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SHAPING THE FUTURE OF FOOD SAFETY AND INTEGRITY

Proteomics: a valuable new scientific tool in the fight against food fraud

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As consumers, we have the right to know what is in the food we buy and where our food is coming from. Yet today's food chain is of unprecedented complexity and span, presenting greater risks in relation to safety and authenticity. So clear and correct labelling of food and drink products is vital.

This is important for producers and retailers, too. They must ensure consumer confidence and protect their products. Which is why UK beef farmers have called for stronger labelling on packaging to ensure any imports entering the country as a result of Brexit trade deals match our standards.

Laboratory analysis is essential to support enforcement of food labelling regulations. Food products are immensely varied, with endless combinations of ingredients and processing techniques.

Thankfully, a wide range of analytical techniques and instruments are available to address authenticity issues.

DNA testing is one. Foods are biological materials, and their DNA and proteins carry information about the species origin of their constituents. This information can be exploited to verify ingredients.

Methods that target DNA markers of biological species, such as polymerase chain reaction (PCR), provide excellent specificity and are widely used. Similarly, techniques targeting marker proteins, such as antibody-based methods, are also frequently used. More recently, however, protein and peptide analysis by liquid chromatography-mass spectrometry approaches (proteomics) have been gaining interest and are showing great promise.

Proteomics methods present a powerful alternative, offering robustness, sensitivity and specificity, as well as multiplexing (detecting multiple analytes in a single test) and high-throughput capacity. Crucially, peptide analysis can cover gaps that exist in other techniques.

In highly processed foods, DNA can be degraded (by processing) to such an extent that DNA-based testing is precluded. But many proteins and peptides will persist - and can be identified using proteomics.

For example, peptide variations that occur during meat dry curing and ageing can be targeted by proteomics as markers of quality and authenticity. Tissue-specific modifications in proteins can also be used to identify the fraudulent addition of certain types of materials to food (for example milk, blood or offal). Proteomics can also be exploited to identify production methods (wild/farmed), technological processes, to determine the presence or otherwise of GMOs, and a raft of other safety and traceability issues.

Considerable effort has been dedicated to research and development of proteomics over the past decade and great progress has been made.

But there are challenges to be addressed before we see these methodologies more widely applied to determine food authenticity.

One of the limiting factors is the restricted number of validated methods. Due to the large diversity of protein constitution, as well as other variables in food products, development of standards and reference materials has been challenging and slow. In addition, proteomics requires reliable gene and protein databases, which are not always available for food-related species.

Closer collaborations between industry, governments and the scientific community would help to focus resources to validate methods, produce standards and improve databases. Although proteomics instruments and procedures are still highly technical, as technology continues to advance, testing methods are becoming simpler and less expensive. Proteomics is surely finding a place of increasing importance in the toolkit to fight food fraud.

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