IMPACT OF VARIOUS PROCESSING TECHNIQUES ON DISSIPATION BEHAVIOR OF ANTIBIOTIC RESIDUES IN POULTRY MEAT

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Received for Publication June 28, 2015
Accepted for Publication August 25, 2015

doi:10.1111/jfpp.12585

ABSTRACT

Instant research was planned to study the dissipation behavior of antibiotic residues in chicken meat using various heat-processing treatments. Purposely, poultry birds were procured and administered with antibiotics for a period of 42 days. Chicken meat, after slaughtering, was processed through boiling, grilling, microwaving and roasting techniques to assess the impact of processing on antibiotic (enrofloxacin, ciprofloxacin, oxytetracycline and doxycycline) residues through high-performance liquid chromatography technique. From the obtained results, antibiotics were dissipated as a function of processing technologies. Specifically, enrofloxacin residues were reduced with roasting (68.76%) and boiling (68.18%) against unprocessed meat, while grilling (33.34%) was least effective in reducing the antibiotic residues. Overall, roasting method was effective in reducing antibiotic residues. However, boiling and microwave processing were statistically at par with each other. Moreover, oxytetracycline was decreased significantly in microwave processing (72.37%). It is suggested that the whole food chain needs to be restructured, and stakeholder should work together in controlling the use of antibiotics.

PRACTICAL APPLICATIONS

Although poultry industry is the leading source of rapid protein to consumers, yet antibiotic residues have emerged as a leading public health concern in the developing countries. There is some unusual high prevalence of antibiotic residues in poultry feed that poses serious health risk to community. Additionally, a little research has been carried out regarding the impact of processing conditions on antibiotic residues in poultry meat with special reference to food safety situation in developing countries. In the present study, the authors have explored the impact of various food processing techniques/methods on the dissipation behavior of antibiotic residues in poultry meat. From the study findings, it is suggested that processing resulted in significant reduction in antibiotic residues. Specifically, roasting emerged as an effective approach with maximum dissipation of antibiotic residues as compared with other processing methods such as boiling, grilling and microwaving.

INTRODUCTION

Globally, there has been an increased incidence of antibiotic residues in meat-based products. Accordingly, food safety has been a major concern, in particular, due to the harmful effects of these antibiotic residues on public health. Antibiotics are used to increase animal growth, to increase feed efficiency and to prevent the occurrence of disease (Tollefson and Miller 2000). Efficient poultry production has been aided using antibiotics, permitting the customer to buy high-quality meat at rational price (Donoghue 2003). However, improper uses of veterinary drugs lead to the accumulation of drug residues in the animal products (Adams 2001). Food contaminated by veterinary drug

residues, when consumed by people, can cause detrimental effects on human health causing antibiotic resistance, drug toxicity and allergic reactions (Alhendi *et al.* 2000; Kao *et al.* 2001; Shareef *et al.* 2009). Some of the antibiotics are quickly excreted from the animal body, whereas some of them are not metabolized. From here, they enter to the food chain and cause physiological, pharmacological, pathological and toxicological health hazards (Gould 2008; Venkitanarayanan *et al.* 2013).

There have been quite a number of scientific investigations where the extent of antibiotic residues in poultry meat has been documented. In this context, Abasi *et al.* (2009) evaluated meat sample for the quantification of tetracycline, chlortetracycline and oxytetracycline (TCs) residues using high-performance liquid chromatography (HPLC) method. They observed that 74% of the samples had tetracycline residues. Additionally, 21.7% of the samples were known to contain residues even more than the maximum residue limits (MRLs) as standardized by the World Health Organization. Likewise, Pena *et al.* (2010) assessed antibiotic residues in chicken and turkey meat samples using a method based on liquid chromatography with spectrofluorimetric detection for enrofloxacin, ciprofloxacin, norfloxacin and sarafloxacin. From the results, chicken and turkey samples contained 44.2 and 37.8% residues of enrofloxacin, respectively, much higher than the MRLs (100 μg/kg) for the said antibiotic.

