Investigation of Antibiotic Resistance in Fresh Beef, FreshPork, Fresh Chicken and Dairy Cow

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Abstract

Background: Chemical contamination in food has been a concern in public health both national and global levels. Contamination from pollution included air, water and soil, in meat from veterinary drugs used in animals, pesticides, food additives. Chemical residues in food are dangerous for health both short and long term. Commercial farming has grown, there are potential of using more drugs, especially antibiotics in farms.

Objective: to study on antibiotic residues in fresh beef, fresh pork, fresh chicken and ready-to-drink dairy cow sold for consumers.

Methods: A total of 36 samples which were 12 each of fresh meat, fresh pork and fresh chicken were tested by antibiotic residue detection kits from the Department of Medical Sciences, Thailand. These detection kits have 93% accuracy, 78.9% sensitivity, and 96.7% specificity. 72 samples of raw pork and chicken, which were advertised as organic, were tested for Tetracyclines, Macrolide, Aminoglycoside, Sulfonamide and Penicillins.

Results: Tetracyclines, Macrolide, Aminoglycoside, Sulfonamide, Penicillins were detected in 12 samples of fresh beef, 12 samples of fresh pork, and 12 samples of fresh chicken. Tetracyclines were detected in 6 samples of dairy cow out of 43 samples.

Conclusions: From 79 samples of fresh beef, fresh pork, fresh chicken and dairy cow, Tetracyclines, Macrolide, Aminoglycoside, Sulfonamide and Penicillins had been found in 100% of fresh beef samples, 100% of fresh pork, 100% of fresh chicken and 13.95 of dairy cow samples.

Keywords: drug residues, food safety, antibiotic

Introduction

Chemical contamination in food is a public health concern that has gained worldwide attention and affecting international trade. Contamination can come from air, water and land pollution, or it can be caused by chemicals used such as veterinary drugs, pesticides, food additives including substances that preserve in the food production process. For the dangers of food residues from chemicals, Scientists and Health Authorities have developed a risk assessment method for assessing the safety of human exposure to these chemicals in four steps: Hazard Identification, describing the nature of the danger Hazard Characterization Exposure Assessment and risk characterization (Hazard) from chemicals in food can cause sudden illness. While veterinary drug residues, pesticides and food contaminants from the environment are at risk of causing long-term adverse effects on health, veterinary drug residues are acuteness. Residues of Veterinary Drugs as defined by the International Food Standards Commission (CODEX) mean substances or parent drug substances arising from the process of formation and decay (metabolites), contaminants in pharmaceutical products (associated impurities). This occurs as a result of drug use and left in the organs or product of the animal that is normally consumed when the drug is used in animals. The potential for veterinary drug residues, especially at very low levels, is found in products from meat, milk, eggs, and without a period of discontinuation long enough for the drug to be excreted from the animal's body. There is a chance to find residues from veterinary drugs in larger quantities to a level that may be harmful to consumers especially if the drug is misused. For example, the use of drugs for humans in animals, the use of drugs in different animals other than those specified on the label, identifying the hazards of veterinary drug residues affecting humans is a complex task. It is a problem for consumer protection and international trade Hazards from veterinary drug residues may be classified as follows: 1) Toxicity Hazard (Toxicological Hazards) can be caused by acute or chronic toxicity, such as B-adrenergic agonists such as Clenbuterol, Salbutamo, which are classified as Adrenaline derivatives, are used to treat asthma in humans but

are misused to increase red meat content, reduce animal fat or carcinogenicity, such as Diethystilbesttro (DES) in the past, has been used in animal feed mixtures to accelerate growth in many countries. Long-term exposure caused tumors in mammary tumour vius in rats and altered vaginal tissue. 2) Microbiological harm by bacterial resistance animal to human due to the use of drugs in animals. It is an issue that has been taken into consideration. In addition, antimicrobial residues in the product may interfere with microorganisms in the consumer's gastrointestinal tract and increase the number of drug-resistant bacteria. In determining the allowable amount of veterinary drug residues in food, this aspect must also be taken into account[1]

Meat production, especially pork, is a tendency to expand to support the needs of both domestic and export consumers. In the pig farming industry, every farm needs a well-managed farming system in order to have the highest number of fattening pigs available for sale, it means having the least morbidity or mortality rate. Therefore, the use of antibiotics (antibiotics) in pig farms is widely spread. For the purpose of prevention and control microbial infection, disease treatment and growth promotion if the antibiotic is used carelessly in swine farms inappropriately and the use of excess quantities effected on antibiotic residues in the pork. This makes the population inevitably affected by the consumption of pork with antibiotic residues in several ways: drug (allergic reaction), especially antibiotic Penicillin group (Penicllins), which is believed that about 1-10% of people in the world are allergic to this antibiotic. The antibiotic in the Aminoglycocides group caused an allergic reaction comparable to that of Penicillin. Besides, there is antibiotic that cause an allergic in consumers' frequently[2].

