

*Original Research***Antimicrobial Susceptibility of *Staphylococcus aureus* Isolates from Chicken Meat and Ready to Eat Chicken Products in Jabalpur City**Vijaya Singh Thakur, Bhavana Gupta\*, R. V. Singh, Anju Nayak<sup>1</sup> and Sujata Meravi

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| Rec. Date:   | Sep 23, 2019 09:30  |
| Accept Date: | Nov 15, 2019 17:14  |
| DOI          | <a href="https://doi.org/10.5455/ijlr.20190923093013">10.5455/ijlr.20190923093013</a> |

**Abstract**

*Staphylococcus aureus* is Gram-positive, non-spore forming, non-motile commensal and opportunistic pathogen. In this study 66 *S. aureus* were obtained from 170 samples of raw chicken meat and its ready-to-eat (RTE) chicken products. On *In vitro* antibiogram study of all the isolates of *S. aureus* against 16 different antimicrobials revealed *S. aureus* isolates showed resistance to tetracycline (67.6%), lincomycin (51.5%), erythromycin (48.4%) and ceftazidime (43.9%) and isolates were sensitivity to vancomycin (95.4%), ceftriaxone (92.4%), cefalexin (87.8%) and amoxicillin (83.3%). MAR (Multiple antibiotic resistance) index of various isolates indicates an overall range from 0.06-0.56 where in raw chicken meat and ready to eat (RTE) chicken products range varies from 0.06 to 0.56 and 0.06-0.37, respectively. Maximum isolates of *S. aureus* were resistant to one (25 isolates, MAR index 0.1) followed by resistance to 3 antibiotics (19 isolates, MAR index 0.3), resistance to 2 antibiotics (11 isolates, MAR index 0.2). In conclusion, the study revealed that the chicken meat and meat products in the study area were contaminated with *S. aureus* which indicates poor hygienic practices in slaughter house and retail outlets, further antibiotic resistant strains in raw chicken meat and especially ready-to-eat (RTE) chicken products are indicative of safety risk at consumer level.

**Key words:** Antibiogram and MAR (Multiple Antibiotic Resistance) Index, Raw Chicken Meat and Ready to Eat (RTE) Chicken Products, *Staphylococcus aureus*

**How to cite:** Thakur, V., Gupta, B., Singh, R., Nayak, A., & Meravi, S. (2019). Antimicrobial Susceptibility of *Staphylococcus aureus* Isolates from Chicken Meat and Ready to Eat Chicken Products in Jabalpur City. International Journal of Livestock Research, 9(12), 50-58. doi: 10.5455/ijlr.20190923093013

**Introduction**

*S. aureus* have emerged as one of the major foodborne pathogens causing food-borne illnesses ranging from mild diarrhoea to a life-threatening complication with great public health importance. The pathogen infectiousness is due to combination of toxin-mediated virulence, invasiveness and antibiotic resistance.

Staphylococcal food poisoning is an intoxication that is caused by the ingestion of food containing pre-formed enterotoxin. Food handlers transmitted *S. aureus* via direct contact with their hands or through respiratory secretions. Staphylococcal food poisoning symptoms generally have a rapid onset due to short incubation period, ranges from 1–6 hours after ingestion. Common symptoms include nausea, vomiting, abdominal cramps and diarrhoea. *S. aureus* is considered as one of the major pathogen responsible for a variety of skin infection and is a commensal bacterium in skin and nasal cavity of both human and animals. The virulence of *S. aureus* in causing infection has been attributed to several factors (Ruban *et al.*, 2017). Food poisoning represents a major source of illness and loss of productivity in many developed countries (Scallan *et al.*, 2011). Of particular concern in recent years are outbreaks of food poisoning associated with enterotoxin produced by *S. aureus*, *E. coli* O157:H7 or *L. monocytogenes*, many of which have been associated with consumption of animal origin products. However, accurate data for the estimation of poultry meat borne infections are relatively lacking in India, especially in Madhya Pradesh. This may be due to lack of awareness and resources for diagnosis, documentation and reporting system. So, keeping these points in mind, the present research work was envisaged to observe antimicrobial susceptibility and MAR index of *S. aureus* isolates.