Various processing methods are believed to reduce antibiotic residues in meat. In this milieu, Hussein and Khalil (2013) conducted different cooking methods and found that processing resulted in significant reduction in oxytetracycline and enrofloxacin antibiotics through frying and grilling. Furthermore, higher reduction percentage was observed in oxytetracycline residues as compared with enrofloxacin antibiotic residues. Additionally, Kuhne *et al.* (2001) recorded 50 and 100% reduction in detectable tetracycline and chlortetracycline residues after heat treatment at 133C for 45 min.

Keeping in view the prevalence of antibiotic residues in poultry meat, instant research was designed to relate the effect of various processing methods on overall antibiotic residues and their dissipation behavior. Purposely, meat samples were subjected to roasting, microwaving, boiling and grilling techniques to assess the impact of processing on dissipation behavior of antibiotic residues.

MATERIALS AND METHODS

Procurement and Rearing of Experimental Birds

One-day-old broiler chicks (50 ± 5 g body weight) of "Hubbard strain" were procured from the local market of Faisalabad, Pakistan. Poultry feed (broiler Starter Crumb No. 14 N.D-cum-I.B, Gamboro and Lasuta, [Choong Ang Vaccine laboratories Co., Ltd. (CAvac) Korea]), for feeding the chicks for 6 weeks, was procured from the market. Antibiotics (enrofloxacin, ciprofloxacin, oxytetracycline and doxycycline) and vaccines (including N.D-cum-I.B, Gamboro and Lasuta) for the prevention of Newcastle disease were procured from the local market.

Antibiotic Administration

The chicks were weighted individually and then randomly divided into five experimental units each consisting of 20 broilers. The antibiotics of known amount were administrated to the birds for 10 consecutive days from 33rd to 42nd day of the bird's age by following the crop tube method after making required dilution from the available concentration.

Slaughtering of Experimental Birds

Five birds from each group were slaughtered according to the Halal ethical guidelines at the age of 42 days (at the completion of antibiotic administration). After slaughtering, thigh muscles, chest muscles and livers of chicken meat were collected. Thigh and chest muscles were deboned, wrapped in aluminum foil and finally packed in polythene Ziploc bags with respective labels and stored in the freezer at −40C for further analysis in Food Safety Laboratory, National Institute of Food Science and Technology, University of Agriculture, Faisalabad.

Dissipation Behavior of Antibiotic Residues in Chicken Meat during Heat Processing

Chicken meat was processed by different cooking techniques such as boiling, grilling, roasting and microwaving. Five hundred milliliters of water was heated in a stainless steel pot to boiling (100C) and temperature was maintained for boiling on hot plate. Using metal tongs, 100 g of prewashed deboned chicken meat samples was separately immersed in boiling water for 5 min as described by Avens *et al.* (2002). Grilling of deboned chicken meat was performed by a laboratory-scale infrared (IR) grill with a maximum power of 16 kW. Meat samples were placed on a meshed tray 0.2 m below the metal fiber burner. Samples were grilled for 2.5 min at 8 kW as described by Pieters *et al.* (2009). For roasting, 20 g of chicken meat sample was placed on a metal baking tray and cooked well in the center of electric oven at 200C for 30 min and allowed to cool for further analysis (Javadi *et al.* 2011). A 20 g sample was placed on a turned table for microwaving. The sample was

cooked under full power (900 W) for the specified time (3 min), removed and allowed to cool for further analysis (Javadi *et al.* 2011).

Analysis of Antibiotics in Meat

Chicken meat samples were processed and analyzed for antibiotic residues according to their respective methods as described in the texts that follow.

