Monitoring of Antibiotic Residues in Poultry Meat in Khartoum State

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A B S T R A C T

This study was designed to monitor antibiotic residues in tissues of poultry from Khartoum state. A total of 360 tissue samples, (muscle, liver and kidney) were collected randomly from the market in Omdurman, Khartoum and Bhari localities. The samples were taken in summer, autumn and winter seasons (each season 120 samples). One plate test was used to detect the inhibition zone of the Bacillus sibitilues. The result revealed that 52 (14.4%) samples were positive after screening and 308 (85.6%) were negative. Muscle tissue showed high percentage (18.8%) than liver and kidney (15.0%). The positive samples obtained from Omdurman, Khartoum and Bhari were 20 (16.6%), 18 (15.0%), 14 (11.6%) respectively. The positive samples in summer were higher (35.8%) than autumn (10.8%) and winter (6.6%). The importance of this study is to develop monitoring system for controlling of antibiotic residues in poultry industries to save human health and to minimize drug resistance.

Keywords
Antibiotic resistance, Poultry meat, Human, Monitoring

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Introduction

Chicken and poultry products have been distributed worldwide because of being healthier than other animal products. The white meat is an important in animal food market to satisfy world demand (Bryan, 1980). Drugs residues have been noted are accumulated usually in liver or kidney and different tissues as site and route of administration (Doyle, 2006). The residues of these substances can be present in edible tissues, milk and eggs causing toxicity to consumers with anemia, hypersensitivity and resistance to antibiotic (Suhren et al., 1996). In Sudan, there is increased in poultry industry. The antibiotic are used as routine practice is non avoidable to prevent economic
loss due to diseases and consequent mortality (Hind et al., 2014).

Antibiotic abuse can be occurred in unnecessary over prescribed, employed in wrong combination, changed quickly over to other drugs, used persistently, given in adequate dosage, giving in self-medication, used for preventive purposes and employed as unauthorized (Khan, 1975). Because of these applications, antibiotic residues accumulated in various body tissues, examples muscles, liver and kidneys (Ayres and Krafi, 1964) and eggs of birds (Blom, 1975). The therapeutic and growth promoting antibiotics are the sources of residues in broiler meat if proper withdrawal period is not provided before slaughter the bird the results the meat can be reached to the consumer (Coulson, 1984).

Microbial growth inhibition tests are widely used as the primary screening approach for the detection of antibiotic residues in tissues (Pikkemaat et al., 2011). Antibiotics are used by poultry industries and poultry veterinarians to enhanced growth, feed efficiency and reducing disease. Antibiotic usage has facilitated the production of poultry, allowing the consumer to purchase, as a reasonable cost, high quality meat and egg (Karmi, 2014). The antibiotics are used as routine practice in non-avoidable to prevent economic loss due to the disease and consequent motility (Hind, et al., 2014) residue of these substance can be present in edible tissue, milk and eggs causing toxicity to customer with anemia, hypersensitivity and resistance to antibiotics (Suhren et al., 1996). Drugs residue has been noted accumulated usually in liver or kidney and different tissue as site and route of administration (Doule, 2006).

Many sensitive methods were optimized and validated for detection and determined of different antibiotic residues in animal meat and poultry such as high-performance liquid chromatography (HPLC), liquid Chromatography (LC), liquid Chromatography-mass spectrometry (LCMS), thin layer Chromatography (TLC), for plate test (FPT) (Karmi, 2014).

The microbiological inhibition tests were the earlier test used and are still in use because they are expensive and can cover entire antibiotic spectrum, but are less specific than other tests (Hind, et al., 2014). The main objective of this study was to screen the preset of the antibiotic in muscles, liver and kidney as important poultry tissues in Khartoum State.

**Materials and Methods**

**Study area**

The samples were collected from local market in Omdurman, Khartoum and Bhari localities in Khartoum State.

**Sampling**

A total of 360 poultry liver, muscle and kidney were taken randomly from local market of the three localities seasonally (summer, autumn and winter) in sealed bags and stored in ice till transported to the Central Veterinary Research Laboratory.

**Preparation of plate**

Nutrient agar (28g) were prepared (Oxoid, 2006) by suspending in one liter distilled water and dissolving completely in boiling water bath then sterilized by autoclave at 120b for 15 minutes and then cooled to 47°C.

**Assay**

Poultry tissues were screened or antibiotic residues using the microbial inhibition plate test described by Korean-Dierick et al., (1995) with some modification. The organism was used in this test *Bacillus subitiles* (TCC6633),
one colony from each fresh culture was taken by sterile loop under flame then diluted in 9m sterile normal saline the suspension were shaken by vortex mixer to be homogenized, then adjusted to 0.5 McFarland standard turbidity (equivalent to $3 \times 10^8$ cell/ml). One drop of this mixer was cultured to the plate by using sterile loop under flame, then the tissues were cut into small portion (dimension) and bled and then incubated overnight. The tested samples were read by inhibition zone of their diameter 2mm or more (Tajik et al., 1998; WahatAlla et al., 2011).

