What's the Beef with Sausages?

Introduction

Is the steak in the pie really beef or could it be something else? Consumers need to have confidence that the food they purchase is what they think it is. After all, if they have paid a premium price for beef sausages they expect them to be beef, not mutton.

When raw meats are sold unprocessed, for example as steaks or chops, it is relatively easy to see what species they are. However, when meats have been minced or made into sausages it is not always possible to visibly identify the species of the final product.

Technology has been available to identify the species of raw meats but not if the meat has been cooked in a pie, casserole, curry or stir fry. Recently, local DNA technology has been developed to address the problem with identifying the species of both raw and cooked processed meats. (See 'How does DNA technology work?').

Chicken pieces and lamb chops are easy to identify by their shape – but would you know if the diced meat in your kebab or the sausages was really beef?

Meat species survey

Is this a pork or chicken casserole – or is it something else? With DNA-based technology we can now check both raw and cooked foods.

A survey of 111 meat products was undertaken as part of the Western Australian Food Monitoring Program to determine the accuracy of meat product labelling and identify whether products had been illegally substituted.

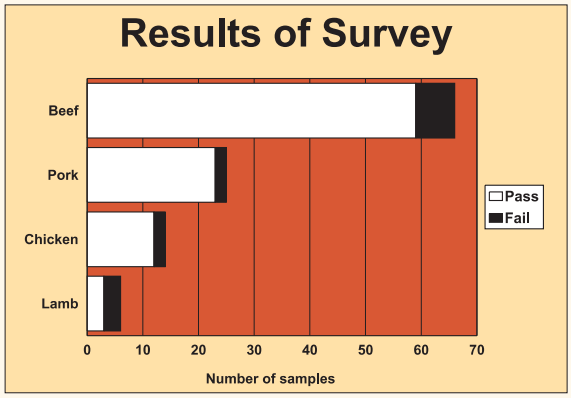
Environmental Health Officers from 38 local governments collected meat product samples from butchers, food halls, restaurants and bakeries throughout Western Australia.

The 75 raw samples included sausages, mince and ready-to-cook meals, while the 36 cooked samples included pies and ready-to-eat meals. All products were labelled as containing a particular species of meat, for example, 'beef' sausage, 'chicken' pie or 'lamb' stir fry.

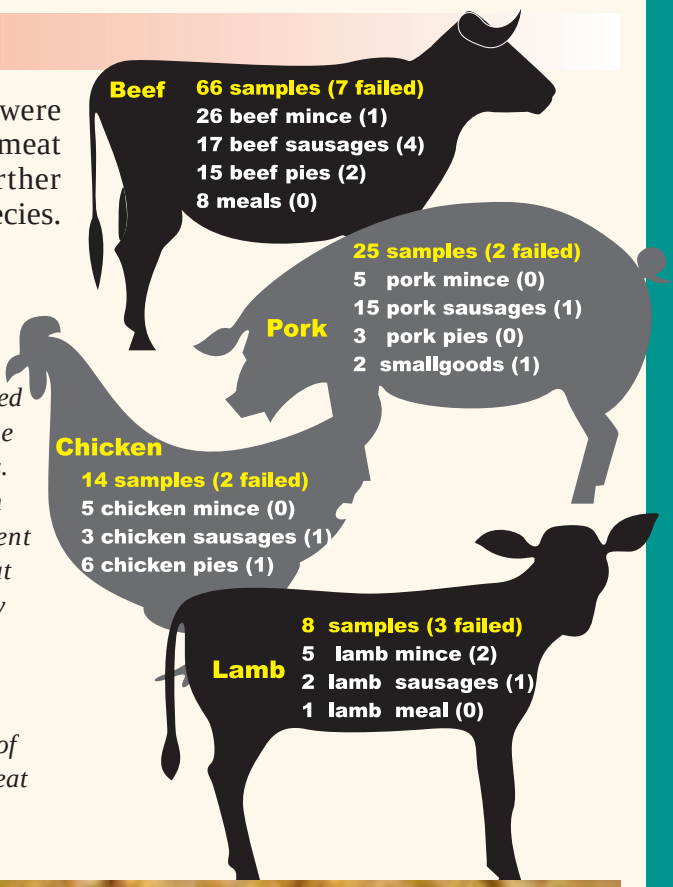
The samples were analysed using DNA-based technology at the Food Laboratory, Chemistry Centre of Western Australia.

What was found?

The survey revealed that six (5%) of the 111 samples were inaccurately labelled as they contained other species of meat or none of the meat species indicated on the label. A further eight samples (7%) contained minute traces of other species. An overview of the results is shown below.



Overall, four (11%) of the 36 cooked meat samples were inaccurately labelled as were 10 (13%) of the 75 raw meat samples.



The description and number of products sampled are shown in the animal outlines. The numbers in brackets represent the samples that failed to comply due to a) inaccurate labelling or b) trace amounts of non-labelled meat species.