Determination of Oxytetracycline and Doxycycline Residues by HPLC

The antibiotic residues in chicken muscles were determined by following the method of Chen-Hao and Zou (2008). Homogeneous sample of 5.00 g (accurate to 0.01 g) of meat was placed into a 50 mL polypropylene centrifuge tube with 20 mL 0.1 mol/L Na_2EDTA-Mcilvaine buffer solution and mixed at vortex mixer for 1 min followed by 10 min ultrasonic extraction in an ice bath. The homogenized thigh meat and chest meat samples were then centrifuged at a speed of 3,000 rpm for 5 min (below 5C) to extract the desired analyte. The supernatant was removed and saved in a clean tube. The extraction was repeated twice and the collected supernatant was stored at −20C in freezer in separate labeled vials for further analysis.

Cleaning through solid phase extraction involved preconditioned hydrophile lipophile balance (HLB-SPE) cartridges, with 2 mL of HPLC-grade methanol and 2 mL of HPLC-grade water used for sample cleanup. A 10 mL extract was passed through (HLB-SPE) the cartridge. After the sample effused completely, the cartridge was washed with 3 mL of a solution containing methanol/water in 1:4 ratio v/v. Finally, the cartridge was eluted with 2 mL of HPLC-grade methanol and each analyte was collected in clean, dried sample vial. Each eluted analyte was dried with gentle nitrogen steam produced through HYN-300 nitrogen stream generator. Then each dried analyte was reconstituted with 1 mL of methanol/HPLC water (50/50% v/v). The analytes were filtered before injection to HPLC.

The residual concentration of oxytetracycline and doxycycline was determined using HPLC (Perkin Elmer series 200). The UV-vis detector was used with wavelength of 360 nm during analysis. The stainless steel column C_{18} of Supelco (Bellefonte, PA) with 25 cm × 4.6 mm (id) with particle size of 5 μm was used. The mobile phase (methanol : acetonitrile : 10 mmol/L trifluoroacetic acid (TFA) solution in the ratio of 7:35:58) was degassed with sonicator before use. The flow rate was 1 mL/min and the injection volume was 100 μL. Calibration curve was established using a series of calibration solutions of oxytetracycline and doxycycline in acetonitrile with concentration of 0.5, 1.5, 2.5, 5.0, 10.0 and 15.0 μg/L.

Determination of Enrofloxacin and Ciprofloxacin Residues by HPLC

The antibiotic residues in feed and chicken muscles were determined by the method of Si-Jun *et al.* (2007). About 2 g of minced sample was placed in a tissue homogenizer tube and 10 mL of 0.1% formic acid in acetonitrile was added to it, which was then homogenized in tissue homogenizer for 3 min. Then 1.0 g of anhydrous sodium sulfate was added to it and homogenized again for 2 min. The supernatant liquid was transferred to a clean centrifuge tube. The tissues were extracted again by repeating the earlier steps.

The HPLC instrument (Perkin Elmer series 200) equipped with fluorescence detector was used for enrofloxacin and ciprofloxacin antibiotic determination. The excitation and emission wavelength of 280 and 450 nm, respectively, was set during analysis. The mobile phase (acetonitrile: 0.02% aqueous formic acid in the ratio of 9:91 v/v) was degassed with sonicator before use. The flow rate was 1.0 mL/min with injection volume of 100 μL. Calibration curve was established using a series of calibration solutions of enrofloxacin and ciprofloxacin in acetonitrile with concentrations of 0.5, 1.5, 2.5, 5.0, 10.0 and 15.0 μg/L.

Statistical Analysis

The data of each parameter were obtained by applying completely randomized design (CRD). Levels of significance ($P \leq 0.05$ and $P \leq 0.01$) were determined (analysis of variance) using two-factor factorial CRD. Significant ranges were further compared using Duncan's multiple range test (Steel *et al.* 1997).

