Veterinary Drug Residues in our Food Chain

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In modern food markets consumers are putting an increasing focus on the quality of their food. In order to keep this quality to the highest standard it is vital that food safety testing is rigorous and provides a complete picture of the food supply chain including safety and traceability.

Regular food screening for chemical residues such as antibiotics, growth promoting steroids and other chemical contaminants should play a key role in protecting the consumer. This screening ensures that only the highest quality products reach the food chain, producing a complete safety profile for all food products. With many food producers trying to meet customer demands for low cost products, the quality of food testing can suffer which could result in foods unsafe for human consumption reaching the supermarket shelves.

The threat of drug residues in food is causing increased concern globally; therefore the presence of anabolic steroids including beta agonists such as Clenbuterol and Ractopamine, as well as other veterinary drugs such as Phenylbutazone is under a strict monitoring program in meat and animal feed. Other food that comes under scrutiny in particular for the presence of antibiotics includes milk, honey and eggs.

As a result of the concern of excessive use of these drugs and the possible adverse effects on human health, many countries have set Maximum Residue Limits (MRLs) or tolerances for these residues in food. The Maximum Residue Limit is the maximum concentration of a residue that can be present in a product from an animal or animal by product intended for the food supply. These MRLs mean that it is required by law in the enforcing countries that any product in the food chain cannot contain residue levels that are harmful to human health above these limits.

Drugs like Clenbuterol, Ractopamine and Phenylbutazone can have serious implications for human health if consumed in quantities exceeding these recommended safe MRLs.

Effects on Human Health

Clenbuterol is used to induce weight gain in food animals. It can cause various health concerns for Humans. Consumption exceeding the MRL can lead to 'mild' effects such as hospitalisation with reversible symptoms of increased heart rate, muscular tremors, headache, nausea, fever, and chills. It has to be noted however that people who are sensitive to this drug could be far more severely affected by Clenbuterol residues in food than the general population.

Ractopamine is a more controversial drug as its use is permitted in food production in some countries like the US & Canada, but the European Union, China, Taiwan and over 100 other countries have banned its use. Ractopamine is used to increase weight gain or leanness in beef and pork animals for the food supply, it is used extensively in the US where it is considered safe, which has led to recent trade disputes between the US and countries banning the use of Ractopamine.

The European Union Food Safety Authority has conducted studies into the effect on humans and results stated that the drugs can cause a range of side effects including; tachycardia (fast heart rate, over 100 beats per minute), vasodilation (widening of blood vessel, skeletal muscle tremor, nervousness, metabolic disturbances such as hyperglycaemia (high blood sugar) and hypokalaemia (lower than normal potassium in the blood.) Because of these possible side effects the European Union has rejected the MRL proposed by the UN's Joint FAO/WHO Expert Committee on Food Additives and said there is no current way of calculating a safe ractopamine residue limit for human consumption with the studies that have been conducted.

Phenylbutazone, commonly known as Bute, has potentially more serious implications on human health than Clenbuterol and Ractopamine. Bute was originally used as a treatment for rheumatoid arthritis in humans in the 1950s but was removed as a result of its effects on human health. Bute has been linked with the development of blood disorders, including aplastic anaemia, leukopenia, agranulocytosis and thrombocytopenia. Phenylbutazone has also been known to be a carcinogen in rats but has not been conclusively proven to have this affect in humans.

Whilst the presence of antibiotics in the food system is a major threat to damaging human health, this is no longer the only issue. Recently the Chief Medical Officer of England, Dame Sally Davies has raised awareness around the issue of antibiotic resistance and the serious threat it poses to the future of human medical care.

With an increased level of antibiotics used in food production, human consumption of regular antibiotics is increasing. This means that when producers do not meet MRLs humans are consuming levels of antibiotics when they are not needed causing an antibiotic resistance. Recent media has highlighted that this can lead to antibiotics losing effectiveness at treating infections. Without antibiotics available to treat infections having simple surgery could become a life threatening procedure. This antibiotic resistance has the potential to be a lot more dangerous than simply being exposed to adverse side effects of the antimicrobial drugs.

The Importance of Testing

The potential human health risks highlight the importance of complete food safety testing before a food product reaches the public.

Globally food scares are all too common. In 2011 China discovered that Chinese pork products tainted with Clenbuterol had entered the food supply. Ractopamine levels in US meat lead to a ban on food products in 2012 containing traces of the drug in Russia. Then in early 2013 it was highlighted that traces of Phenylbutazone were found in horsemeat destined for the European food chain.

This Phenylbutazone scare happened in the midst of a scandal involving the mislabelling of horsemeat as beef in the European food supply. This and previous scares serve to highlight the need for a much more robust food safety testing system that includes traceability as well as safety, allowing the consumer to know a foods origin as well as what it contains.

With this in mind, concern has been raised over the possible presence of Phenylbutazone within the mislabelled horsemeat.

European law around the slaughter of horses requires that all horses have a passport declaring whether they are destined for the food chain or not. Those horses that are for human consumption are then only allowed a limited number of medicinal substances; Phenylbutazone is not on this approved list.

Even with these measures in place between 2% - 5% of horse meat samples have tested positive for traces of Bute in the UK. With traces of Bute being found in horses destined for the food chain there is a possibility of Bute also being present in some of this mislabelled beef.

Test Methods

Phenylbutazone screening methods are limited with a large proportion of testing being carried out by costly and lengthy confirmatory methods such as HPLC, GCMS and LC/MS. An ELISA screening test to detect Phenylbutazone in serum and horse tissue is available from Randox Food Diagnostics. This ELISA has excellent limits of detection at 2ng/ml in serum and 1.0 ng/g in tissue. Additional ELISA test kits offered includes beta agonist, clenbuterol, ractopamine and many other veterinary drugs, all of which offer low limits of detection with minimal sample preparations.

