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COLLABORATIVE INSIGHTS

ANALYTICAL CAPABILITIES AND AREAS FOR FUTURE DEVELOPMENT

A response to Defra's **Implications of Emerging Novel Protein Sources for Food Authenticity and Labelling** report.

BY **ROSARIO ROMERO**
FERA SCIENCE LTD
& **DR MICHAEL WALKER**
QUEEN'S UNIVERSITY BELFAST

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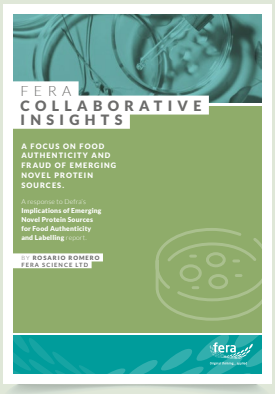
Original thinking... applied

THE REPORT'S CORE FINDINGS

Defra has recently published a report, commissioned to Fera Science Ltd, focussing on potential emerging risks regarding authenticity and labelling of alternative protein food products. Discussed in this report are aspects such as how these products may fit under the current regulatory labelling framework, how current testing capability can support product authentication and detection of emerging fraud risks and future research needs in this sector.

Following this publication, and to continue the debate into the current challenges and future opportunities within the industry, Fera is producing a series of articles culminating in a webinar, bringing together key industry stakeholders, researchers, and representatives from regulatory bodies.

Authored by Rosario Romero, Science Lead from Fera Science with input from several subject matter experts in this field, Defra's report has the potential to shape our understanding of and inform future authenticity method development needs to ensure testing capability for alternative proteins and future research needs are considered.



CLICK HERE TO READ THE FULL REPORT

In this brief article the co-authors delve into the key findings and the broader implications.

THE REPORT'S CORE FINDINGS

The report, titled **Implications of emerging novel protein sources for food authenticity and labelling** provides an expert review of the information available in relation to potential food labelling and authenticity risks associated with alternative proteins (AP).

Its findings can be distilled into several key themes:

KEY FINDING 1

Currently, not much consideration has been given to potential food fraud in the alternative protein sector, as most of the effort has been focused on developing products and associated technologies.

KEY FINDING 2

The use of new production and processing techniques as well as novel sources of protein may present challenges for current analytical methods for food authentication.

KEY FINDING 3

In addition to analytical methods, the wider food supply chain control systems must evolve to accommodate increasing complexities.

KEY FINDING 4

Labelling of AP faces two important challenges concerning the use of descriptors and imagery traditionally used for animal-derived foods and the question of transparency regarding methods of production.

A Synergy of Findings & Expertise:

In this article Rosario and Michael Walker, QUB, will discuss emerging challenges regarding tools to support food authenticity and traceability of novel alternative proteins. Areas for future development to mitigate food fraud risks will be highlighted.

INTRODUCTION

from **Dr Rosario Romero**

Rosario Romero
Science Lead, Novel Foods

The world's population is projected to reach 9.7 billion in 2050 and ensuring that everyone has access to safe and nutritious food whilst protecting natural resources represents a serious challenge.

Alternative sources of proteins are thought to have potential in helping to tackle this challenge. The interest in alternative proteins has been increasing as a result in recent years and this trend is expected to continue. Technological advances are enabling an acceleration of innovations, and a plethora of alternative proteins products are being developed. Potential authenticity issues and risks of food fraud in this industry must be considered and tools to mitigate must be developed to support enforcement and to protect industry and consumers.

Current analytical methods for food authentication will face issues such as a lack of genome data for novel species, the effect of novel processing techniques on biomolecules, identification of animal proteins produced by precision fermentation or identification of cell lines used for cultivated meat products. Suitable reference materials and databases will be needed to support authenticity testing. In addition to analytical methods, the wider food supply chain control systems must evolve to accommodate emerging complexities.

Areas considered potentially promising to mitigate food fraud risks include:

Computational solutions: block chain, big data, artificial intelligence

Integration of computational tools with analytical technologies such as sensors or molecular markers

Standards and certification schemes

OVERVIEW & OPINION

from **Dr Michael Walker**

Dr Michael Walker
Queen's University,
Belfast

Here, a high level overview is given of the analytical science aspects of AP fraud. Other articles will cover other aspects. Detection of food fraud / crime is important to protect food safety, value for money, business reputation and consumer trust. These attributes are important for both conventional and alternative proteins, and fraudulent cross-over in both directions.

Analytical detection of food fraud / crime is rarely straightforward.

There are few single unequivocal markers of 'authentic' or 'not-authentic' in any food authenticity scenario (mammalian species assignment by DNA is a rare exception).