**Statistical analysis**

Data collected was analyzed using descriptive methods. Frequency showed the occurrence of the observation in this data.

**Results and Discussion**

As shown in table 1 all samples were detected by microbial inhibition one plate test and the positive to antibiotic were 52 (14.4%) and the negative were 308 (85.6%). Muscle tissues revealed high percentage (18.0%) inhibition zone than liver and kidney (15.0%).

The results showed that (Figure 1) positive samples in Omdurman were 20 (16.6%), Khartoum was 18 (15.0%) and Bahr were 14 (11.6%). These organs in Omdurman locality were contained high concentration of antibiotics than other two localities.

Also in this results the number of positive sample to antibiotic were 31 (25.8%) in summer while in autumn were 13 (10.8%) and in winter were 8 (6.6%).

From this result the usage of antibiotic was increased in hot seasons than cold seasons. In Sudan there is little data concerning the presence of antibiotic residues in the food sold for human consumption. The present study using one plate test for monitoring antibiotic residue revealed considerable percentage in poultry tissues collected from local market in Khartoum state. This result was in agreement with that done by Hind et al., (2014), who found 27% positive samples and Hala (2006) observed a high percentage (16.87%) in poultry.

In the present result when different tissue samples were tested, muscles (18.8%) showed high percentage than livers and kidneys. This result was similar to that obtained by Hind et al., (2014) and Palvlov et al., (2008), while Hala (2006) found that lower percentage of positive sample was detected in muscle and liver compared to kidneys for poultry tissues in Khartoum. Muhammad and Khalida (2006) stated that liver and kidney had a higher residue percentage than muscles and eggs. Also, Shahid et al., (2007) found high percentage of positive samples in liver, kidney and muscle respectively. Ahmed et al. (2015) found higher positive samples in liver sample than in muscles with no significant difference. The distribution of antibiotic within broiler tissues concentrated more in breast or high muscles (Reyes and Donoghue, 2008).

Our result revealed that the positive samples in summer were higher than autumn and winter (Fig. 2). While Palvlov et al., (2008) found a higher percentage in winter in Bulgaria. This may be attributed to that Sudan is a tropical country and summer is known as hottest season that increases the growth of the microorganism and lead to increasing the usage of antibiotic for prevention of acute and sub-acute bacterial infections. Omdurman locality represents higher percentage than Bahri and Khartoum (Fig. 1), while Ahmed (2015) found 8% in Khartoum, 4% in Bahri and 0% in Omdurman locality.
**Table 1** Percentage of Poultry liver, muscle and kidney (360) in Khartoum State

| Samples  | Frequency | Percent |
|----------|-----------|---------|
| Positive | 52        | 14.4    |
| Negative | 308       | 85.6    |
| Total    | 360       | 100.0   |

**Fig.1** Distribution of antibiotic residues in poultry meat (360) in Khartoum State

**Fig.2** Seasonal variation of antibiotic residue in poultry meat (360) in Khartoum state
In Sudan more than 80% of veterinarians did not determine animal weight when describing doses, no following up of cases after leaving the clinic, slaughtered animals during treatment without completing withdrawal periods (Mohammed et al., 2011).

In poultry industries the producers used a variety of products to control diseases and increase yields. The risks of residues in foodstuff from animal origin could be reflected into several forms, carcinogens, allergies toxicity alteration of the intestinal flora, bacteria resistant (Wageh et al., 2013; Mohamed et al., 2019). The risk of violative drug residues is minimized when treatment protocols are carefully followed. Therefore, poultry industries have started to enhance the production of meat using enriched feed for disease prevention (Mehdi et al., 2018).

In conclusion, the antibiotic abuse is most important cause of high prevalence of residue and large number of resistant bacteria. Developing monitoring system for screening residues in food is an important issue now a day to produce food and to meet the international standard to enhance international trade.

References

Ahmed El Rayah Yousif Hussein; Elmansoury, Y. H.; Mohammed Osman Hussien; Mohammed Idress Taha; Hoyam Awad Mahgou; Abdelrahim Mohamed El Hussein (2015) Oxytetracycline residues in Sheep Meat in Khartoum State, Sudan I. Adv. Vet. Anim. Res., 2(3): 321-325.

Ayres J. C. and Krafi, A. A. (1969). Animal growth promoters in: Chemical and Biological Hazards in Food. Hafiner Publishing Co., New York.

Blom, L (1875). Residues of drugs in eggs after medication of laying hens for eight days. Acta Vet. Scand. 16:396-406.

Bryan, F.L. (1985). Poultry and meat production (Edited by Silliker J.H., Elliot R.P., Baird-Parken A.C., Bryan F.L., Christain, J.H.B., Clark, D.C., Olson, J.C. and Roberts, T.A). In: Microbial Ecology of Food, Vol. 2: Food Commodities (ICMSF) 410-450.

