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Exploring the effect of heat treatments on eliminating the remains of antibiotic residues (colistin)

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Abstract:

This study aims to know the effect of heat treatments on eliminating the remains of antibiotic residues, especially (colistin), as all antibiotics, especially colistin, are overused in poultry farming, and drug withdrawal times are rarely followed during the sale of meat birds or adherence to the medical prescription and consultation. The doctor, as well as there may be supervisors of the poultry houses, do not have sufficient information about the times of drug withdrawal or the danger of these residues on the health of the consumer and the danger they pose to the kidneys and body allergies.

The chickens were treated by drinking water for (3) days and at (40_41_42) days old, using the antibiotic colistin, so that all chicken samples took the same dose of colistin, and the results of colistin residues showed, an estimated high-performance liquid chromatography device in the central laboratory at Omar Al-Mukhtar University. After completing the extraction of samples by us at the age of (40/41/42) days after the slaughter, in the chest muscles 67000/43000/37000 ppb, in the kidneys 61000/38000/32000 ppb, and in the liver 46000/25000/19000 ppb, and after using different thermal treatments on the tissues, it was found that The highest breakdown of these residues in the liver at the age of (40-41-42) days is 5000-3500-3000 ppb in the microwave at under 150 degrees for 20 minutes, and at the age of (41) days it is (4000 ppb) by a microwave at under 150 degrees Celsius for 20 minutes. At the age of (42) days (2500 ppb) using grilling in the oven under (180) degrees Celsius for (80) minutes, all of these results were high, which confirms that all heat treatments, whether microwave, boiling, or grilling, are unable to get rid of the remaining antibiotic residues. Here, we must focus on educating educators about the danger of these residues to human health over time and commitment to the process of withdrawing the drug and constant detection and investigation by health authorities.

Keywords: Colistin, Antibiotic, Chicken, Meat, High-Performance Liquid Chromatography.

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معرفة مدى تأثر تركيز بقايا المضادات الحيوية (الكوليستين) في لحوم الدواجن بالمعاملات الحرارية

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الملخص

تهدف هذه الدراسة إلى معرفة تأثير المعالجات الحرارية في التخلص من بقايا المضادات الحيوية وخاصة (الكوليستين) حيث أن جميع المضادات الحيوية وخاصة الكولستين يتم الإفراط في استخدامها في تربية الدواجن، ونادرا ما يتم اتباع مواعيد سحب الدواء أثناء بيع لحوم الطيور أو الطيور. الالتزام بالوصفة الطبية والاستشارة الطبية. فالطبيب وكذلك قد يكون هناك مشرفين على حضانات الدواجن ليس لديهم معلومات كافية عن مواعيد سحب الدواء أو خطورة هذه البقايا على صحة المستهلك وخطورتها على الكلى وحساسية الجسم.

عولجت الدجاج بمياه الشرب لمدة (3) أيام وبعمر (40_41_42) يوم باستخدام المضاد الحيوي الكوليستين، بحيث أخذت جميع عينات الدجاج نفس الجرعة من الكوليستين، وأظهرت نتائج بقايا الكوليستين تقديراً عالي الأداء. جهاز كروماتوغرافيا السوائل بالمختبر المركزي بجامعة عمر المختار. بعد الانتهاء من استخراج العينات لدينا بعمر (42/41/40) يوم بعد الذبح، في عضلات الصدر 37000/43000/67000 جزء في البليون، في الكلى 32000/38000/61000 جزء في البليون، وفي الكبد 46000 جزء في البليون /19000/25000 جزء في البليون، وبعد استخدام المعالجات الحرارية المختلفة على الأنسجة وجد أن أعلى نسبة تكسر لهذه البقايا في الكبد عند عمر (40-41-42) يوماً هي 5000-3500-3000 جزء في البليون في الميكروويف على درجة حرارة أقل من 150 درجة مئوية لمدة 20 دقيقة، وعند عمر (41) يوماً يكون (4000 جزء في البليون) بواسطة الميكروويف على درجة حرارة أقل من 150 درجة مئوية لمدة 20 دقيقة. عند عمر (42) يوم (2500 جزء في البليون) باستخدام الشوي في الفرن تحت درجة (180) درجة مئوية لمدة (80) دقيقة كانت جميع هذه النتائج عالية مما يؤكد أن جميع المعالجات الحرارية سواء بالميكروويف أو السلق أو الشوي ، غير قادرين على التخلص من بقايا المضادات الحيوية المتبقية. وهنا يجب التركيز على توعية المثقفين بخطورة هذه المخلفات على صحة الإنسان مع مرور الوقت والالتزام بعملية سحب الدواء والكشف والتقصي المستمر من قبل الجهات الصحية.