### Materials and Methods

A total of 170 samples including 100 raw chicken and 70 chicken products consisting of chicken samosa (10), chicken pattis (10), chicken momos (15 fried and 15 steamed), chicken barbeque (10) and chicken tikka (10) were collected from different retail outlets in Jabalpur city. The samples were collected in properly sterilized polythene bags and transferred to laboratory in chilled condition for bacteriological examination on ice and stored at 4°C till further processing. All samples were processed for isolation of *S. aureus* within 24 hrs of arrival in the laboratory. (Agarwal *et al.*, 2003).

### Antimicrobial Sensitivity Test

The *in vitro* antibiogram of *S. aureus* isolates against 16 different antibiotics was determined by disc diffusion method of Bauer *et al.* (1966) on Muller-Hinton agar (Hi-Media). A loopful of the growth from slant was inoculated in brain heart infusion (BHI) broth and incubated at 37°C for 3 to 5 hrs. A sterile cotton swab was dipped into the broth culture and excess of the bacterial suspension was removed by pressing and rotating the swab against the inner walls of the test tube. Streak was applied thrice across the entire agar surface and the plate was being turned for 60° between each streaking. The surface of pre incubated and sterile Mueller-Hinton agar petriplate was kept at room temperature for 30 min to allow the inoculum to be absorbed on the surface. Antibiotic sensitivity octadisc (Hi Media Ltd, Mumbai, India) were placed with the help of flamed forceps on the plates. The plates were incubated overnight at 37°C (Fig. 1). The results were interpreted according to the instructions of the manufacturer.



Figure 1: Antimicrobial assay of *S. aureus* isolates from raw chicken meat and its products

## Results

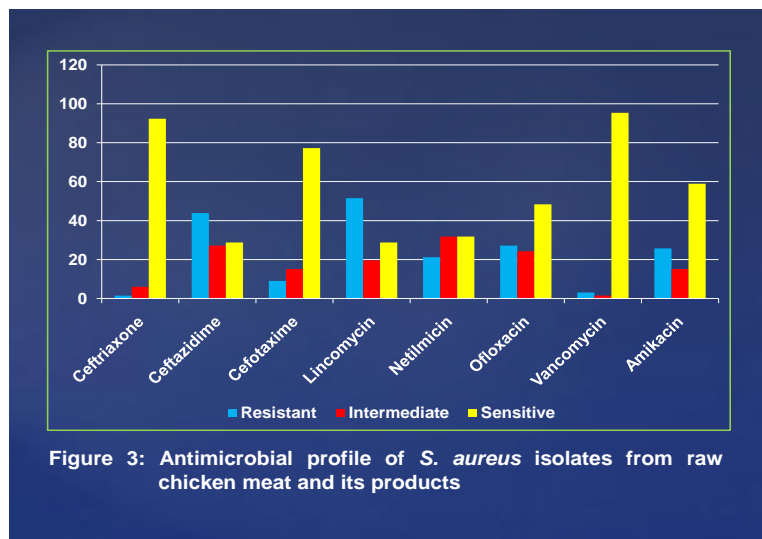
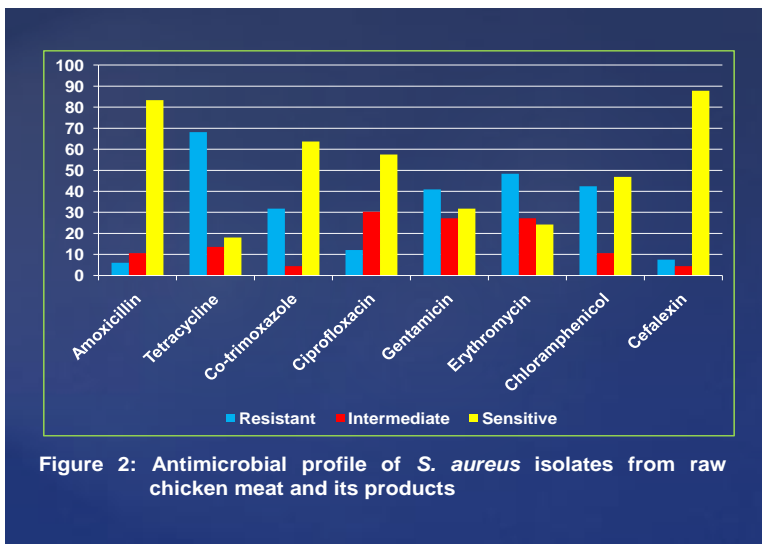
*In vitro* antibiogram study of the isolates of *S. aureus* against 16 different antimicrobials revealed sensitivity to vancomycin (95.4%), ceftriaxone (92.4%), cefalexin (87.8%) and amoxicillin (83.3%). *S. aureus* isolates showed resistance to tetracycline (68.1%), lincomycin (51.5%), erythromycin (48.4%) and ceftazidime (43.9%) as shown in Table 1 and 2. Multiple antibiotic resistance (MAR) index of various isolates (Table 3) indicates an overall range from 0.06-0.56 where in raw chicken meat and ready to eat (RTE) chicken products range varies from 0.06 to 0.56 and 0.06-0.37, respectively. Maximum isolates of *S. aureus* were resistant to one (25 isolates, MAR index 0.1) followed by resistance to 3 antibiotics (19 isolates, MAR index 0.3), resistance to 2 antibiotics (11 isolates, MAR index 0.2). Six isolates were having MAR index 0.06 and one isolate is having MAR index 0.00, whereas resistance to 4 antibiotics (1 isolates, MAR index 0.4) and 5 antibiotics (03 isolates, MAR index 0.5) was also reported in this study. From raw chicken meat 71.05% (27/38) isolates are having MAR index  $\geq 0.2$  with 42.1% (16/38) isolates MAR index 0.3, 18.42% (7/38) isolates MAR index 0.2, 2.6% (1/38) MAR index 0.4 and 7.9% isolates MAR index (3/38). In case of ready to eat (RTE) chicken meat products 25.00% (07/28) isolates are having MAR index  $\geq 0.2$  with 10.72% (03/28) isolates MAR index 0.3 and 14.28% (4/28) isolates MAR index 0.2.

