A Case Study of Antibiotic Residues in Seafood sold in Restaurants in Bangkok, Thailand

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Abstract

Background: Antibiotic residues have caused antibiotic-resistant bacteria to enter human consumption resulting in less effective medicine to cure diseases. An estimated 1.2 million people around the world died from antibiotic-resistant bacterial infections in 2019 alone and this continues to increase each year mostly due to individuals uneducated about it.
Objective: To examine antibiotic residue in seafood
Study Methods: The samples were tested with antibiotic residue detection kits from the Department of Medical Sciences, Thailand. These detection kits have 93% accuracy, 78.9% sensitivity, and 96.7% specificity. Convenience sampling was conducted. A total of 21 samples were tested for antibiotic residues; Tetracycline, Macrolide, Aminoglycoside, Sulfonamide, and Penicillin. Results: From the antibiotic residues in the samples, 21 samples were tested. Only 1 sample; Squid (Tako Wasabi) tested positive in the detection of Tetracycline (4.76%) and 20 other samples tested negative (95.24%)
Conclusion: There were still antibiotic residues detected in some foods.
Keywords: antibiotic residues, seafood, sashimi

Introduction

Antibiotics are medicines that are used to prevent and treat bacterial infections such as penicillins, cephalosporins, tetracyclines, and more. Antibiotic resistance develops as a result of irrational antibiotic usage, which causes bacteria to evolve antibiotic resistance through natural selection; the antibiotic-resistant bacteria pass down the strong allele to their offspring causing more bacteria to also be antibiotic-resistant. The medicine may have been successful in curing an illness before resistance developed, but it is no longer working as intended. [1] This can cause enormous damage in terms of health and the country's economy. Antibiotics are widely utilised in agriculture, cattle, and veterinary medicine. Antibiotics are used in animal husbandry to treat sick animals, prevent common disease occurrences, and promote animal development. [2] Using an excessive amount of antibiotics on animals may result in antibiotic residues in their meat. Consequently, if a human consumes meat containing antibiotic residue over a lengthy period of time, bacteria in their body may become antibiotic-resistant. [3] According to Thailand's Ministry of Public Health, the maximum residue limit in beef, pork, lamb, fish, and other seafood is 200 micrograms per kilogram. [4] If the amount of residue left in meat is more than the limit, it can potentially cause the bacteria in our body to develop and become antibiotic-resistant.

Many people have already been affected by antibiotic-resistant bacteria. More than 2.8 million antimicrobial-resistant infections occur in the U.S. each year, and more than 35,000 people die as a result. [5] Around the world, an estimated 1.2 million people died in 2019 from antibiotic-resistant bacterial infections. [6] A 2016 review on antimicrobial resistance forecasts that by 2050, as many as ten million people could die each year due to antibiotic-resistant infection. The explanation for the significant increase in deaths might be that many individuals are unaware of the situation or are uneducated about it. [7]

Seafood is popular as it is a low-fat high-quality protein source. Furthermore, it is high in many necessary nutrients for our bodies. Fish is packed with omega-3 fatty acids and vitamins D and B2 (riboflavin). Fish is high in calcium and phosphorus and high in minerals including iron, zinc, iodine, magnesium, and potassium. [8] As part of a balanced diet, the American Heart Association recommends eating fish at least twice a week. [9] As a result, the number of fish farms grows every year to keep up with the demand for seafood. Tragically, many farms utilise an excessive quantity of antibiotics on fish and other marine life, which results in antibiotic residues in seafood. It has been estimated that 90% of bacteria originating in seawater are resistant to one or more antibiotics and up to 20% of the bacteria are resistant to at least five. [10] Results of a global survey on antimicrobial use in aquaculture showed high use of antibiotics in fish and shrimp farming, including prohibited drugs (Tusevljak et al. 2013), and this raised critical human health concerns. [11] Additionally, antibiotics can be prevented to some extent by cleaning the meat and cooking it thoroughly, however, this method is obviously not effective enough to be able to remove all of the residues. [12] Therefore, knowing which meat has more amount of residue than the maximum residue limit would help guide us to which type of meat would be safe for our health.

Moreover, we are also interested in examining the amount of antibiotic residue in 'Sashimi' too. Firstly, Japanese cuisine is well-known around the world. 'Sashimi', one of their most popular meals, is thinly sliced raw fish or seafood. [13] Unfortunately, consuming raw meats increases the possibility of ingesting antibiotic residue. As Japanese food is getting more popular day by day, it could be one of the major factors in the increase in death from antibiotic-resistant infections. Thus, we are expected to research antibiotic residues in sashimi, which has never been done before.

Objective

1. To examine antibiotic residue in seafood

Study Methods

Sample

This study examined samples of fresh salmon, fresh tuna, fresh squid marinated in wasabi, fresh shrimp, cooked shrimp, fresh Japanese scallop, and fresh salmon egg for the presence of Tetracycline from common sushi restaurants in Bangkok. A total of 21 samples were used with convenience sampling, consisting of 1 fresh salmon, 1 fresh salmon egg, 1 Hotate (Japanese scallop), 1 fresh tuna, 1 squid wasabi, 1 cooked shrimp, and 15 fresh shrimps.

Procedure

To assess if the samples used contained antibiotic residues, the Antibiotic Residue Detection Kit of the Department of Medical Sciences produced by Rojanarak Pharmacy which can detect at least 12 drug residues. The test kit has an accuracy of 93%, a sensitivity of 78.9%, and a specificity of 96.7%. International standards include Penicillin, Amoxicillin, Tetracycline, Oxytetracycline, Chlortetracycline, Gentamicin, Neomycin, Streptomycin, Sulfadimethoxine, Tyrosine, Erythromycin, Bacitracin.