الكلمات المفتاحية: كوليستين، مضاد حيوي، دجاج، لحم، كروماتوغرافيا سائلة عالية الأداء.

Introduction

Colistin has been used to treat animals since the mid-twentieth century. It's an antibacterial that inhibits the growth of bacteria. Poultry are given colistin orally during their treatment period. Colistin comes in various concentrations and is typically used to treat salmonella and Escherichia coli infections (1).

About 51% of the total animal protein in the country consists of poultry meat, which represents 45% of the total meat production. Therefore, poultry farming has spread on a large scale, especially in the areas of Al Jabal Al Akhdar, and thus the use of antibiotics has increased in combating many bacterial infections that affect poultry during rearing (2).

In chickens, antibiotics are frequently used to maintain health, stimulate growth, and increase feed efficiency, in addition to treating diseases, but in most cases the treatment is without the supervision of a doctor specialized in poultry treatment, and the drug is given randomly without taking into account the concentrations required for treatment of resistant microbial infections (3)

When antibiotics are given randomly, this may lead to the precipitation of drug residues in chicken products, which may pose a threat to the health of customers, especially in light of the absence of periodic supervision in poultry stores, and it is also difficult to detect these residues in ready-made poultry products (4).

With the passage of time, the repeated use of antibacterials, the residue may also cause the germs to become resistant to the antibiotics present in the environment and living organisms, and it becomes difficult for us to resist them with the passage of time and the emergence of new generations of microbes resistant to all antibiotics (5).

Numerous bacteria are recognized for their ability to generate an extensive range of antibiotics, which are now being researched and employed to treat a multitude of serious illnesses and infections that affect people, animals, and crops(6).

Many types of microorganisms, including fungi, bacteria, and actinomycetes, create antibiotics as a natural defensive mechanism against other germs that are nearby. Because soil is heterogeneous, a wide variety of microorganisms can be found there(7).

Many incorrect procedures occur prior to the slaughter process and a failure to apply the correct rules that affect the consumer's health, as well as groups of biologically active substances and determining the best way for their delivery. Therefore, more research is required to determine the appropriate doses, the correct use of antibiotics, and adherence to the grace period before the slaughter process(8).

Resistance strains have emerged as a result of the widespread overprescription and careless usage of antibiotics. Regretfully, in underdeveloped nations, the majority of antibiotics are freely accessible without a prescription and may be purchased over the counter(9).

The worldwide endeavor to create novel antibiotics or alter current ones to combat resistant diseases is now immense. When bacteria can evade the effects of antibiotics by several means, such as neutralizing the

medications, pumping them outside of the cell, or altering their outer structure to prevent the drugs from attaching to the bacterium, antibiotic resistance develops(10).
Due to the risks they pose, antibiotic residues are in the collection A variety of animal products can be harmful to the health of the consumer, especially children, pregnant women and the elderly (11).
Colistin's resistance to the interaction between humans, animals, and the environment highlights how important the One Health strategy is to achieve its successful management. Coordinated efforts from several disciplines and agreement among physicians, veterinary surgeons, and environmental specialists should be used to address such initiatives(12).
Antibiotic-resistant bacteria: It has long been known that certain bacteria are resistant to certain antibiotics, However, since the rate of bacterial resistance to antibiotics has increased recently, it has started to become more noticeable(13).