**Table 1:** Antibiogram assay of *S. aureus* isolates

| S. No. | Name of antimicrobial agent | Pattern of antibiogram | Total | Percentage (%) |
|--------|-----------------------------|------------------------|-------|----------------|
| 1      | Amoxicillin (10mcg)         | R                      | 4     | 6              |
|        |                             | I                      | 7     | 10.6           |
|        |                             | S                      | 55    | 83.3           |
| 2      | Tetracycline (30 mcg)       | R                      | 45    | 68.1           |
|        |                             | I                      | 9     | 13.6           |
|        |                             | S                      | 12    | 18.1           |
| 3      | Co- trimoxazole (25mcg)     | R                      | 21    | 31.8           |
|        |                             | I                      | 3     | 4.5            |
|        |                             | S                      | 42    | 63.6           |
| 4      | Ciprofloxacin (5mcg)        | R                      | 8     | 12.1           |
|        |                             | I                      | 20    | 30.3           |
|        |                             | S                      | 38    | 57.5           |
| 5      | Gentamicin (10mcg)          | R                      | 27    | 40.9           |
|        |                             | I                      | 18    | 27.2           |
|        |                             | S                      | 21    | 31.8           |
| 6      | Erythromycin (15mcg)        | R                      | 32    | 48.4           |
|        |                             | I                      | 18    | 27.2           |
|        |                             | S                      | 16    | 24.2           |
| 7      | Chloramphenicol (30mcg)     | R                      | 28    | 42.4           |
|        |                             | I                      | 7     | 10.6           |
|        |                             | S                      | 31    | 46.9           |
| 8      | Cefalexin (30mcg)           | R                      | 5     | 7.5            |
|        |                             | I                      | 3     | 4.5            |
|        |                             | S                      | 58    | 87.8           |
| 9      | Ceftriaxone (30mcg)         | R                      | 1     | 1.5            |
|        |                             | I                      | 4     | 6              |
|        |                             | S                      | 61    | 92.4           |
| 10     | Ceftazidime (30mcg)         | R                      | 29    | 43.9           |
|        |                             | I                      | 18    | 27.2           |
|        |                             | S                      | 19    | 28.7           |
| 11     | Cefotaxime (30mcg)          | R                      | 6     | 9              |
|        |                             | I                      | 10    | 15.1           |
|        |                             | S                      | 51    | 77.2           |
| 12     | Lincomycin (2mcg)           | R                      | 34    | 51.5           |
|        |                             | I                      | 13    | 19.6           |
|        |                             | S                      | 19    | 28.7           |
| 13     | Netilmicin (30mcg)          | R                      | 14    | 21.2           |
|        |                             | I                      | 21    | 31.8           |
|        |                             | S                      | 21    | 31.8           |
| 14     | Ofloxacin (2mcg)            | R                      | 18    | 27.2           |
|        |                             | I                      | 16    | 24.2           |
|        |                             | S                      | 32    | 48.4           |
| 15     | Vancomycin (30mcg)          | R                      | 2     | 3              |
|        |                             | I                      | 1     | 1.5            |
|        |                             | S                      | 63    | 95.4           |
| 16     | Amikacin (30mcg)            | R                      | 17    | 25.7           |
|        |                             | I                      | 10    | 15.1           |
|        |                             | S                      | 39    | 59             |