RESULTS

Dissipation of Antibiotic Residues during Chicken Meat Processing

Antibiotic Profiling of Whole Chicken Meat. This research was conducted to check the efficiency of the processing techniques in reducing the contents of antibiotics in various body organs of broiler chicks. In this trial, poultry birds were fed on antibiotic-rich diet that was started from 33rd day and fed for 10 consecutive days up to the 42nd day. After the trial, the birds were slaughtered and processed using different techniques (boiling, roasting, grilling and microwaving) and antibiotic residues were evaluated.

The means showing the presence of different antibiotics and impact of various processing techniques in reducing them are presented in Table 1. The results were quite conclusive that oxytetracycline is present in significantly higher amounts, i.e., 824.16 ± 7.20 μg/kg in raw poultry meat at

TABLE 1. EFFECTS OF PROCESSING CONDITIONS ON ANTIBIOTIC RESIDUES (μg/kg) IN WHOLE CHICKEN MEAT

Processing	Enrofloxacin	Ciprofloxacin	Oxytetracycline	Doxycycline
Unprocessed	746.34 ± 5.62	643.14 ± 6.97	824.16 ± 7.20	680.84 ± 8.84
Boiling	237.53 ± 2.13	205.46 ± 9.72	383.33 ± 3.70	425.53 ± 5.65
Grilling	497.56 ± 4.75	535.95 ± 5.31	686.80 ± 6.50	567.37 ± 6.20
Microwaving	334.68 ± 3.63	288.40 ± 3.23	227.67 ± 2.10	544.67 ± 6.67
Roasting	233.23 ± 10.19	200.98 ± 10.62	274.72 ± 3.40	340.42 ± 4.92
Overall means	409.86 ± 5.26[c]	374.78 ± 7.17[d]	479.34 ± 4.58[b]	511.76 ± 6.45[a]

Means sharing same letters in a row do not differ significantly at $P < 0.05$.

completion of feeding trial. The antibiotic enrofloxacin followed the trend with mean value of 746.34 ± 5.62 μg/kg in raw whole chicken meat. Doxycycline and ciprofloxacin followed the ladder with mean residues of 680.84 ± 8.84 and 643.14 ± 6.97 μg/kg, respectively. The processing reduced the antibiotic residues significantly while different processing conditions behaved differently.

Enrofloxacin residues were reduced from 746.34 ± 5.62 to 233.23 ± 10.19 and 237.53 ± 2.13 μg/kg, as a function of roasting and boiling, respectively. The grilling of poultry meat was least effective in reducing the residues of the aforementioned antibiotic. Likewise, roasting and boiling decreased the ciprofloxacin residues from 643.14 ± 6.97 to 200.98 ± 10.02 and 205.46 ± 9.72 μg/kg, respectively. The processing influenced the oxytetracycline contents significantly and it decreased from 824.16 ± 7.20 to 227.67 ± 2.10 μg/kg due to microwave processing. The doxycycline residues decreased from 680.84 ± 8.84 to 340.42 ± 4.92 μg/kg as a function of roasting.

Antibiotic Profiling of Thigh Chicken Meat. It was apparent from the results regarding the antibiotic profiling and influence of processing techniques on reducing them (Table 2) that enrofloxacin and oxytetracycline is present in significantly higher amounts, i.e., 927.48 ± 7.36 and 921.10 ± 8.04 μg/kg, respectively, in raw poultry meat (thigh). Ciprofloxacin followed the trend with mean residues of 823.08 ± 7.96 μg/kg. In raw thigh meat, least antibiotic residues were recorded for doxycycline, i.e., 722.32 ± 5.90 μg/kg. The processing reduced the antibiotic residues significantly but different processing conditions behaved differently. Enrofloxacin residues were reduced from 927.48 ± 7.36 to 309.16 ± 2.12 and 386.45 ± 3.40 μg/kg, as a function of roasting and boiling, respectively. The grilling of thigh part of chicken meat was least effective in reducing the residues of the aforementioned antibiotic. Likewise, roasting and boiling decreased the ciprofloxacin residues from 823.08 ± 7.96 to 274.36 ± 2.65 and 342.95 ± 3.82 μg/kg, respectively. The processing influenced the oxytetracycline contents significantly and it decreased from 921.10 ± 8.04 to 263.17 ± 3.16 μg/kg due to microwave processing. The doxycycline residues decreased from 722.32 ± 5.90 to 321.03 ± 3.29 μg/kg as a function of roasting.