Why did products fail?

The DNA-based technology can identify if beef sausages contain traces or large amounts of other species. This means it is possible to identify if a product has been accidentally contaminated or deliberately substituted with meat of a different species. Products in the survey were found to fail for four main reasons.

Traces of other species were found in samples. The content of eight products contained traces of other species. They were beef pie, beef and potato pie, beef mince, beef sausages, chicken and vegetable pie, chicken sausages and two samples of lamb mince.

The small amounts detected in the minced products would be consistent with a mincer not being cleaned thoroughly between uses. This demonstrates poor manufacturing practice. Food handlers must clean and sanitise equipment thoroughly between uses to prevent bacteria from one batch of food contaminating the next batch through the machine. The small amounts of other species detected in the pies may be due to the gravy being made with stock from a different species.

Product did not contain a labelled species. One sample of unpackaged sausages purchased from a butcher was labelled in the display tray as 'beef and bacon sausages'. However, it did not contain any bacon (pork). The product was found to contain

Have scraps of mutton been used to bulk out the beef sausages?

synthetic bacon flavouring. The correct labelling should have been 'bacon flavoured beef sausages'.

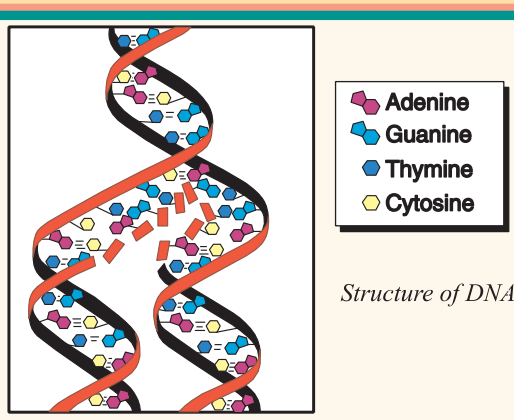
Product contained an 'extra' species. Four samples contained 'extra' species of meats. These were beef sausages containing added pork, beef sausages containing added lamb, pork salami containing added beef and pork sausages containing added beef. These could be intentional acts to deceive the consumer by adding cheaper meats to a product, or laziness by the butcher using any handy scraps of meat to bulk up a product's meat content.

Product did not contain labelled species. One product labelled as lamb and rosemary sausages did not contain any lamb, but consisted solely of beef. As beef generally is more expensive than lamb, it is unlikely that the product was intentionally substituted. Poor placement of a label in a tray of sausages at the butcher's shop could be responsible for this contravention and demonstrates that the business has poor practices without an appropriate checking system in place.

How does DNA-based technology work?

Proteins are essential for the growth and repair of animal tissue and their structure varies among species. The 'recipe' for making a protein comes from the genes contained in chromosomes.

The genes consist of deoxyribonucleic acid (DNA), a double-stranded group of chemicals that are attached to each other along their length by four special groups of chemicals. The chemical groups are arranged in a different sequence depending on the species of animal.



Structure of DNA

Under certain chemical conditions, small amounts of DNA can be separated into single strands and 'replicated' into larger amounts by a technique called polymerase chain reaction (PCR). As the DNA method requires large amounts of DNA to be accurate, the PCR step is used to make enough DNA for analysis.

PCR involves separating the two strands that make up the DNA, exposing the areas where they are joined. The separated DNA strands are then placed in a solution containing chemicals that make up DNA. Chemicals from the solution attach to the exposed joining sites to make more DNA. This step is repeated a number of times and is often referred to as DNA amplification.

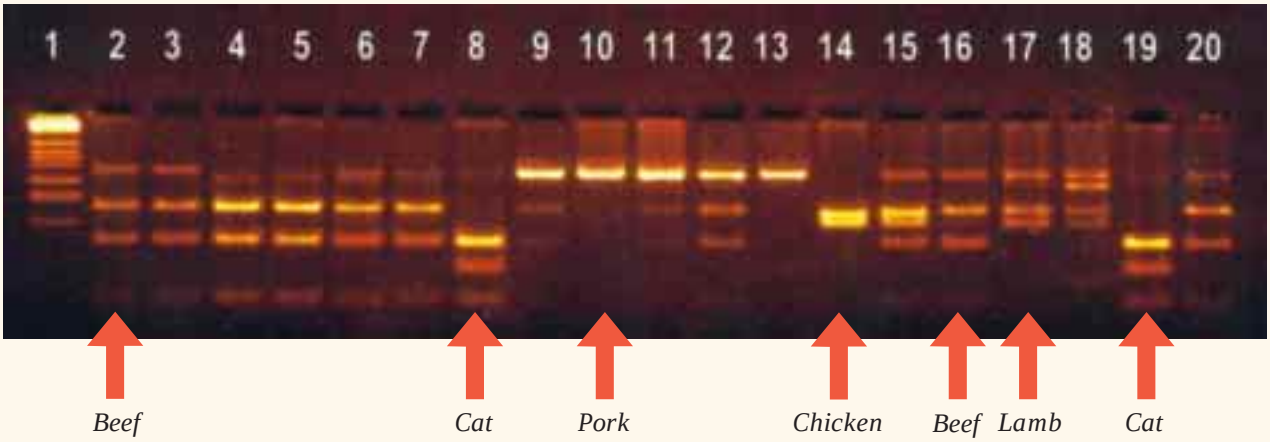
The DNA is then treated with DNA cutting enzymes which cut it into smaller sizes. DNA of different species will be cut differently. Treated DNA is processed by placing it on a gel plate through which an electric current is passed. Under these conditions, the DNA separates and forms distinct banding patterns as shown in the photograph below. Tests are repeated using two other DNA cutting enzymes to confirm results.

