Honey - the context

What is honey?

Honey is tightly defined under a 2001 European Directive, implemented in each of the member states, which defines honey as:

“the natural sweet substance produced by Apis mellifera bees from the nectar of plants or from secretions of living parts of plants or excretions of plant-sucking insects on the living parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in honeycombs to ripen and mature”.

Internationally, the Codex Alimentarius Honey Standard has a wider coverage than the EU directive. Rather than exclusively covering honey from Apis Mellifera (European honeybee), it applies to all honeys produced by honeybees and covers all styles of honey presentation offered for direct consumption.

It establishes requirements for naming and labelling of honey, limits for essential composition and quality factors, requirements for hygiene, additives and contaminants, and provides methods of analysis for the determination of the compositional and quality factors

How is honey regulated in England?

The Honey (England) Regulations 2015 provide the basis for the marketing of honey to consumers. The key aims are to:

- protect the use of the reserved description ‘honey’ by setting a minimum expected compositional standard for our market
- instil consumer confidence in UK that the honey is what it says it is
- create a level playing field for industry and fair trading
- prevent misleading or fraudulent practices on our market

The 2015 Honey England Regulations cover honey from the Apis mellifera (European honey bee) and lay down reserved descriptions that must be used which relate to:

- the source from which the honey is obtained (for example, blossom, honeydew)
- the processes by which it is extracted (for example, drained, extracted)
- the way it is presented (for example, comb, chunk honey, filtered honey, baker’s honey)

Honey must comply with set specifications. There are a range of general quality criteria for honey focused around its colour, consistency, flavour and aroma. No additions are permitted. No pollen or constituent particular to honey may be removed except where this is unavoidable in the removal of foreign inorganic or organic matter. The honey must be free from organic or inorganic matters foreign to its composition. It must not have any foreign tastes or odours, have begun to ferment, have an artificially changed acidity, or have been heated in such a way that the natural enzymes have been either destroyed or significantly inactivated.

As well as the quality criteria above, for honey to be labelled as honey it must comply with a set of specific compositional requirements, including set prescribed levels for:

- sugar content: fructose and glucose content
- moisture content
- water-insoluble content
- electrical conductivity
- free acid (a measure of honey condition deterioration)
- diastase (used as an indicator of honey freshness. It is also a parameter used to determine whether the honey has been extensively heated during processing)
- HMF (HydroxyMethylFurfuraldehyde – used as an indicator of heat and storage changes in honey)

UK regulations are still aligned with EU regulations in terms of limits allowed.

How are honey regulations enforced in England?

Regulation of the honey market is necessary to protect the use of the reserved description ‘honey’ by setting a minimum expected compositional standard and instil consumer confidence in the UK that the honey is what it says it is. It is also necessary to create a level playing field for industry and fair trading, and prevent misleading or fraudulent practices.

The Food Standards Agency (FSA) has oversight for food enforcement policy. Rules are enforced on the ground by local authorities such as trading standards officers and environmental health officers who adopt a risk-based approach on enforcement. The tendency is to take an improvement notice approach with backstop criminal sanctions for failure to comply.

Product of Animal Origin (POAO) imports, which includes honey, are subject to mandatory checks (100% documentary; 15% minimum additional checks) by Port Health Authorities.

While key quality indicators (such as HMF, diastase etc) are set in honey rules, other non-permitted additions such as added sugars are not specifically provided for but are implicit in the rules that “No pollen or constituent particular to honey may be removed except where this is unavoidable in the removal of foreign inorganic or organic matter”.

Example: testing throughout the honey supply chain

Below is the text version of the flowchart that explains the different routes for testing honey through the supply chain:

- Commercial lab database (s)
- Commercial testing lab (commercial certificate of analysis)

Domestic honey producer to:

- The bulk distributor
- The honey packer
- Distributor
- Packager
- Retailer
- Customer

Regulatory checks, UK Port Health Authority

- physical check

- document check
- sample taken

The Retailer can submit a honey sample for testing:

- Domestic honey producer
- Distributor
- Retailer
- Trading Standards (regulatory tests)
- Public Analyst Official laboratory (sample submitted)

Department for Environment, Food and Rural Affairs (Defra): Regulations

Food Standards Agency (FSA): Oversight

Public Analyst Official laboratory has access to the official lab database(s).

