

mEAT quality

EU Meat Database for authentication purposes

A template for a European Meat Database to help combat food fraud

Report for Subtask ST6.3.2 on the EU Meat Database

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Executive summary

Across different projects, huge amounts of data are generated on authentic meat samples, but access to this data is often restricted. By sharing such data in a database, it could be used to build and strengthen existing methodologies focused on authenticating foods, and thereby fighting food fraud.

For Subtask ST6.3.2 of the Project, a basic outline for an 'EU Meat Database' was developed based on the WP5 data in the Data Warehouse. The purpose of the database is to serve as a reference for meat quality and authentication methods, and to provide the knowledge on quality and authenticity of meat from different regions and production systems. This report details the data that has been generated and how we envision such a database to function. It describes all the methods and procedures that were used to generate the data, process the results, and compare it to the reference database as guideline for future research. The protocols used in the project are provided as separate documents and can be accessed by anyone interested (open access).

It is envisioned that the database will be hosted by a suitable community of practice such as the EFF-CoP (European Food Fraud Community of Practice, <https://www.eff-cop.eu/>) which has a central hub (<https://hub.eff-cop.eu/>) where members gain access to different resources. The concept is that we provide the outline for on 'EU Meat Database' with the first entries being for broiler and pork (based on the results of the *mEATquality* project). This could then be expanded with other species.

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Introduction

Food products have characteristics of various types that can include distinguishing features of the product related to its origin, the processes in making it, its composition, the presence of additives, organic labelling, etc. Some of these characteristics, like composition, are physico-chemically inherent in the product, while other characteristics like geographical origin or organic label status are indirect (associated product characteristics) and relate to the conditions under which the product was produced or the environment in which it was produced¹. Claims can be explicit (“product is organic and the label says so”) or implicit (“this food is safe”) statements made about a food product, where a product is said or implied to have a certain characteristic. Authenticity is when there is a match between the actual characteristic of the food product and the claim made about it. When an intentional false claim is made about a food product, causing a deliberate lack of authenticity, it is referred to as food fraud. Authentication is the process of verifying the authenticity (or claims made) of a product, where methods for authentication can either be based on the analysis of product characteristics or the analysis of recorded data.

In the *mEATquality* project, data on broiler and pork meat characteristics were generated by analysing authentic samples from various studies exploring the effect of different ‘extensification factors.’ The value of this data is that it was collected across different European countries and analysed using standard procedures. The results shed light on how extensification factors (extensive husbandry practices) affect meat characteristics, and fundamentally also how product authenticity is impacted. Given that meat products are one of the top food categories most vulnerable to food fraud, the authentication and traceability of meat products are becoming increasingly important. Therefore, the results of the *mEATquality* project directly address this need.

However, apart from the insights and publications generated by the project, there is a need to further exploit the data so that it benefits the wider scientific community and industry. Resultingly, the project proposed to design and construct the first building blocks of an EU Meat Database, which has the potential to be used for reference purposes.

This report details the data that has been generated and how we envision such a database to function. The database will start by sharing the methods and protocols as guidance on how the (open access) data should be generated by other scientists. This will feed the database to maintain it, and enable comparability between future datasets. It is expected that as the database grows, other innovations such as AI and machine learning could be used to analyse the data to verify product provenance, detect mislabelled products and identify meat fraud types.

¹ European Committee for Standardization (CEN). (2024). EN 17972:2024, Food authenticity - Food authenticity and fraud - Concepts, terms, and definitions. Brussels, Belgium.

EU Meat Database

1. Purpose, function and target group

On 20 November 2025 we conducted a workshop with the project partners to discuss the database. Their response to the purpose of the database is shown in **Figure 1**. The purpose of the database will be to serve as a reference for meat quality and authentication methods, and to provide the knowledge on quality and authenticity of meat from different regions and production systems. During the discussions it was clear that this outline should be a reference and inform, instead of a policing instrument like the 'EU Wine Databank'. The goal is for researchers to share standard protocols and data openly, creating a community interested in advancing the science and protecting food products.