Antibiotic Profiling of Chest Part of Chicken Meat. Table 3 shows the presence of different antibiotics in raw chest part of poultry meat at the completion time of

TABLE 2. EFFECTS OF PROCESSING CONDITIONS ON ANTIBIOTIC RESIDUES (μg/kg) IN THIGH PART OF CHICKEN MEAT

Processing	Enrofloxacin	Ciprofloxacin	Oxytetracycline	Doxycycline
Unprocessed	927.48 ± 7.36	823.08 ± 7.96	921.10 ± 8.04	722.32 ± 5.90
Boiling	386.45 ± 3.40	342.95 ± 3.82	447.14 ± 4.35	401.29 ± 3.61
Grilling	662.49 ± 4.11	587.91 ± 4.12	657.93 ± 5.89	515.94 ± 4.35
Microwaving	427.41 ± 3.14	379.30 ± 3.49	263.17 ± 3.16	573.27 ± 4.73
Roasting	309.16 ± 2.12	274.36 ± 2.65	354.27 ± 3.71	321.03 ± 3.29
Overall means	542.60 ± 4.02[a]	481.52 ± 4.41[c]	528.72 ± 5.03[ab]	506.77 ± 4.37[b]

Means sharing same letters in a row do not differ significantly at $P < 0.05$.

TABLE 3. EFFECTS OF PROCESSING CONDITIONS ON ANTIBIOTIC RESIDUES (μg/kg) IN CHEST PART OF CHICKEN MEAT

Processing	Enrofloxacin	Ciprofloxacin	Oxytetracycline	Doxycycline
Unprocessed	610.64 ± 7.84	562.50 ± 7.74	733.62 ± 5.32	647.54 ± 6.87
Boiling	234.86 ± 3.48	216.35 ± 3.13	313.51 ± 4.81	462.53 ± 5.62
Grilling	381.65 ± 5.78	450.00 ± 5.79	586.90 ± 5.85	518.03 ± 5.30
Microwaving	232.18 ± 3.29	213.88 ± 4.91	195.63 ± 1.62	509.87 ± 6.76
Roasting	203.55 ± 3.28	187.50 ± 4.58	203.78 ± 2.98	269.81 ± 3.86
Overall means	332.58 ± 4.73[c]	326.04 ± 5.23[c]	406.69 ± 4.12[b]	481.56 ± 5.68[a]

Means sharing same letters in a row do not differ significantly at $P < 0.05$.

TABLE 4. EFFECTS OF PROCESSING CONDITIONS ON ANTIBIOTIC RESIDUES (μg/kg) IN LIVER PART OF CHICKEN MEAT

Processing	Enrofloxacin	Ciprofloxacin	Oxytetracycline	Doxycycline
Unprocessed	1,175.96 ± 9.17	1,145.96 ± 10.29	1,167.74 ± 6.01	1,096.48 ± 6.74
Boiling	568.10 ± 8.77	553.60 ± 8.24	449.13 ± 2.47	783.20 ± 6.67
Grilling	734.98 ± 9.60	763.97 ± 7.19	778.49 ± 5.01	730.99 ± 4.83
Microwaving	725.90 ± 9.09	707.38 ± 8.25	417.05 ± 2.93	812.21 ± 6.48
Roasting	653.31 ± 10.98	636.64 ± 9.83	530.79 ± 3.01	548.24 ± 3.87
Overall means	771.65 ± 8.92[ab]	761.51 ± 8.76[ab]	668.64 ± 3.89[b]	794.22 ± 5.72[a]