Material and methods

In this study, 120 broiler chickens were used after being raised for a period of 43 days in very appropriate conditions in terms of ventilation and temperature. They were reared and fed on clean, balanced feed in terms of protein content. The feed was given at a rate of 3.5 kg/bird during the bird's survival period(14). The weight of the birds during this period reached about (100.2) kg. The first age stage: (2,300) in the second age stage and (2,450) in the third age stage. This sample of broilers was given colistin at a concentration of (50%) at a dose of (1) gram per liter of water for (3) days at the age of (37-39). one day.
The birds were slaughtered in 3 stages, with 40 birds per cage at each age stage, as follows: The first stage of life / at 40 days The second stage of life / at 41 days The third stage of life / at 42 days.

The method for estimating the residues of the antibiotic colistin is summarized as follows:

1. (10) grams were weighed for each of the chest muscles, kidneys, and liver.
2. The sample was placed and 10 ml of ethanol was added to it
3. The samples were crushed well and dissolved in 10 ml ethanol
4. Then place all samples in test tubes in a centrifuge at a speed of (5000) rpm for (10) minutes
5. The filtrate was withdrawn and placed in a clean, sterile test tube to be dried in an air-drying oven until it dried at a temperature of (45) Celsius.
6. The standard solution was prepared in advance by mixing 1.0 grams of pure colistin powder with (4) ml of methanol(15).
7. All residues of the antibiotic (colistin) were identified using HPLC. The concentration of antibiotic residue (colistin) was determined in HPLC Three samples each of pectoral, kidney, and liver muscles were selected withdrawn, and cooled. In sterile test tubes to the central laboratory at Omar Al-Mukhtar University for examination with the HP LC device. Shaft type selected 6.4 x c m 15,5um, 18mm(Lc) If colistin was detected at a wavelength of 270 nm, the buffer was prepared by dissolving 2.8 g of monobasic sodium phosphate in 50 mM acetonitrile to prepare the mobile phase.In the mobile phase, the retention time was(1) minute and(88) seconds, the flow rate was 1 mL/min, and the injection volume was 20 µL.

Results and discussion

Table No. (1) the results of the concentration of colistin residues after slaughter and processing at the three age stages (40, 41, 42) days, which were estimated using an HPLC device.

Table No. (1) Colistin residues that were estimated using an HPLC device.

Liver	Kidney	Chest muscles	The age of a meat bird
46000 ppb	61000 ppb	67000ppb	40
25000 ppb	38000 ppb	43000 ppb	41
19000 ppb	32000 ppb	37000 ppb	42

Table No. (2) shows the results appeared after performing the heat treatments used in this study on the various samples (chest muscles, kidneys, and liver).

Table No. (2): Sample results after thermal treatments.

Concentration of colistin residue In the liver in age (today)			Concentration of colistin residue In the kidneys at the age of (today)			Concentration of colistin residue In the chest muscles at the age of (today)			the time By the minute	Type of transaction
42	**41**	**40**	**42**	**41**	**40**	**42**	**41**	**40**		
19000 ppb	25000 ppb	46000 ppb	32000 ppb	38000 ppb	61000 ppb	37000 ppb	43000 ppb	67000 ppb	**0**	**Grilling in the oven Below 180 percentile**
11000 ppb	18000 ppb	23000 ppb	12000 ppb	17000 ppb	35000 Ppb	15000 ppb	27000 ppb	45000 ppb	**40**	
6000 ppb	10000 ppb	14000 ppb	8000 ppb	12000 ppb	19000 Ppb	11000 ppb	13000 ppb	25000 ppb	**60**	
2500 ppb	5400 ppb	8000 ppb	6500 ppb	5000 ppb	6000 Ppb	6600 ppb	8000 ppb	13000 ppb	**80**	
19000 ppb	25000 ppb	46000 ppb	32000 ppb	38000 ppb	61000 ppb	37000 ppb	43000 ppb	67000 ppb	**0**	**Boiling under 100°C**
15000 ppb	18000 ppb	41000 ppb	27000 ppb	29000 ppb	59000 Ppb	31000 ppb	39000 ppb	62000 ppb	**20**	
11000 ppb	18000 ppb	37000 ppb	22000 ppb	24000 ppb	56000 Ppb	28000 ppb	30000 ppb	55000 ppb	**30**	
8000 ppb	13000 ppb	31000 ppb	19000 ppb	21000 ppb	45000 Ppb	22000 ppb	25000 ppb	40000 ppb	**40**	
19000 ppb	25000 ppb	46000 ppb	32000 ppb	38000 ppb	61000 ppb	37000 ppb	43000 ppb	67000 ppb	**0**	**Microwave**
8000 ppb	12000 ppb	23000 ppb	16000 ppb	17000 ppb	29000 ppb	12000 ppb	19000 ppb	40000 ppb	**10**	
5000 ppb	6000 ppb	10000 ppb	9000 ppb	14000 ppb	13000 Ppb	4000 ppb	7000 ppb	12000 ppb	**15**	
3000 ppb	3500 ppb	5000 ppb	4500 ppb	6500 ppb	7000 Ppb	2700 ppb	4000 ppb	1000 ppb	**20**	