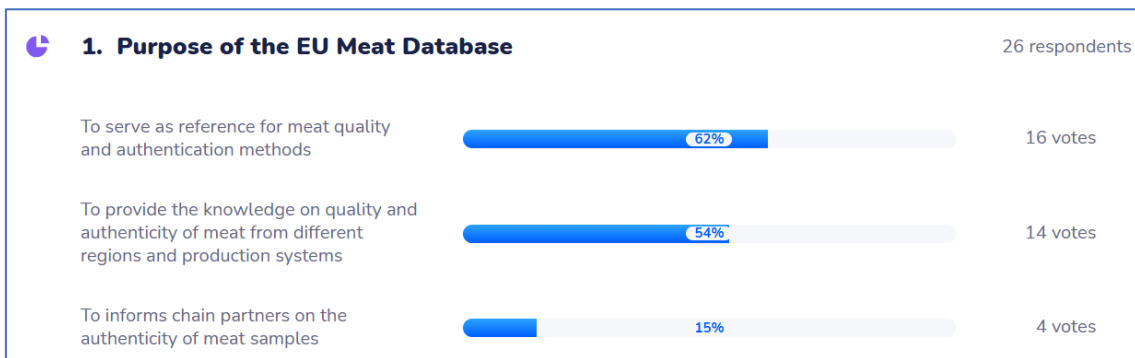


Figure 1. Project partner vote on the purpose of the database.

The project partner response to the function of the database is shown in **Figure 2**. Essentially they expect it to mainly provide the methods on how to generate the data, followed then by instructions on how to compare the results to the database.

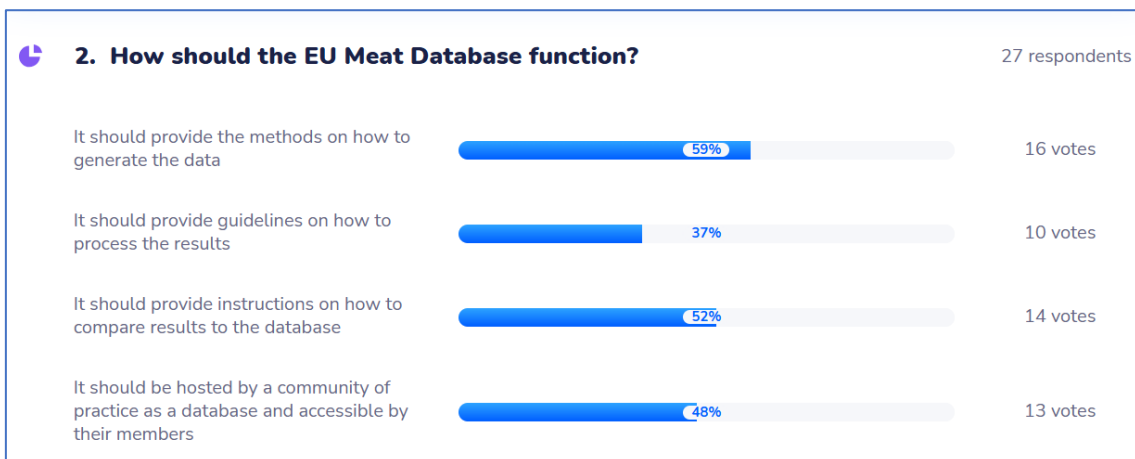


Figure 2. Project partner vote on how the database should function.

2. Data collection

The protocols on data to collect using in the *mEATquality* project will be shared in the database to serve as guidance. It is essential for authentic samples to collect animal information in the form of core qualitative metadata on the production systems (organic, conventional, higher welfare, etc.) and conditions, diet/feed, genetic broiler lines, sex, age class, transportation details, slaughter conditions, muscle cut/type, time/conditions before analyses. In **Table 1**, an overview is given of the data to collect from farm to processor (for broiler and pork chains) up until shipment of the meat samples to the different laboratories.

Table 1. Recommended data to collect from farm to processor for broiler and pork chains.

Information type	Details
Farm information (per experiment or treatment group)	Country
	Activity and factors (production systems)
	Farm name or description
	Time period / season
	Experimental unit (pen or animal)
Handling: transportation (per experiment or treatment group)	Date and duration
	Area/animal
Handling: lairage (per experiment or treatment group)	Date and duration
	Area/animal
Slaughtering (per experiment or treatment group)	Date and time
	Stunning method and settings
	Type of scalding and settings
	Type of chillers and settings
Animal (per individual animal)	Breed / genetic line
	Age
	Sex
	Live weight (only for pigs)
	Carcass weight (hot)
	Carcass weight (cold)
	Weight of muscle or cut removed for analysis
	pH after 45 minutes post-mortem
pH after 24 hours post-mortem	
Shipment: meat (per experiment or treatment group)	Date and duration

In **Table 2**, an overview is given of the data to collect in the laboratory for broiler and pork samples.

Table 2. Recommended meat quality data to collect for broiler and pork samples.