Means sharing same letters in a row do not differ significantly at $P < 0.05$.

feeding trial along with the impact of various processing techniques in reducing them. The trends are almost identical to that of whole chicken and thigh chicken meat. Oxytetracycline is present in significantly higher amounts, i.e., 733.62 ± 5.32 μg/kg, followed by doxycycline (647.54 ± 6.87 μg/kg) in unprocessed chest meat. Enrofloxacin and ciprofloxacin were statistically similar with mean residues of 610.64 ± 7.84 and 562.50 ± 7.74 μg/kg, respectively. The processing reduced the antibiotic residues significantly, e.g., enrofloxacin residues were reduced from 610.64 ± 7.84 to 203.55 ± 3.28 and 232.18 ± 3.29 μg/kg as a function of roasting and microwaving, respectively. The grilling of chest part of chicken meat was least effective in reducing the residues of aforementioned antibiotic. Likewise, roasting and microwaving decreased the ciprofloxacin residues from 562.50 ± 7.74 to 187.50 ± 4.58 and 213.88 ± 4.91 μg/kg, respectively. The processing influenced the oxytetracycline contents significantly and it decreased from 733.62 ± 5.32 to 195.63 ± 1.62 μg/kg due to microwave processing. The doxycycline residues decreased from 647.54 ± 6.87 to 269.81 ± 3.86 μg/kg as a function of roasting.

Antibiotic Profiling of Liver Part of Chicken Meat. The means showing the presence of different antibiotics and the impact of various processing techniques in reducing them are presented in Table 4. The results were quite conclusive that enrofloxacin is present in significantly higher amounts, i.e., 1,175.96 ± 9.17 μg/kg, in raw liver part of chicken meat at the completion time of feeding trial. The oxytetracycline antibiotic followed the trend with mean value of 1,167.74 ± 6.01 μg/kg in liver part of meat at raw stage. Ciprofloxacin and doxycycline followed the ladder with mean residues of 1,145.96 ± 10.29 and 1,096.48 ± 6.74 μg/kg, respectively. The processing reduced the antibiotic residues significantly but different processing conditions behaved differently. Enrofloxacin residues were reduced from 1,175.96 ± 9.17 to 568.10 ± 8.77 and 653.31 ± 6.98 μg/kg as a function of boiling and roasting, respectively. The grilling of liver part of chicken meat was least effective in reducing the residues of aforementioned antibiotic. Likewise, boiling and roasting decreased the ciprofloxacin residues from 1,145.96 ± 10.29 to 553.60 ± 8.24 and 636.64 ± 9.83 μg/kg, respectively. The processing influenced the oxytetracycline contents significantly and it decreased from 1,167.74 ± 6.01 to 417.05 ± 2.93 μg/kg due to microwave processing. The doxycycline residues decreased from 1,096.48 ± 6.74 to 548.24 ± 3.87 μg/kg as a function of roasting.

DISCUSSION

Antibiotic residue dissipation during processing is due to heat treatment given to chicken meat that can convert them into less toxic or nontoxic metabolites. Poultry birds were fed with antibiotics and processing can tell us fate of that targeted antibiotic residues. A similar study was conducted by Hassani *et al.* (2008). They attained reduction in doxycycline residues through high-temperature and short-time treatment. Hussein and Khalil (2013) studied the processing behavior of oxytetracycline by feeding the birds at the rate of 15 mg/kg per day for five consecutive days. According to the findings of Rose *et al.* (1996), antibiotic residues show varying degree of stability during cooking processes and cooking influences the level of risk posed by antibiotic residues. Previous studies regarding the effect of heat treatment on tetracycline residues showed that these antibiotics are not very heat stable.