**Table 2:** Antibiogram assay of *S. aureus* isolates from different samples

| S. No. | Name of antimicrobial | Pattern of antibiogram | Raw chicken meat (n=38) | Ready to eat chicken products (RTE) (n=28) |                     |                    |                   |                      |
|--------|-----------------------|------------------------|-------------------------|--|---------------------|--------------------|-------------------|----------------------|
|        |                       |                        |                         | Chicken samosa (7)                         | Chicken patties (3) | Chicken momos (15) | Chicken tikka (2) | Chicken Barbeque (1) |
| 1      | Amoxicillin           | R                      | 2(5.2%)                 | 0(0.00%)                                   | 0(0.00%)            | 0(0.00%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | I                      | 3(7.8%)                 | 0(0.00%)                                   | 0(0.00%)            | 2(13.3%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | S                      | 33(86.8%)               | 7(100%)                                    | 3(100%)             | 13(86.6%)          | 2(100%)           | 1(100%)              |
| 2      | Tetracycline          | R                      | 29(76.3%)               | 4(57.1%)                                   | 3(100%)             | 6(40.0%)           | 0(0.00%)          | 1(100%)              |
|        |                       | I                      | 1(2.6%)                 | 1(14.2%)                                   | 0(0.00%)            | 4(26.6%)           | 2(100%)           | 0(0.00%)             |
|        |                       | S                      | 8(21.0%)                | 2(28.5%)                                   | 0(0.00%)            | 5(33.3%)           | 0(0.00%)          | 0(0.00%)             |
| 3      | Co- trimoxazole       | R                      | 11(28.9%)               | 0(0.00%)                                   | 1(33.3%)            | 0(0.00%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | I                      | 2(5.2%)                 | 0(0.00%)                                   | 0(0.00%)            | 2(13.3%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | S                      | 25(65.7%)               | 7(100%)                                    | 2(66.6%)            | 13(86.6%)          | 2(100%)           | 1(100%)              |
| 4      | Ciprofloxacin         | R                      | 5(13.1%)                | 0(0.00%)                                   | 0(0.00%)            | 0(0.00%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | I                      | 13(34.2%)               | 2(28.5%)                                   | 1(33.3%)            | 5(33.3%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | S                      | 20(52.6%)               | 5(71.4%)                                   | 2(66.6%)            | 10(66.6%)          | 2(100%)           | 1(100%)              |
| 5      | Gentamicin            | R                      | 16(42.1%)               | 1(14.2%)                                   | 1(33.3%)            | 5(33.3%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | I                      | 12(31.5%)               | 3(42.8%)                                   | 0(0.00%)            | 6(40.0%)           | 1(50.0%)          | 1(100%)              |
|        |                       | S                      | 10(26.3%)               | 3(42.8%)                                   | 2(66.6%)            | 4(26.6%)           | 1(50.0%)          | 0(0.00%)             |
| 6      | Erythromycin          | R                      | 17(44.7%)               | 5(71.4%)                                   | 2(66.6%)            | 2(13.3%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | I                      | 10(26.3%)               | 2(28.5%)                                   | 1(33.3%)            | 3(20.0%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | S                      | 11(28.9%)               | 0(0.00%)                                   | 0(0.00%)            | 10(66.6%)          | 2(100%)           | 1(100%)              |
| 7      | Chloramphenicol       | R                      | 14(36.8%)               | 3(42.8%)                                   | 1(33.3%)            | 0(0.00%)           | 1(50.0%)          | 1(100%)              |
|        |                       | I                      | 5(13.1%)                | 1(14.2%)                                   | 0(0.00%)            | 4(26.6%)           | 1(50.0%)          | 0(0.00%)             |
|        |                       | S                      | 19(50.0%)               | 3(42.8%)                                   | 2(66.6%)            | 11(73.3%)          | 0(0.00%)          | 0(0.00%)             |