Analysis (method in brackets)	Details	Papers describing methods
pH and temperature (standard procedure)	Measure pH and temperature on the intact muscle before doing any basic analyses. Use a portable/benchttop pH meter with calibrated glass electrode and temperature probe.	Broiler: [1] [2] [3] [4] [5] Pork: [6] [7] [8] [9]
Drip loss (EZ-DripLoss) ¹	Measure on fresh intact meat at 48 hrs post-mortem. Use EZ-driploss containers, circular knife (Ø 25 mm x 20 mm height) and a laboratory scale	Broiler: [2] [3] [4] [5] Pork: [6] [7] [8] [9]
Colour (Reference method for CIE L*a*b* ²)	Measure on fresh intact meat at 48 hrs post-mortem. Use a colour-guide 45°/0° colorimeter.	Broiler: [2] [3] [4] Pork: [6] [7] [8] [9]
Cooking loss (Reference method ²)	Measure on frozen-thawed intact meat (2-3 months of freezing). Use a water-bath and vacuum plastic bags and laboratory scale.	Broiler: [2] [3] [4] Pork: [6] [7] [8] [9]
Texture (Reference method ²)	Measure on frozen-thawed intact meat (2-3 months of freezing). For pork the meat is aged until 72 hrs post-mortem then frozen. Use a Texturometer or Instron.	Broiler: [2] [3] [4] Pork: [6] [7] [8] [9]
Homogenisation (AOAC Method 983.18)	Homogenise samples for analyses. Use a food chopper or bowl cutter or food processor.	Broiler: [1] [2] [3] [4] Pork: [6] [7] [8] [9]
Moisture (AOAC Method 950.46, Loss on drying)	Measure on frozen-thawed homogenised meat (2-3 months of freezing). Use a drying oven.	Broiler: [1] [2] [3] [4] [5] Pork: [6] [8] [9]
Protein (AOAC Method 981.10, Kjeldahl method; AOAC Method 992.15, Dumas)	Measure on frozen-thawed homogenised meat (2-3 months of freezing). Use a Kjeltec™ 2300 (based on Tecator™ Technology) or Flash EA 1112 Protein Analyzer.	Broiler: [1] [2] [3] [4] [5] Pork: [6] [7] [8] [9]
Fat (AOAC Method 991.36, Crude fat in meat)	Measure on frozen-thawed homogenised meat (2-3 months of freezing). Use Soxtec™ 8000 FOSS (extraction unit).	Broiler: [2] [3] [4] [5] Pork: [6] [7] [8] [9]
Near-infrared spectroscopy	Measure on fresh intact meat at 48 hrs post-mortem, and after homogenising the meat.	[11]
Fatty acids	Measure on frozen-thawed intact meat (2-3 months of freezing).	[6] [8] [9]
Proteomics	Measure on flash-frozen in liquid nitrogen samples stored at -80°C	[1]
Isotopes and elements	Measure on defatted freeze-dried matter.	[10]

¹ <https://www.dti.dk/specialists/ez-driploss-equipment/35497>

² Honikel, K. O. (1998). Reference methods for the assessment of physical characteristics of meat. Meat Science, 49(4), 447-457. doi: [https://doi.org/10.1016/S0309-1740\(98\)00034-5](https://doi.org/10.1016/S0309-1740(98)00034-5).

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Important considerations for sample selection and analyses

When selecting samples for analyses the following criteria should be considered:

- For broilers: sample carcasses that are representative of the average weight of the pen (at least 6 per pen); defects, such as myopathies and broken wings should be noted and recorded, and these samples should not be selected.
- For pork: sample loins/cuts from pigs that are representative of the average weight of the group; if two sexes or seasons are used balance the number of samples to be taken equally per treatment (the absolute minimum pigs to take per sex is 6 pigs); defects, such as pale, soft, exudative (PSE) meat should be noted and recorded, and these samples should not be selected.

Irrespective of the species, the meat (entire portion of the muscle) must always be cut transversely to the grain (across the fibre direction). Determine in what direction the fibres run in the meat and cut the meat into steaks with one fluid motion. All meat

used for a specific quality test should be of the same thickness as it is important in relation to water holding capacity and colour measurements. Meat thickness should not be a variable within a study. If all quality tests are to be performed, cut a minimum of two steaks from each muscle that is being evaluated.

The following timelines for measurements are recommended for broiler and pork in **Figure 5A** and **Figure 5B**, respectively.