In the past 10 years, Thailand has used antibiotics more than 10 billion baht a year and there are more than 100,000 Thai people infected with drug-resistant yearly, more than 38,000 deaths per year, causing enormous economic losses. A part of the contributing factor to drug-resistant bacteria is the use of antibiotics in livestock farms to accelerate growth and prevent disease especially in chicken and pig farms. One of the reasons was a lack of knowledge about antibiotic use in animal husbandry among farmers. All of these causes antibiotic residues in meat and the environment, drug-resistant pathogens in animals and can be transmitted from animals to humans. Many provinces in the northeastern region are more than 10,000 livestock farmers who farm animals such as cattle, pigs, goats, chickens, fish, etc. They provide antibiotic to animals, most of them have been using low-dose antibiotics for a long time to prevent disease in animals[3].

Objective

1. To study the residue of antibiotic in fresh beef, fresh pork, fresh chicken and ready-to-eat beef.

Research Methods

This is a Cross Sectional Research by studying on antibiotic Tetracillin, Macroline, Aminoglycocide, Sulfonamide and Penicillin Group residue in fresh beef, fresh pork, fresh chicken from the fresh market in Bangkok region and Ratchaburi and ready-to-drink cow milk in convenient store.

Population and Sample

In a field survey, A total of 79 samples of fresh beef, fresh pork, fresh chicken and those sold in the fresh market were randomly collected, consisting of beef, pork, chicken and ready-to-drink cow milk sold in convenience stores. A total of 79 samples are shown in Table 1.

No.	Samples	Amount
1	Fresh Beef	12
2	Fresh Pork	12
3	Fresh Chicken	12
4	Ready-to-drink cow milk	43
Total		**79**

Table 1

Research Tools

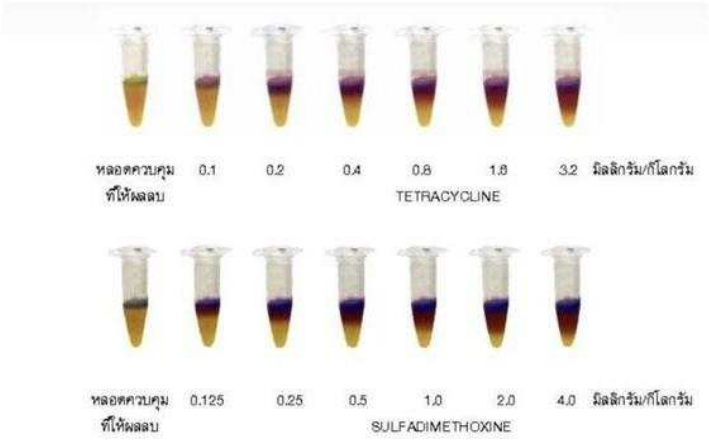
The antibiotic residue test kit of the Department of Medical Sciences is produced by Rojanarak Pharmacy. This test kit has an accuracy of 93%, a sensitivity of 78.9%, a specificity of 96.7% and can detect at least 12 drug residues.

Data Gathering Period

Study from March to May 2022

Data Analysis

Descriptive statistics were used to find the frequency, percentage, mean by analyzing the test results from the resulting colors (Colorimetric). Compared to the control tube, if the sample test tube is darker than the control tube. It means that there are residues of Tetracyclines, Macrolides, Aminoglycosides, Sulfonamides and Penicillins, depending on the type of reagent used in the test. If the test kit changes color from purple to yellow throughout the tube, it indicates that no residue was found. The test kit turned partially yellow or does not change color by the color bar depends on drug residue.



Result

Antibiotic residues were analyzed in 36 samples of fresh beef, pork and fresh chicken of Tetracyclines, in 36 samples, or 100%, Macrolide antibiotics were detected. Aminoglycine and Sulfonamides and Penicillin in 36 samples, representing 100%, and penicillin group antibiotics were detected in 36 samples, representing 100% (Table No.1.)

Table No.1 Amount and percentage of Tetracyclines , Macrolide, Aminoglycine and Sulfonamides and Penicillin in samples of fresh beef, fresh pork fresh chicken (n=36)

No	Samples	Amount	Amount of Samples that contaminated antibiotic		
			Tetracycline (n=79)	Macrolide, Aminoglycine and Sulfonamide (n=36)	Penicillin (n=36)
1	Fresh Beef	12	12	12	12
2	Fresh Chicken	12	12	12	12
3	Fresh Pork	12	12	12	12
	Total	36	36	36	36
% of the antibiotic residue			100	100	100

The result of the analysis of Tetracycline antibiotic residue of 43 ready-to-drink cow milk samples, there were 13.95% of the antibiotic residue in 6 samples.