| 8      | Cefalexin             | R                      | 1(2.6%)                 | 0(0.00%)                                   | 0(0.00%)            | 0(0.00%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | I                      | 1(2.6%)                 | 0(0.00%)                                   | 0(0.00%)            | 0(0.00%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | S                      | 36(94.7%)               | 7(100%)                                    | 3(100%)             | 15(100%)           | 2(100%)           | 1(100%)              |
| 9      | Ceftriaxone           | R                      | 1(2.6%)                 | 0(0.00%)                                   | 0(0.00%)            | 0(0.00%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | I                      | 1(2.6%)                 | 0(0.00%)                                   | 0(0.00%)            | 0(0.00%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | S                      | 36(94.7%)               | 7(100%)                                    | 3(100%)             | 15(100%)           | 2(100%)           | 1(100%)              |
| 10     | Ceftazidime           | R                      | 21(55.2%)               | 3(42.8%)                                   | 0(0.00%)            | 7(46.6%)           | 1(50.0%)          | 0(0.00%)             |
|        |                       | I                      | 10(26.3%)               | 3(42.8%)                                   | 3(100%)             | 2(13.3%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | S                      | 7(18.4%)                | 1(14.2%)                                   | 0(0.00%)            | 6(40.0%)           | 1(50.0%)          | 1(100%)              |
| 11     | Cefotaxime            | R                      | 1(2.6%)                 | 0(0.00%)                                   | 0(0.00%)            | 0(0.00%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | I                      | 2(5.2%)                 | 3(42.8%)                                   | 0(0.00%)            | 2(13.3%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | S                      | 35(92.1%)               | 4(57.1%)                                   | 3(100%)             | 13(86.6%)          | 2(100%)           | 1(100%)              |
| 12     | Lincomycin            | R                      | 22(57.8%)               | 1(14.2%)                                   | 2(66.6%)            | 4(26.6%)           | 1(50.0%)          | 0(0.00%)             |
|        |                       | I                      | 9(23.6%)                | 3(42.8%)                                   | 1(33.3%)            | 2(13.3%)           | 1(50.0%)          | 1(100%)              |
|        |                       | S                      | 7(18.4%)                | 3(42.8%)                                   | 0(0.00%)            | 9(60.0%)           | 0(0.00%)          | 0(0.00%)             |
| 13     | Netilmicin            | R                      | 7(18.4%)                | 2(28.5%)                                   | 1(33.3%)            | 1(6.6%)            | 0(0.00%)          | 0(0.00%)             |
|        |                       | I                      | 15(39.4%)               | 0(0.00%)                                   | 1(33.3%)            | 5(33.3%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | S                      | 16(42.1%)               | 5(71.4%)                                   | 1(33.3%)            | 9(60.0%)           | 2(100%)           | 1(100%)              |
| 14     | Ofloxacin             | R                      | 11(28.9%)               | 0(0.00%)                                   | 0(0.00%)            | 5(33.3%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | I                      | 6(15.7%)                | 2(28.5%)                                   | 2(66.6%)            | 2(13.3%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | S                      | 21(55.2%)               | 5(71.4%)                                   | 1(33.3%)            | 8(33.3%)           | 2(100%)           | 1(100%)              |
| 15     | Vancomycin            | R                      | 0(0.00%)                | 0(0.00%)                                   | 0(0.00%)            | 0(0.00%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | I                      | 0(0.00%)                | 0(0.00%)                                   | 0(0.00%)            | 0(0.00%)           | 0(0.00%)          | 0(0.00%)             |
|        |                       | S                      | 38(100%)                | 7(100%)                                    | 3(100%)             | 15(100%)           | 2(100%)           | 1(100%)              |
| 16     | Amikacin              | R                      | 12(31.5%)               | 1(14.2%)                                   | 2(66.6%)            | 2(13.3%)           | 1(50.0%)          | 0(0.00%)             |
|        |                       | I                      | 5(13.1%)                | 1(14.2%)                                   | 1(33.3%)            | 2(13.3%)           | 1(50.0%)          | 1(100%)              |
|        |                       | S                      | 21(55.2%)               | 5(71.4%)                                   | 0(0.00%)            | 11(73.3%)          | 0(0.00%)          | 0(0.00%)             |