Non-domestic, non-nomadic honey:

- Processing factory
- Packaging
- Official testing
- Exporter
- Regulatory checks
- Bulk distributor
- Honey packer
- Packager
- Retailer
- Customer

Manuka from New Zealand:

- Processing factory
- Packaging
- Official testing
- Exporter
- Regulatory checks
- Bulk distributor
- Honey packer
- Packager
- Retailer
- Customer

Nomadic bee keepers in for example, China:

- Collection station
- Exporter
- Regulatory checks
- Bulk distributor
- Honey packer
- Packager
- Retailer
- Customer

Where test results are queried, the government recommends applying a weight of evidence approach. This approach includes gathering information on product traceability – from beehive to jar – and results from any other testing that has been undertaken. This can also involve carrying out follow-up discussions with the relevant business.

Where the honey originates from the UK, there is no requirement for a business to test their honey but it is considered good due diligence and business practice to do so, to ensure the product meets the required standards.

How is honey adulterated?

Honey adulteration can be direct – sugar/syrup added to the honey at some point in the supply chain – or indirect, in the form of deliberate inappropriate bee feeding with sugars when nectar is naturally available. Direct adulteration is thought to be the most common. Other varieties of adulteration are shown in the diagram below.

'Immature' honey, where the honey is removed early from the hive and then the moisture reduced, is a matter of much discussion. It falls foul of the Codex definition.

Direct adulteration of the honey:

- Original mislabelling (organic)
- Botanical origin and mono -v multi-floral
- Geographical including PDO, PGI honeys

Production (organic):

- Cheaper honey (blending) - Organic - Botanical origin and mono-v multi-floral, geographical including PDO, PGI honey.

- Inappropriate filtration
- Resin treatment
- Marker of pollen addition
- Thermal treatment

Production - Contaminants (pesticides, heavy metals, veterinary residues, GMO, toxins), fermentations microbiology).

Substitution - by cheaper similar ingredients (water added)

Indirect adulteration by inappropriate bee finding:

- Sugars and sugar syrups - sugars: sucrose (as is or invert): Cane sugar (C4), Beet sugar (C3). From starches: corn (maize) syrup (C4), rice syrup (C3), high fructose cassava syrup (C3/C4), Chicory syrup (C3), Wheat syrup (C3). Others: high fructose inulin syrup (C3)*, date syrup (C3), Jaggery syrup (mainly C4).
- Inappropriate antibiotic treatment

*Inulin produced from many plants industrially but mainly from chicory.

Honey authenticity: methods available for testing

Analytical techniques to authenticate honey include the following:

1. Classical methods

2. Modern methods

Classical methods:

- **Physiochemical parameters:** pH, sugar content, Proline, Enzymatic activity, moisture content, ash content, diastase activity, free acidity, HMF content.
- **Melissopalynology (microscopy study of pollen grains)**

Modern methods:

- **Chromatographic methods:** HPLC, GC. Sugar profile, Amino acid profile, Phenolic profile, Flavanoid profile.
- **Mass spectrometry:** LC-MS, GC-MS, Stable isotopic ratio. Volatile profile, sugar profile, Phenolic profile, Flavanoid profile.
- **Infrared spectroscopy:** Fourier transform infrared (FTIR), Near infrared (NIR), FT-Raman spectroscopy. Sugar profile, Amino acid profile.
- **Nuclear magnetic resonance (NMR):** 1H NMR, 13 C NMR. Identification of individual compounds (targeted analysis), molecular fingerprint of a sample (non-targeted analysis), combined techinques such as LC-IRMS.
- **Molecular techniques:** SDS-PAGE, Western-Blot, Real-time PCR, DNA sequencing. Protein, DNA.

There are significantly different perspectives on the ways in which testing methods are applied to honey. These relate to different perspectives on how honey should be defined, and also how rules and regulations should be applied as practices.