By growing bacteria at a concentration of 108 CFU/ml in a culture medium that is appropriate and favourable for antibody penetration, the antibiotic test kit uses Bacillus Stearothermophilus spores as a tester. In plastic tubes, spore development and microorganisms are contained. (Polypropylene) cubes with a diameter and height of 1 cm and an acidity-alkalinity colour indicated. pH=6.8; normal test kits are purple. If the test kit becomes acidic, it becomes yellow (pH = 4). Drop 0.1 ml. of the sample into the test kit to conduct the test.

Interpretation

By observing the colour shift in the test tube, we can determine the results of the antimicrobial residual test on a beef sample. If the test tube colour turns yellow, the sample exhibits no microbial residue; nevertheless, if the test tube colour stays purple, there is microbial residue. The sample may contain small amounts of microbial residues if the test tube is purple with a yellow underside or a lighter shade of purple without yellow, as the detection limits of the probe can be 100% because the check set's underlying theory depends on B. Stearothermophilus's division in the event that it is not wrinkled. Then, using the nutrients in a test tube, the microbial medication produces a corticosteroid state. As a result of the acidic environment in the test tube and the fact that B Stearothermophilus Navratilova (Navratilova, Navratilova, Navratilova) is a suitable candidate for rapid growth at high temperatures (64°C) and is highly sensitive to the detection of lactam antibiotics in livestock, Bromocresol Purple (purple) changes from purple to yellow in this manner.

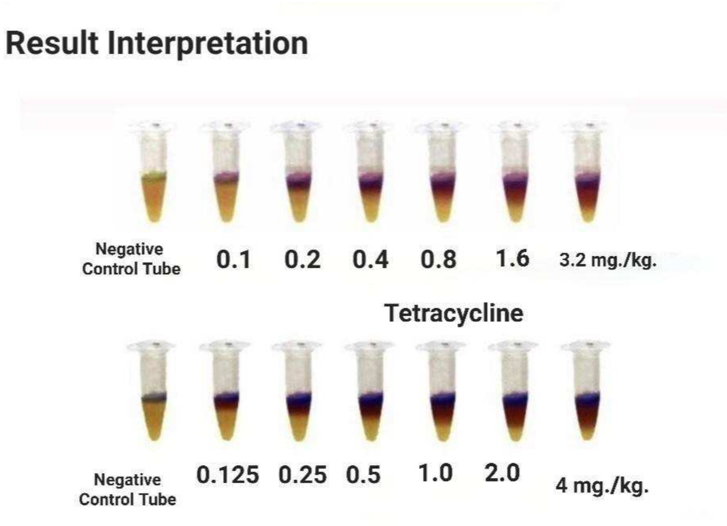

Figure 1. Result Interpretation

Result

From the antibiotic residues in the samples, 21 samples were tested; 1 cooked shrimp, 1 salmon, 1 salmon egg, 1 Hotate (Japanese scallop), 1 tuna, 1 squid wasabi, and 15 shrimps. 13 shrimps were bought from local markets which 2 shrimps were bought from well-known markets. Additionally, other samples were bought from a well-known Japanese restaurant. Out of 21 samples, 1 Tako Wasabi tested positive in the detection of Tetracycline (4.76%) and 20 other samples tested negative (95.24%) (Table 1)

Table 1. No. of samples that detected antibiotic residues and percentage of samples that detected antibiotic residues.

Sample	No. of Sample	Detection of Tetracycline	
		Positive	Negative
Cooked Shrimp	1	0	1
Salmon	1	0	1
Salmon egg	1	0	1
Hotate (Japanese scallop)	1	0	1
Tuna	1	0	1
Tako wasabi (squid in wasabi)	1	1	0
Shrimp	15	0	15
Total	21	1	20

Discussion

From the antibiotic residues in the samples, 21 samples were tested. Only 1 sample; Tako Wasabi tested positive in the detection of Tetracycline (4.76%) and 20 other samples tested negative (95.24%).

One of the reasons why only the Tako Wasabi was detected may be that the squids used are originally from Thailand which is heavily commercialised. [14] This may result in the heavy use of antibiotics to gather more squids. Additionally, the catching methods are mostly undocumented which allows fishers to bypass the food safety standard resulting in the overuse of antibiotics especially being sold within Thailand itself. [15] Another reason may be that some restaurants in Thailand have marinated the squids in fever medicine (containing aspirin, ibuprofen, diclofenac, and more) to give the squid a more plumped-up crispy texture and look which makes it look more appetising to customers. [16] This poses an obvious health risk to consumers and does not pass the health safety standard.

From 2 samples of salmon and one sample of Tuna, we did not detect any Tetracycline which might be because salmons are mostly imported from other countries, therefore there are certain regulations to control the presence of antibiotic residue, which explains why salmon did not give a positive result for the detection of Tetracycline. [17]

From 16 samples of shrimp, none of them were detected with Tetracycline residue which might be because, in Thailand, shrimp is one of the products which we export to other countries. In 2019, 21,321.92 tonnes of shrimp were exported from Thailand. [18] Thus, there are also certain regulations to control the number of antibiotic residues so the shrimp is up to quality.

Limitation

In this study, samples were gathered from only 1 Japanese restaurant in the city of Bangkok, therefore, the results cannot be generalised with every seafood.

Conclusion

Tetracycline residues were tested in 21 samples where 1 sample of squid (Tako Wasabi) tested positive in the detection of Tetracycline (4.76%) while 20 other samples tested negative (95.24%).

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