**Table 3:** *S. aureus* isolates from raw chicken meat and ready to eat chicken (RTE) products showing multiple antibiotic resistance

| S. No. | No. of antibiotics<br>Type of sample | No. of antibiotics |             |             |            |           |           |           |
|--------|--------------------------------------|--------------------|-------------|-------------|------------|-----------|-----------|-----------|
|        |                                      | 3                  | 4           | 5           | 6          | 7         | 8         | 9         |
| 1      | Raw chicken meat (n=38)              | 2 (5.26%)          | 6 (15.78%)  | 10 (26.31%) | 7 (18.42%) | 1 (2.63%) | 2 (5.26%) | 1 (2.63%) |
| 2      | Ready to eat chicken products (n=28) | 7 (28.00%)         | 6 (21.42%)  | 4 (14.28%)  | 2 (7.14%)  | 1(3.57%)  | 0 (0.00%) | 0 (0.00%) |
|        | Total (N=66)                         | 9 (13.63%)         | 12 (18.18%) | 14 (21.21%) | 9 (13.63%) | 2 (3.03%) | 2 (3.03%) | 1 (1.51%) |

**Discussion**

The antibiotic resistance is an emerging public health problem worldwide. The resistance in pathogenic bacteria is generally contributed by indiscriminate and injudicious use of antibiotics in the treatment of animals and humans. This problem is now becoming menace due to multiple drug resistance (Chatterjee *et*

al., 2009). Over the last few decades, *S. aureus* strains resistance towards methicillin and vancomycin are gaining importance because of bacteria intrinsic virulence, ability to cause a diverse array of life threatening infections including nosocomial or community infections and its capacity to adapt to different environmental conditions (Shrestha *et al.*, 2009). Therefore, there is a need for continuous evaluation to develop strategies to control the multidrug resistance problem. The present study of *S. aureus* antimicrobial resistance/ sensitivity in chicken meat and chicken meat products (ready to eat) revealed sensitivity to vancomycin, ceftriaxone, cefalexin and amoxicillin and resistant to tetracycline, lincomycin, erythromycin, ceftazidime and chloramphenicol. Isolates revealed overall range of MAR index from 0.06-0.5 with 0.06 to 0.56 and 0.06-0.37 for raw chicken meat and ready to eat chicken products (RTE), respectively.