Table No. (3): Maximum limits set by the European Medicines Agency (EMA) (16) and the US Food and Drug Administration (17) for residues of the antibiotic colistin as follows:

Table No. (3): Maximum residue limits for the antibiotic colistin.

125_100ppb	**Chest muscles**
125_100 ppb	**Liver**

As Table No. (2) shows the concentration of colistin antibiotic residues in the chest muscles after performing the thermal treatments prescribed in the study, it was shown in this table that the highest destruction of colistin residues by microwave at (20) minutes reached (1000) ppb, while at the age of 41 One day, the highest percentage of destruction was (4000) ppb by using a microwave at (20) minutes, while at the age of (42) days, the highest destruction of colistin antibiotic residues was (2500) ppb by the grilling process at a temperature below (180) degrees Celsius for a period of (80) minutes. Comparing these results with the permissible limits shows that they are higher than the permissible limits according to the percentages set by the European Agency.

From Table (2), it appears to us that at the age of (40) the highest destruction of antibiotic (colistin) residues in the kidneys reached (6000) ppb by grilling in the oven under (180) degrees Celsius for 80 minutes. However, at the age of (41) the highest percentage was reached. Destruction of antibiotic residues (colistin) in the kidneys (5000) ppb by grilling in the oven at (180) degrees Celsius for (80) minutes, while at the age of (42) the highest rate of destruction of antibiotic residues (colistin) in the kidneys reached (4500) ppb. Use a microwave at 20 degrees for (20) minutes.

All results showed at the age of (40) days that the highest destruction of residues in the livers reached (5000) ppb using a microwave for (20) minutes, and the highest destruction reached (3500) ppb at the age of 41 days using a microwave device for 20 minutes, while at the age of On (42) days, the highest percentage of destruction of the antibiotic (colistin) residue (2500) ppb was reached by grilling in the oven at 180 degrees Celsius for (80) minutes.

From the table above, it becomes clear to us that after the various heat treatments, not all of them reached the permissible limits despite the differences in temperature, timing, and method. The presence of these residues is due to non-compliance with the drug withdrawal periods before slaughtering and marketing operations(18). as well as the presence of protein bonds to the antibiotic colistin that hinders its release. Destroying the residue(19).

Conclusion

Animal diseases are prevented or treated with antimicrobial drugs. Antibiotics are used extensively in chicken production in Libya, however, there are concerns that animal food tissues contaminated with antimicrobial residues may have negative health impacts on consumers. Much research indicates that the amount of antibiotic residues in edible tissues and offal will decrease with more judicious use of antibiotics throughout broiler production in Libya. Collected poultry meat samples contain traces of colistin, as proven by our investigations. There may be a risk to public health from this. Therefore, it is recommended to take the necessary steps to ensure that appropriate withdrawal times are followed before marketing and to monitor the use of medications in veterinary care, especially in the field of poultry farming. This depends on the culture of the breeder and his feelings about the danger of excessive use of antibiotics.

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