Coulson, A. (1884). Stakhanovism and Side Effects. In: Antimicrobial in Agriculture. Butter Worthy, London.

Doyle, M.E. (2006). Veterinary Drug residues in processed meat – potential health risk. A review of the Scientific Literature

Hala, IMS. (2006). Residues of antibiotic in poultry meat. Thesis of Master degree (MSc) Preventive Medicine, Faculty of Veterinary Medicine, University of Khartoum, Sudan.

Hind, A. Elnasri; Adil, M. Salman and Samah, A. ElRade (2014). Screening of antibiotic residue in poultry liver, kidney and muscle in Khartoum State. Journal of Applied and Industrial Science, 2(3): pp. 116-122.

Karmi, M. (2014). Detection and presumptive identification of antibiotic residues in poultry meat by using FPT. Global Journal of Pharmacology 8C2: 160-165.

Khan, A. J. (1975). Misuse of antibiotics. In: Cento-seminar on Use and Misuse of Antimicrobial Drugs.

Koenen – Dierick, K; Okerman, L.; de Zutter L.; Dogroodi, JM.; Rantooof, F. J.; Srebrnik, S. (1995). A one-plate microbiological Screening Test for Antibiotic Residue Testing in Kidney Tissues and Meat: an alternative to EEC four-plate method? Food Addit. Contm. 12(1): 77-82.

Mehdi; Y; Letourneau-Montiminy, M.-P; Gaucher, M.-P; Chorfi, Y.; Suresh, G.; Bouissi, T.; Brar, S. K.; Cote, C;
Ramires, A. A. and Godbout, S. (2018). Use of antibiotic in broiler production: Global impact and alternatives. *Anim. Nutr.* 4:170-178.

Mohammed, BWA., Twfig, EM. Atif, EA (2011). Detection of antibiotics residues in beef in Ghanawa Slaughterhouse. Khartoum State, Sudan. *African Journal of Food Science*, 5: 574-580.

Mohamed, I.M. Fangama; Ismail, M. Fangama; Siham, E.S. and Abdalla, M.A. (2019). Assessment of Uses Antibiotic Residues Consumed in Khartoum State, Sudan, *Int. J. Curr. Microbiol. App. Sci.*, 8 (2):3192-3196.

Muhammad, N. and Khalida, K. S. (2006). Determination of Residues of Quinolones in Poultry Products by High Pressure liquid Chromatography. *Journal of Applied Sciences*. 6: 373-379.

Oxoid, LTD. (2006). The Oxoid Manual. Ninth edition- Oxoid, Wade Road, Basingstoke, Hamshire.

Pavlov, A. I.; Lashev, L.; achin, I and Rusev, V. (2008). Residues of antimicrobial drugs in chicken meat and offals. *Trakia Journal of Sciences*, Vol. 6, Suppl. Pp: 23-25.

Pikkemaat, MG.; Rapallini, ML.; Zuidena, T.; Elferminke, TW.; Oastra-vanDijk, S.; Driessen-van Lankveld WD. (2001). Screening method for the detection of antibiotic residues in slaughter animals: Comparison of the European Union Four-Plate Test, the Nouws Antibiotic Test and the Premi ® Test (applied to muscle and kidney). *Food Risk Assess.*, 28(1): 26-34- doi:10.1080/19440049. 2010. 535027.

Reyes-Herrera, I.; Donoghue, DJ. (2008). Antibiotic residues distribute uniformly in broiler chicken breast muscle tissue, *J.Food Prot.*, 71 (1): 223-5.

Shahid, M. S.; Muhammad S.; Hameed S. H. (2007). Evaluation o a Microbiological Growth Inhibition Assay as a Screening Test for the Presence of Antibiotic Residues in Poultry Meat. *American Journal of Food Technology*, Vol. 25, p 457-461,

Suhren, G.; Reichmuth, J. and Walte, H.G. (1996). Detection of Beta-Lactam antibiotic in milk by penzym-test. Milchwissenschaft (Germany).

Tajik,H., Malekinejad, H.; Razavi-Rouhani, S.M.; Pajouhi, M.R.; Ahmoudi, R.A.; Haghnazari, A. (1998). Chloramphenicol residues in chicken liver, kidney and muscle: A comparison among the antibacterial residues monitoring methods of four plate test, ELISA and HPLC, *Food and Chemical Toxicology*, 48, 2464-2468.

Wageh, SD.; Elsaid, AE.; Mohamed, TE.; Yoshinori, ISN.; Mayumi, I. (2013). Antibiotic residues in food: The African Scenario. *Japanese Journal of Veterinary Research*, 61: 13-22.

WahabAlla, M.; Bashir, Eltigani, Twfig, M. and AtifElami (2011).Detection of antibiotic residues in beef in Ghannawa slaughterhouse, Khartoum State, Sudan. *African Journal of Food Science*, Vol. 5(10), 574-580.