The study by various workers revealed widespread multi drug resistance problem against several antibiotics for the strains of *S. aureus*, Naik *et al.* (2009) observed high resistance against ampicillin, penicillin and tetracycline and recorded high sensitivity against amikacin and ciprofloxacin while, Hoerlle *et al.* (2009) observed 100% susceptibility to vancomycin. Although similar study was conducted in milk products by Tripathi *et al.* (2015) in Jabalpur region and found that *S. aureus* isolates were sensitive to lincomycin and amikacin, resistant to amoxicillin and tetracycline. They also reported multiple drug resistance in some of isolates. Das and Mazumder (2016) studied the antibiotic susceptibility of 30 isolates of *S. aureus* from meat and found variably resistant to the antibiotics tested with maximum resistance for penicillin (73.33%) followed by erythromycin (36.66%), tetracycline (26.66%), oxacillin (23.33%), ciprofloxacin (16.66%), chloramphenicol (10%) and vancomycin (3.33%). Sasidharan *et al.* (2011) during a study in dairy products revealed resistance of few strains to methicillin, vancomycin and tetracycline and sensitivity to chloramphenicol, kanamycin. In another study, Sharma *et al.* (2011) examined 15 antimicrobial drugs and found that almost 80-90% isolates showed multiple drug resistant to majority of antimicrobial agents. Several isolates from milk samples were found resistant to amoxicillin+sulbactam, cloxacillin, erythromycin and kanamycin. They also reported various isolates were found susceptible to the ofloxacin, oxacillin, streptomycin, sulphafurazole and ciprofloxacin.

Sunitha *et al.* (2017) The *S. aureus* isolates were found highly sensitive to Chloramphenicol (93.10%), Cefuroxime (82.75%), Gentamicin (75.86%), Ciprofloxacin (75.86%), moderately sensitive to Erythromycin (48%) and found resistant to Methicillin, Vancomycin, Ampicillin, Amoxycyclav, Cotrimoxazole and Tetracycline. Daka *et al.* (2012) had shown similar results with our study in drugs like penicillin group viz. amoxicillin, penicillin and oxacillin where they examined resistance between 40-71%. Besides, they also found the higher sensitivity to chloroquinolones drugs viz. erythromycin, vancomycin as 100%, 68% and 61.5%, respectively and for ceftriaxone, 71% also reported multidrug resistance problem. Rahimi *et al.* (2013) observed resistance of *S. aureus* against 14 antimicrobial drugs via disc diffusion technique and found that highest resistance for ampicillin (55%) followed by tetracycline (40%)

and penicillin G (30%). They also found that 95% of isolates were resistant to one two antimicrobial agent and 45% isolates were resistant to three or more of drugs.

In this study we found that 71.05% (27/38) isolates are having MAR index  $\geq 0.2$  with 42.1% (16/38) isolates MAR index 0.3, 18.42% (7/38) isolates MAR index 0.2, 2.6% (1/38) MAR index 0.4 and 7.9% isolates MAR index (3/38) in case of raw chicken meat similarly 25.00% (07/28) isolates are having MAR index  $\geq 0.2$  with 10.72% (03/28) isolates MAR index 0.3 and 14.28% (4/28) isolates MAR index 0.2 isolates from ready to eat (RTE) chicken meat products. All isolates showing more than 0.2 MAR index exhibits that these are from a high-risk source of contamination where antibiotics are frequently used (Onaolapo *et al.*, 2016).

Most of the above mentioned study has shown similarity with the present study, while in case of few antimicrobials, the difference was observed with the present findings, this may be due to difference in the antimicrobial used for prophylactic and therapeutic purpose or as feed additive, as it is one of the main phenomena behind development of drug resistance in microbes. Multiple drug resistance pattern observed in this study may be due to increase in irrational consumption rate of antibiotics, transmission of resistant isolates between animals, human and environment. Self-medication, non-compliance with medication and sales of substandard drug in veterinary as well as in medical field.

### Conclusion

The study suggests that antibiotic susceptibility assay of chicken meat and meat products (ready-to-eat RTE chicken products) from slaughter house and retail outlets in the area were contaminated with antibiotic resistant strains *S. aureus*, of which in some strains multidrug resistance was also reported which is a matter of concern to consumer safety.

### Acknowledgments

Authors are thankful to incharge head of department of VPH and Epidemiology; Dean COVS& A. H., Jabalpur, DRS, NDVSU, Jabalpur for providing laboratory and other facilities to conduct research work.

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