33
Ampicillln		2	5.56	3	8.33	31	86.11
Chloramphenicol		10	27.78	6	16.67	20	55.56
Gentamycin		10	27.78	8	22.22	18	50.00
Nalidix acid		14	38.89	8	22.22	14	38.89
Kanamycin		13	36.11	7	19.44	16	44.44
Streptomycin		7	19.44	3	8.33	26	72.22

Legends: No. = Number and % = Percentage



Legends: % = Percentage; CP= Coagulase positive and CN= Coagulase negative

Figure 1. Name and percentage of samples positive for bacterial isolates in raw chicken meats.

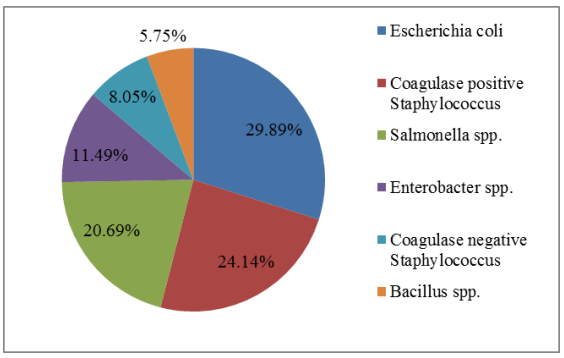
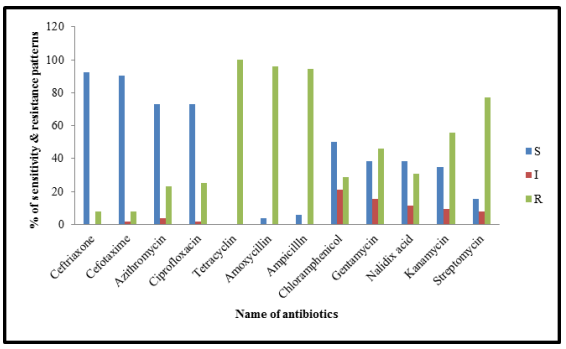
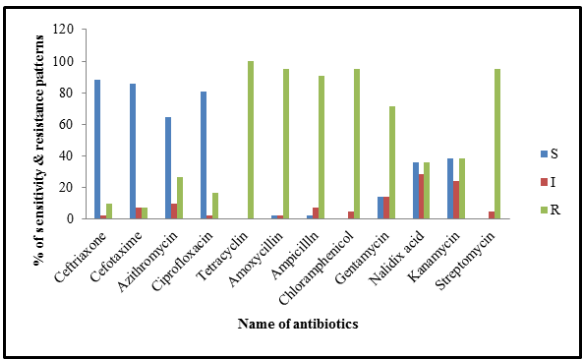


Figure 2. Overall prevalence of bacteria isolated from raw chicken meats.



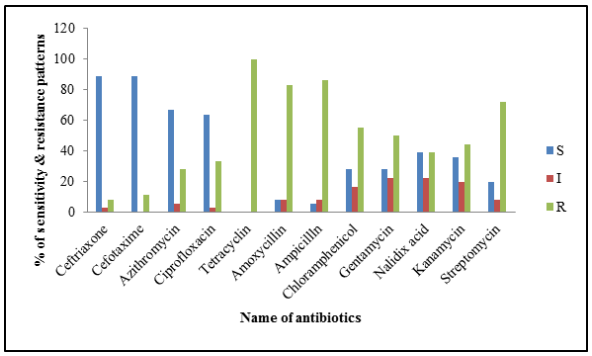
Legends: % = Percentage; S = Sensitive; I = Intermediate sensitive and R = Resistant

Figure 3. Antibiotic sensitivity and resistance patterns of isolated *Escherichia coli.*



Legends: % = Percentage; S = Sensitive; I = Intermediate sensitive and R = Resistant

Figure 4. Antibiotic sensitivity and resistance patterns of isolated coagulase positive *Staphylococcus.*



Legends: % = Percentage; S = Sensitive; I = Intermediate sensitive and R = Resistant

Figure 5. Antibiotic sensitivity and resistance patterns of isolated *Salmonella* species.

4. Conclusions

Contaminated raw chicken meat is one of the main sources of foodborne illnesses and a potential risk of the transmission of zoonotic infections. In this study, it was revealed that 100% of samples were contaminated by at least one species of bacteria belonging to 5 genera such as *Staphylococcus*, *Escherichia coli*, *Salmonella*, *Enterobacter* and *Bacillus*. All most all isolates of *Escherichia coli*, Coagulase positive *Staphylococcus* and *Salmonella* species were developed multidrug resistance properties (resistant to more than two antimicrobial agents) which is alarming for the poultry industry and an increasing food safety concern for human. Further molecular characterization is prerequisite to detect multidrug resistant genes in order to find out the ways to prevent multidrug resistance properties of food borne pathogens.

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Conflict of interest

None to declare.

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