Usually, multiple markers of varying weight of evidence are required and a typical outcome when some or all of these are positive is that further investigation is required.

This is typically a combination of further testing and investigation such as mass balance, documentary audit or inspection. Seizure and examination of electronic data (laptops, PC's mobile phones) may also be important.

Such investigative follow-up is extremely resource intensive, requiring highly experienced investigators.

Hence the crucial part played by analytical testing is to provide robust independent data driven prioritisation for investigation in the supply chain. This Defra report produced by Fera Science Ltd demonstrates the rapidly evolving nature of the AP market, placing added strain on analytical capability. It prompts the question: based on the findings can we rely on analytical science to flag up fraud in the AP market?

With limited exceptions the answer is NO. Which is why this report is so important as a wake-up call for investment in dedicated, coordinated multidisciplinary and multinational preparedness work in the analytical research communities.

We must not be caught on the hop as we were in the horsemeat scandal.

OVERVIEW & OPIONION

from **Dr Michael Walker**

Here are the priorities:

EXISTING METHODS

Collate the limited existing methods, review their validation, performance characteristics and accreditation, making good any gaps. Invest in their scalable application and, safety considerations such as allergenicity aside, define consensus 'thresholds' that flag economically motivated adulteration.

HORIZON SCANNING

The Defra/Fera report is an excellent start, and the momentum must continue to identify and prioritise the species, processes and emerging analytical techniques of interest on a rolling basis.

GENOMICS

Plant, insect, and seafood genomic bioinformatics lag well behind their mammalian counterparts. Prioritised sequence data acquisition is crucial, and this in particular requires coordinated international research. Next generation sequencing will clearly feature significantly.

PROTEOMICS

Alongside genomic research, since molecular information on proteins is often based only on expression potential, dedicated work is needed on prioritised real-world protein chemistry, i.e., amino acid composition, primary, secondary, tertiary, quaternary structure and post translational modification (PTM). PTM induced by food processing is particularly relevant to protein extraction, detection and if required, quantification. Proteomic research may be crucial to distinguish precision fermented proteins and their conventional counterparts.

METABOLOMICS

Non-targeted metabolomics supported by chemometrics complements genomics and proteomics and requires robust classification models and advanced tools to aid identification of discovered molecules. Shared repositories for the composition of edible insects have been proposed but are as yet in their infancy. The accessibility of these approaches to regulatory and enforcement authorities will require new regulatory models.

DATA FUSION

Data fusion moves on from orthogonal confirmation to carry out the joint chemometric analysis of datasets obtained from different sources (e.g., various types of spectroscopy techniques). The process of correlating and fusing information from multiple sources allows more accurate inferences about the sample under study. This has shown promising results in several food sectors and is application to AP would be interesting.

DATABASES

Databases of the analytical characteristics authentic specimens along with appropriate metadata are essential for the successful application of many of many of the measurement techniques described in the report. The transparency, scope, analytical methodology, sampling, collection and storage of data, validation and curation are essential aspects that must be assured and trusted between stakeholders.

Continued...

OVERVIEW & OPIONION

from **Dr Michael Walker**

ANALYTICAL SCIENCE

- This Defra/Fera report includes fascinating insights about current analytical research activities and close study of the detail in the report is recommended.
- Overall, blue sky method development for AP authenticity testing is required and must be funded if we are to avoid a scandal jeopardising trust in AP as a sustainable solution. This may be carried out in the academic or industrial sectors.
- Academic research will generally be published and hence available to other scientists. Official safety risk assessment of AP, where it is required, will typically include an industry funded method as part of a submitted dossier. Regulatory and enforcement (official control) scientists must not be denied access to these and other industrially funded methods owing to intellectual property restrictions. Moreover, method validation and accreditation, which are laboratory specific, will remain to be funded and carried out.
- Method development, validation and accreditation require access to reference materials, and certified reference materials. These exist within a well-defined metrological infrastructure but are seldom commercial propositions to prepare, characterise and curate properly.
- Proficiency test schemes are an excellent means of assuring the performance of methods, laboratories, and the personnel within them. They are a mandatory requirement for accreditation. Such schemes must be developed for AP analysis.
- Lastly, much work on AP will rely on untargeted analysis for which a well-defined international infrastructure of performance characteristics, validation and accreditation remain to be established.

Conclusion

Alternative proteins are an emerging and very dynamic sector, and much of the efforts so far have been focused on identifying suitable sources and advancing the technologies. Therefore, there are still important research gaps, certainly regarding the topics of alternative proteins authenticity and related methodologies. This report provides an initial assessment of these issues, however, further research will be needed as the sector progresses, some of the emerging products become established and further data becomes available.

Click here to access the full report and delve deeper into its findings.