Table No.2 Amount and Percentage of Example of ready-to-drink cow milk where Tetracycline antibiotic residue were found (n=43)

No.	Sample	Amount	Amount of Samples that contaminated antibiotic
			Tetracycline (n=43)
1	Cow Milk	43	6
	Total	43	6
% of the antibiotic residue			13.95

Discussion

From the 12 samples of fresh beef, 12 samples of fresh pork and 12 samples of fresh chicken, a total of 36 samples. Antibiotics of Tetracyclines, Macrolides, Aminoglycosides, Sulfonamides and Penicillin residues were found in fresh beef. 12 samples of fresh beef representing 100%, 12 samples of fresh represent 100%, and 12 samples of fresh chicken representing 100%, and the determination of Tetracycline group antibiotic residues in ready-to-drink cow milk. A total of 43 samples were found with Tetracycline antibiotic in 6 samples of ready-to-drink cow milk, representing 13.95%, pesticide residues were Tetracyclines, Macrolides, Aminoglycosides, Sulfonamides, and Penicillin in this example fresh beef, fresh pork, fresh chicken and ready-to-drink cow milk because most farmers use antibiotics in their livestock farms. This is consistent with the study of Natthida Suksai and colleagues (2016) who studied the use of antibiotics in livestock farms. It was found that more than 80% of farmers used antibiotics in their livestock farms[5]. Antibiotic usage in livestock should be discontinued at least 7-

14 days prior to delivery to the slaughterhouses. The potential for veterinary drug residues, especially at very low levels, can be found in products, meat, milk, eggs, and in case of the dosing regimen is not long enough for the drug to be excreted from the animal's body, there is a chance that residues from veterinary drugs are found in larger quantities that may be harmful to consumers Especially if the drug is misused. For example, the drug for humans is used in animals, the drug is used in different animals other than those specified on the label identifying the hazards of veterinary drug residues affecting humans is a complex task. It is a problem for consumer protection and International Trade may be classified as dangerous from veterinary drug residues[7].

The presence of antibiotic residues in fresh beef, fresh pork, and fresh chicken samples have shown no discontinuation of the drug for a sufficient period of time prior to slaughterhouses. This may be because farmers lack of knowledge and understanding about how to use of antibiotics properly, consistent with Natthida Suksai et al. (20165), and most of the farmers have a moderated level of the knowledge about the use of antibiotics usage and the effects of antibiotic use in livestock's.

Antibiotic residues have been found throughout the years and in many areas. From the study of the detection of antibiotic residues in pork samples in Khon Kaen Municipality (2002), it was found that from 300 samples of fresh pork, 14 samples of antibiotic residues were found at 4.67%. 8 from an antimicrobial study in fresh chicken, swine and cow milk in Thailand (2002).) Antibiotic residues of Tetracycline was found in fresh chicken sample representing 65%, 40% in pork and 55% in cow milk and analyze patterns of antimicrobial usage of farmers that are the cause of residues in fresh pork and fresh chicken in Songkhla Province and sustainable prevention guidelines (2014). Antibiotic residues were found in samples of fresh pork and fresh chicken sold in the fresh market. 7.5-12.92 and 8.88-15%, respectively, from the Integrated Food Safety Report. In fiscal year 2019, drug-resistant bacteria were detected in 78.9% of fresh chicken samples, 65.6% of fresh pork and 55.8% of fresh beef, indicating that antibiotics were used in livestock until the development of drug-resistant bacteria[9].

From the result of this study and the past studies have shown that vital food ingredients such as fresh beef, fresh pork, fresh chicken and ready-to-drink cow milk, contain antibiotics, Tetracyclines, Macrolides, Aminoglycosides, Sulfonamides and Penicillins. The residue of antibiotic throughout the consumption of food can cause harm to consumers, such as side effects of drugs, drug allergy and drug resistance [10] in particular, most of the antibiotics used in animals belong to the same class of drugs used in humans. Prevention of drug-resistant infections can be done by 1) stopping the creation of drug-resistant bacteria is the rational use of antibiotics in both humans and animals; not eating food contaminated with drug-resistant bacteria residues and antibiotic residues. 3) Stop the transmission of drug-resistant bacteria is to maintain hygiene.

Conclusion

From the study of residues of Tetracyclines, Macrolides, Aminoglycosides, Sulfonamides and Penicillins were collected in fresh pork and fresh beef. A total of 79 samples of fresh chicken and ready-to-drink cow milk were divided into 12 samples of fresh beef, 12 samples of pork, 12 samples of chicken and 43 samples of ready-to-drink cow milk. Macrolides, Aminoglycosides, Sulfonamides and Penicillins residues in all 12 fresh beef samples calculated as 100%, residues in all 12 fresh pork samples calculated as 100%, residues in all 12 fresh chicken samples calculated as 100%. Residual Tetracyclines in 6 samples of ready-to-drink cow milk calculated as 13.95%.

Recommendation

Consumers should avoid having the meat that contaminated antibiotic residue to decrease the health problems that may cause such as side effects, antibiotic residue allergy, drug resistance by choosing only the meat without antibiotic residue in the organic farm or in a farm that use antibiotic appropriately.

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