The results of the present study are supported by the findings of Javadi *et al.* (2011) that cooking treatments reduced antibiotic concentration. They determined the effect of boiling, roasting and microwaving on enrofloxacin residues in chicken muscles, liver and gizzard tissues. Highest reduction was achieved through boiling process followed by roasting and microwaving. The effect of cooking method on oxytetracycline residues coincides with the finding of Marouf and Bazalou (2005), who studied the effect of frying process and the reported reduction was 85.71%. The results of our study are in harmony with other studies on the fate of doxycycline residue. AL-Ghamdi *et al.* (2000) mentioned that the MRL for doxycycline exceeded in raw liver samples in three poultry farms. Mean concentrations of doxycycline were also above the MRL in raw muscle obtained from five farms. However, after cooking (100C for 20 min), the MRL of these drug was exceeded only in two of the farms. According to a study on the low-temperature, long-time treatments (conventional sterilization) would destroy >98% of the initial concentration of the residues of the doxycycline; high-temperature, short-time treatments

(UHT) would leave unaltered doxycycline in 50–90% range (Hassani *et al.* 2008). The losses of TC residues increased with prolonged cooking time. Doxycycline was the most heat stable of TCs, while oxytetracycline was the most heat labile. The time required to destroy 90% of the initial TC level was 23.9, 53.2 and 101.6 min for microwaving, boiling and roasting, respectively (Abou-Raya *et al.* 2013). There are limited research works regarding the degradation of antibiotic residues by microwave heat treatment. However, Ibrahim and Moats (1994) documented 60% reduction of oxytetracycline residues in microwave-treated meat samples and 95% decrease was observed in meat samples cooked in boiling water and 17.3% in frying samples.

From the last few years, quite a number of researchers have attempted to relate the effect of processing parameters on reducing antibiotic residues in poultry meat (Hassani *et al.* 2008). Different studies have been conducted using chemical and microbiological analysis to evaluate the heat stabilities of different antibiotic residues (Franje *et al.* 2010). Moreover, alterations of genotoxicity through heating and structural changes were also evaluated. Various scientists suggested that most of the antibiotics are heat stable (Papapanagiotou *et al.* 2005), while some are heat labile or partially heat labile (Traub and Leonhard 1995; Hassani *et al.* 2008).

Regarding the thermal degradation of antibiotics in meat, most scientists describe reduction in the residual amounts (Gonzalez and Visweswariah 1984; Conchello *et al.* 1993a,b). The concentration of antibiotic residue after different cooking processes decreases and residues in the boiling process usually excrete from the tissue to the cooking fluid. Antibiotic residues affected by various agents during cooking process, cooking temperature and time play a major role in the reduction of antibiotic residues during cooking of food. Cooking methods are important for checking the stability of these residues as they have different life span (Hassani *et al.* 2008).

The findings of the present study can conclude that cooking processes cannot annihilate the total amounts of this drug but it can only decrease their amounts and most of the residues in boiling process are excreted from tissue to cooking fluid during the boiling process. Thus, exposure to residues may be reduced by discarding any juices that come from the edible tissues as they are cooked. Between the various agents affecting antibiotic residue after the cooking process, it was found that cooking time and temperature can play major roles about antibiotic residue reduction while cooking food.

CONCLUSION

From the findings, it can be concluded that antibiotic residues can be significantly reduced by the application of heat treatments. Among treatments, roasting was considered to be a more effective approach to reduce antibiotic residues. However, both boiling and microwave heating were at par in reducing the antibiotic residues. It is suggested that there is a dire need of awareness regarding use, detoxification and control of antibiotics in poultry industry to avoid incidence of metabolic and physiological disorders in humans. It was also observed that oxytetracycline was decreased significantly in microwave-processed thigh chicken meat. The grilling was least effective in decreasing the antibiotic residues in thigh part of chicken meat.

ACKNOWLEDGMENTS

This work was carried out at the National Institute of Food Science and Technology (NIFSAT), University of Agriculture, Faisalabad. The authors wish to thank for the financial assistance provided by the Higher Education Commission (HEC), Pakistan.

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