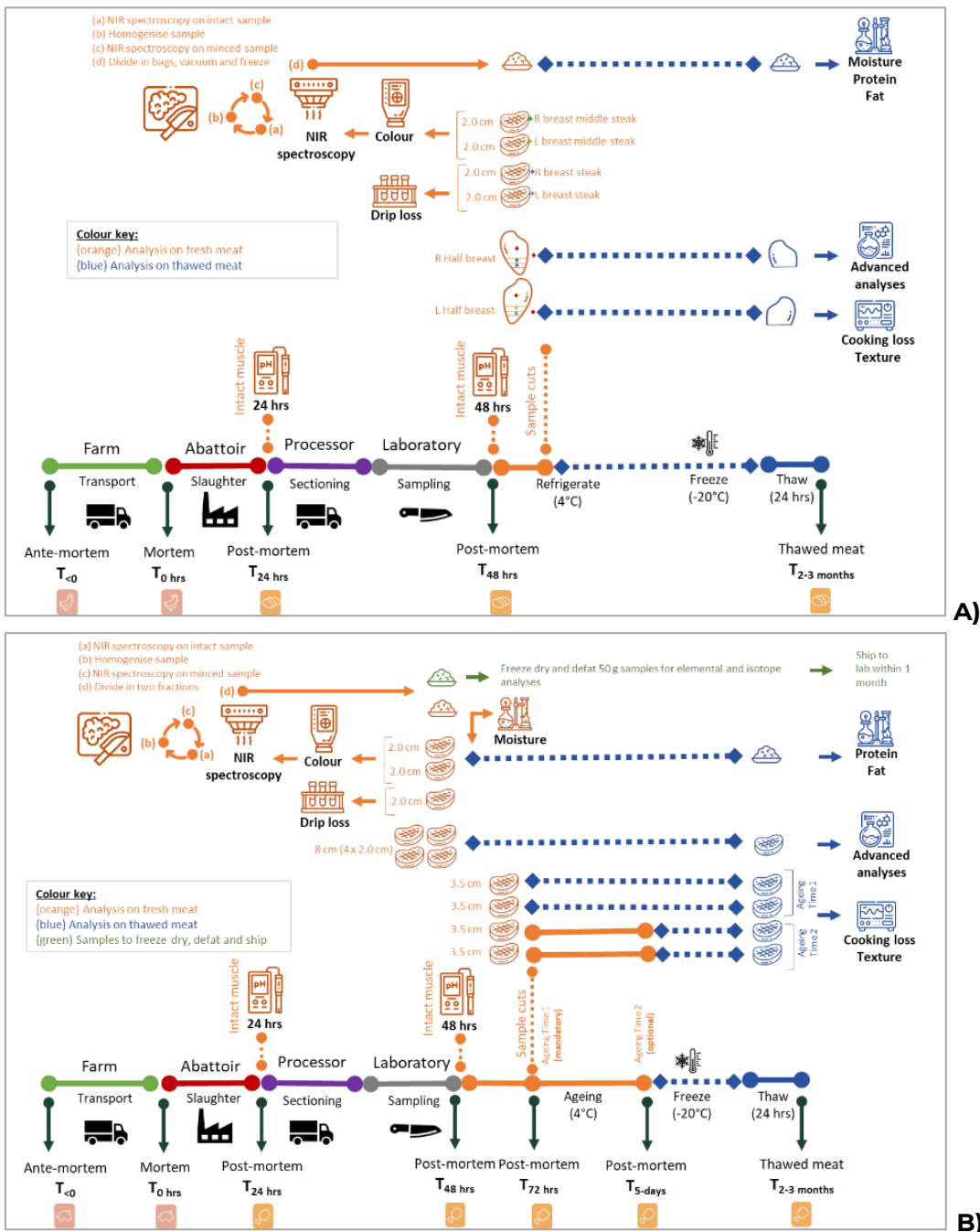


Figure 5. The timeline for meat samples measurements for **A)** broiler and **B)** pork.

3. Data to include as starting point

The *mEATquality* project explores how the data submitted to the project's 'Data Warehouse' can be included in a EU Meat Database for authentication purposes.

The vision is that by starting this initial basic outline (with the authentic sample data from the *mEATquality* project), scientists and researchers (and other relevant stakeholders) will help further expand and develop the database so that it can reach the ultimate aim of serving as a reference to assist competent authorities and relevant stakeholders to verify product provenance, detect mislabelled products and identify different types of meat fraud.

The summary of the data included in this first outline of the EU Meat Database is shown in **Table 3**. The database contains elemental composition of pork samples, stable isotope ratios of pork and broiler samples, proteomics profiles of broiler samples, physicochemical properties of all pork and broiler samples. The related data can be downloaded and used via the link provided.

It is envisioned that the database will be hosted by a suitable community of practice such as the EFF-CoP (European Food Fraud Community of Practice, <https://www.eff-cop.eu/>) which has a central hub (<https://hub.eff-cop.eu/>) where members gain access to different resources. The idea is that we provide the outline for the EU Meat Database with the first entries being for broiler and pork. Users will be encouraged to use the data by comparing with their own results or to expand the database by sharing access to data.