ELISA screening methods offers an excellent way for food producers and processors to conduct their own in house screening to ensure that the quality of their food has not been compromised by drug residues administered earlier in the food chain.

Sample preparations required for rapid drug residue tests such as dipsticks, lateral flow devices and receptor binding assays along with ELISAs often require a low level of technical expertise and reduced consumable costs.

ELISA screening along with the revolutionary multi-analyte biochip array technology offer the same advantages as the rapid test kits. However they also have the ability to provide quantitative sample concentrations with a high sample throughput which allows the end user to have a high degree of control. Biochip array technology is now used by many governmental institutes worldwide and has been reported to provide a reliable and efficient way to screen samples for residues of multiple veterinary drugs.

Biochip technology provides a platform that enables the simultaneous determination of multiple veterinary drugs in a single sample using a single sample preparation. It uses miniaturised assay procedures which reduces the sample/reagent consumption and cost-effectiveness of the tests.

The technology is based upon well tested and reliable ELISA principles of sandwich and competitive immunoassays. Multiple specific ligands (antibodies or antigens) are attached at pre-defined discrete test regions on the surface of the biochip (similar to antibodies on a microtitre plate). Any veterinary drug present in a sample leads to binding of conjugate labelled with

Horseradish Peroxidase (HRP). The addition of signal reagent leads to generation of a light signal and analysis of results completed via the Evidence Investigator analyser.

Conclusion

No matter what test screening method is chosen, it is important that residues of veterinary drugs are at the fore front of any food safety initiative. The percentage of food scares should be decreased to allow consumers a high degree of confidence in all food stuffs consumed on a regular basis. Modern techniques now available commercially such as the biochip array technology; allows for the presence of multiple drugs to be tested rapidly, ensuring that any positive samples are eliminated from the food chain prior to any scares being highlighted in the media.

Company Profile

Randox Food Diagnostics is an associate of Randox Laboratories who have 30 years' experience in the diagnostic market and a devoted research and development team.

Due to the in house capabilities of this dedicated research and development team, Randox Food Diagnostics have the ability to respond rapidly to emerging new drugs of abuse and regulations in relation to food and animal safety. Sixty-five new residue drug targets are currently in development to keep up with the ever changing market of food safety.

Randox Food Diagnostics will ensure that all residue screening laboratories requirements are met by providing reliable food safety screening on a global scale.

Sources:

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Comprehensive Point-of-Care Management System

The AQURE point-of-care management system from **Radiometer** provides a straightforward way of managing access to all point-of-care instruments, offering a convenient way of controlling user access, training and documentation. AQURE enables you to quickly and easily create and manage users profiles, review operator performance and assign e-learning and competency testing modules as required. In addition, AQURE offers time-saving features to monitor operator certification and track assay failure rates – sending notifications if defined performance criteria are not met – helping to identify when further training or testing is required.

Centralised competency management with AQURE allows you to assign courses to operators by email, review training programme completion and test results, and archive paperless records, all within one system. Built on Microsoft® technology, AQURE can be easily integrated into existing hospital IT infrastructures. Its open platform allows you to develop and upload your own materials, or use resources from a third party, offering a customisable, highly flexible and scalable software solution for point-of-care operator management.

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ADVERTORIAL

New Multi-Analyte Array Available for the Detection of Antimicrobials in Honey

Antimicrobials are used to kill or prevent the presence of bacteria or viruses that are detrimental to health. They are used in the food production industry to treat infections but also to act as a growth promoting compound. The use of certain antimicrobials has been banned in food producing animals in many countries and maximum residue limits (MRLs) have been set in order to monitor antimicrobial usage.

Strict controls have been put in place due to serious concern over the health risk caused by excessive use of antimicrobials in food producing animals. This concern exists as the excessive presence of antimicrobials in food leads to the development of antibiotic resistant strains of micro-organisms.

A reliable and cost-effective screening method is required within the honey testing industry to ensure that the produce on our shelves is safe for consumers. Randox Food Diagnostics have developed the new Antimicrobial Array IV (AMIV) to detect multiple antimicrobial compounds in a single honey sample on the Evidence Investigator screening analyser. Unlike other commercially available kits that provide qualitative determination only, the AMIV testing platform is able to discriminate between compounds providing a quantitative concentration.

Benefits of the AMIV array include:

- Unique test platform - can detect 37 aminoglycosides and macrolide compounds
- Only commercially available test kit for Apramycin, Josamycin, Paromomycin, Amikacin, Hygromycin B, Tobramycin, Desmycosin and Tylosin
- Detects both marker residue and metabolites
- Rapid sample preparation - simple dilution in buffer
- 630 tests in <2hrs
- Excellent sensitivity

For further information on the Randox Food Diagnostics AMIV array or any of our other Antimicrobial arrays please contact enquiries@randoxfooddiagnostics.com or visit www.randoxfooddiagnostics.com

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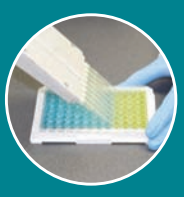
Horse DNA isn't your only concern

Traces of bute found in the food chain

Randox Food Diagnostics offers the Phenylbutazone ELISA platform to detect Phenylbutazone (bute) in urine samples with a tissue preparation available upon request

- Exceptional Limits of Detection
- Excellent detection of the main metabolite oxyphenbutazone
- Plates pre-coated with analyte specific antibody, reducing assay set up time

Assay Limits of Detection
Equine Serum - 2.01 ng/ml
Tissue - 1.0 ng/ml



Assay Specificity Compound (% Cross-Reactivity)
Phenylbutazone (100)
Oxyphenbutazone (15)

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FOOD DIAGNOSTICS

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