Samples of meat collected for the survey were compared against DNA extracted from authenticated standards of meats including cow, sheep, pig, horse, kangaroo, chicken, cat, dog, etc. Digital photographs are taken of the gel plates so that the banding patterns can be compared accurately using a computer.

DNA-based technology is very accurate and can identify very low levels of individual species in a mixture. It is also possible to use the technology to identify if a product is contaminated with small amounts or contains larger quantities of meat from other species.

How do you know if it's chicken or cat?

Using a computer, a combination of sample patterns is compared to those of standards from authenticated specimens. Each gel plate can accommodate a combination of 20 samples and standards. From the photograph below, can you identify the species of the unknown samples by comparing them to the arrowed standards? The answers are shown at the bottom of the page.



Answers: 3–7 = beef, 9 = pork and beef, 11 = pork and beef, 12 = beef and pork, 13 = pork, 15 = chicken and beef, 18 = lamb, 20 = beef.

What can be done?

Businesses can avoid the product failures identified in the survey by implementing an appropriate food safety program, for example FoodSafe Plus.

Would you know what was in these sausages?

A food safety program helps a business identify what it makes, how it is made and what can go wrong at each stage of the process. It then helps the proprietor to identify and implement procedures to prevent problems occurring. A food safety program can identify and improve practices that lead to the contamination and mislabelling of products. For example:

- A cleaning and sanitising procedure for the mincer would ensure that food handlers know when and how to clean and sanitise the machine, and also record when this had been done. This would avoid contamination between species.
- The schedule of products made or sold should identify the accurate naming of products, for example bacon-flavoured beef sausage. A procedure for labelling bulk foods would ensure that the correct label had been placed on the food.
- Trimmings and off-cuts of meat should be placed in labelled containers and covered in the coolroom. This would prevent the mixing of species accidentally.
- Labels in bulk food containers can be marked on both sides so they are visible by the consumer and butcher. Tags that pierce the product are a source of cross-contamination and should not be used. They can also be easily removed from products and put back in the wrong place. Labels attached to the tray are more hygienic and cannot be removed as easily.

Environmental Health Officers can explain to businesses what a food safety program is and highlight areas where it would improve hygiene practices.

Food safety and DNA-based technology

DNA-based technology can provide many benefits to the food industry, law enforcers and consumers.

Industry can use the technology to identify species of both fish and meat products. For example, importers and manufacturers of processed meat and fish products can use this technique as part of their food safety program to ensure products are made from the species as ordered. The results of analysis can be used to demonstrate due diligence in a court of law.

Environmental Health Officers can use this technique to detect fish or meat substitution in both raw and cooked products. For example, samples can be compared against standards for dog, cat, horse, camel, kangaroo, emu and crocodile as well as beef, pork, chicken and lamb. An approximation of the level of substitution can also be determined, for example, if it is a trace or a significant amount and, eventually, percentages of mixes will be able to be determined accurately.

Does the product contain real bacon – or is it bacon flavouring?

Consumers benefit from this technique as the method will help provide information to ensure that products are labelled accurately, therefore so maintaining consumer confidence in the food supply.

DNA-based technology is being refined to identify if products have been genetically modified or irradiated.

The Western Australian Food Monitoring Program will continue to undertake low level DNA surveillance of products to monitor label accuracy.

Who was involved in this survey?

Metropolitan local governments (21)
Armadale, Bassendean, Bayswater, Canning, Claremont, Cockburn, Fremantle, Gosnells, Joondalup, Kalamunda, Mandurah, Melville, Mundaring, Perth, Rockingham, South Perth, Stirling, Subiaco, Swan, Victoria Park, Wanneroo

Country local governments (17)
Broome, Bunbury, Capel, Carnarvon, Denmark, Derby-West Kimberley, Geraldton, Harvey, Irwin, Kalgoorlie-Boulder, Northam (Town), Plantagenet, Port Hedland, Roebourne, Serpentine-Jarrahdale, Wagin, Wyndham-East Kimberley

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April 1999