Table 3. Summary of data to include in the first version of the EU Meat Database.

Work package (WP) number	Data (number of samples, n)	Description of the data	Open access link to data
Broilers			
WP2	Animal information (n = 770)	Core qualitative metadata on the production systems (organic, conventional, higher welfare, etc.) and conditions, diet/feed, genetic broiler lines, sex, age class, transportation details, slaughter conditions, muscle cut/type, time/conditions before analyses	<i>mEATquality</i> Data Warehouse
WP3	Stable isotope ratios (n = 192)	$\delta^{18}\text{O}$, $\delta^2\text{H}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$, $\delta^{34}\text{S}$	Made available when paper is published
WP3	Proteomics profiles (n = 78)	Differentially expressed proteins where representative birds per pen (at least one per pen) were selected	https://doi.org/10.1038/s41538-025-00530-8 https://www.ebi.ac.uk/pride/archive/projects/PXD066390 https://doi.org/10.1016/j.foodchem.2026.148964 https://www.ebi.ac.uk/pride/archive/projects/PXD069586
WP3	Physicochemical properties (n = 770)	pH, drip loss, colour (L*, a*, b*), moisture, protein, fat, cooking loss, texture (shear force), fatty acids	<i>mEATquality</i> Data Warehouse
Pork			
WP1	Animal information (n = 1101)	Core qualitative metadata on the production systems ((organic, conventional, free-range, etc.) and conditions, diet/feed, breeds, sex, age class, transportation details, slaughter conditions, muscle cut/type, time before/conditions analyses	<i>mEATquality</i> Data Warehouse
WP3	Elemental composition (n = 612)	K, P, Na, Mg, Ca, Zn, Fe, Cu, Se, Mn, Cr, Mo, Ni, Co, Rb, Sr, Ba, Cs, Pb, Ag, Li, As, Cd, V, Tl, Ga, U	https://doi.org/10.6084/m9.figshare.31410264
WP3	Stable isotope ratios (n = 612)	$\delta^{18}\text{O}$; $\delta^2\text{H}$; $\delta^{13}\text{C}$; $\delta^{15}\text{N}$; $\delta^{34}\text{S}$	https://doi.org/10.6084/m9.figshare.31410264
WP3	Physicochemical properties (n = 1101)	pH, drip loss, colour (L*, a*, b*), moisture, protein, fat, cooking loss, texture (shear force), fatty acids	<i>mEATquality</i> Data Warehouse

Annex. 1. Supporting documents from the project

Provided as: EU Meat Database_Supporting documents.accdb

1. Documents provided separately as guidance: Data to collect forms

Data to collect - farm to processor (Broiler).docx

Data to collect - farm to processor (Pork).docx

Data to collect - laboratory (Broiler).docx

Data to collect - laboratory (Pork).docx

2. Documents provided separately as guidance: Meat quality SOPs (Word docs)

ST3.1.2 Meat quality SOPs_Basic_V9.0.docx

ST3.1.2 Meat quality SOPs_pH.docx

ST3.1.2 Meat quality SOPs_Drip loss.docx

ST3.1.2 Meat quality SOPs_Colour.docx

ST3.1.2 Meat quality SOPs_Cooking loss.docx

ST3.1.2 Meat quality SOPs_Texture.docx

ST3.1.2 Meat quality SOPs_Moisture.docx

ST3.1.2 Meat quality SOPs_Protein.docx

ST3.1.2 Meat quality SOPs_Fat.docx

ST3.1.2 Meat quality SOPs_NIR spectroscopy.docx

ST3.1.2 Meat quality SOPs_Fatty acids.docx

ST3.3.2 Meat quality SOPs_Isotopic and elemental profiling

3. Documents provided separately as guidance: Meat quality SOPs (Ppts docs)

ST3.1.2 Meat quality_SOPs_Method manager framework.pptx

ST3.1.2 Meat quality_SOPs_Sampling.pptx

ST3.1.2 Meat quality SOPs_Cutting the samples.pptx

ST3.1.2 Meat quality SOPs_Sample measurements for methods.pptx

ST3.1.2 Meat quality SOPs_Timeline for measurements_Broiler.pptx

ST3.1.2 Meat quality SOPs_Timeline for measurements_Pork.pptx

4. Documents provided separately as guidance: Excel sheet used for Data Warehouse

WP3_ID CODES laboratory analysis_v1.5_with_example

Document information

Document history			
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V1	13-11-2025	First written version compiled	Sara Erasmus (WP3 leader, WU)
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