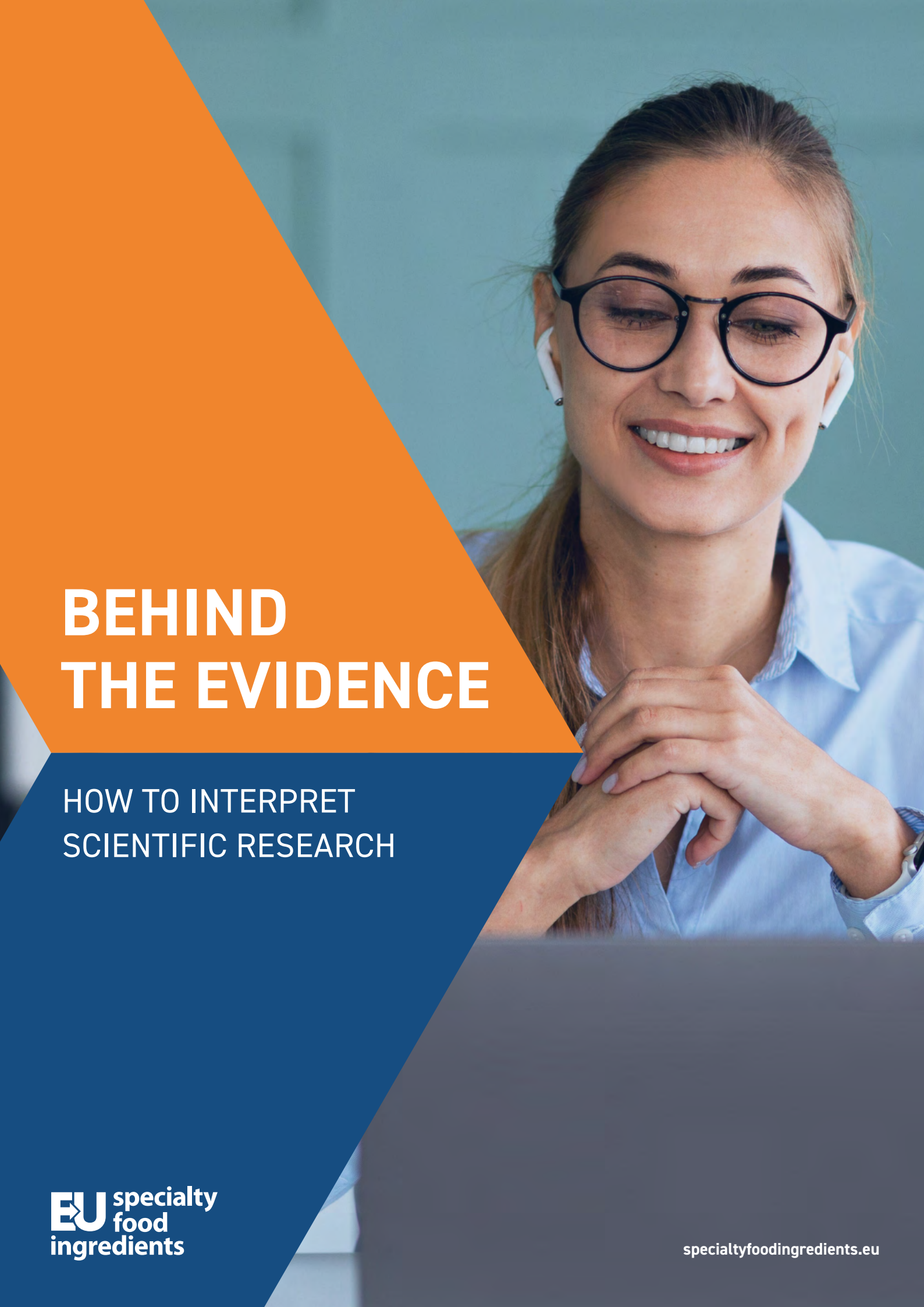




BEHIND THE EVIDENCE

HOW TO INTERPRET
SCIENTIFIC RESEARCH

CONTENT

- 2 [Introduction](#)
- 3 [Grading the Evidence](#)
- 4 [Observational Research](#)
- 6 [Interventional Research](#)
- 8 [Misinterpretations & Misunderstandings](#)
- 10 [How to Read a Scientific Paper Accurately](#)



INTRODUCTION

Just like everything in the world around us, nutrition and food science continue to evolve.

New research findings are published regularly, shedding fresh light and suggesting interesting possibilities that enable consumers to have access to safe, tasty, affordable and sustainably produced food.

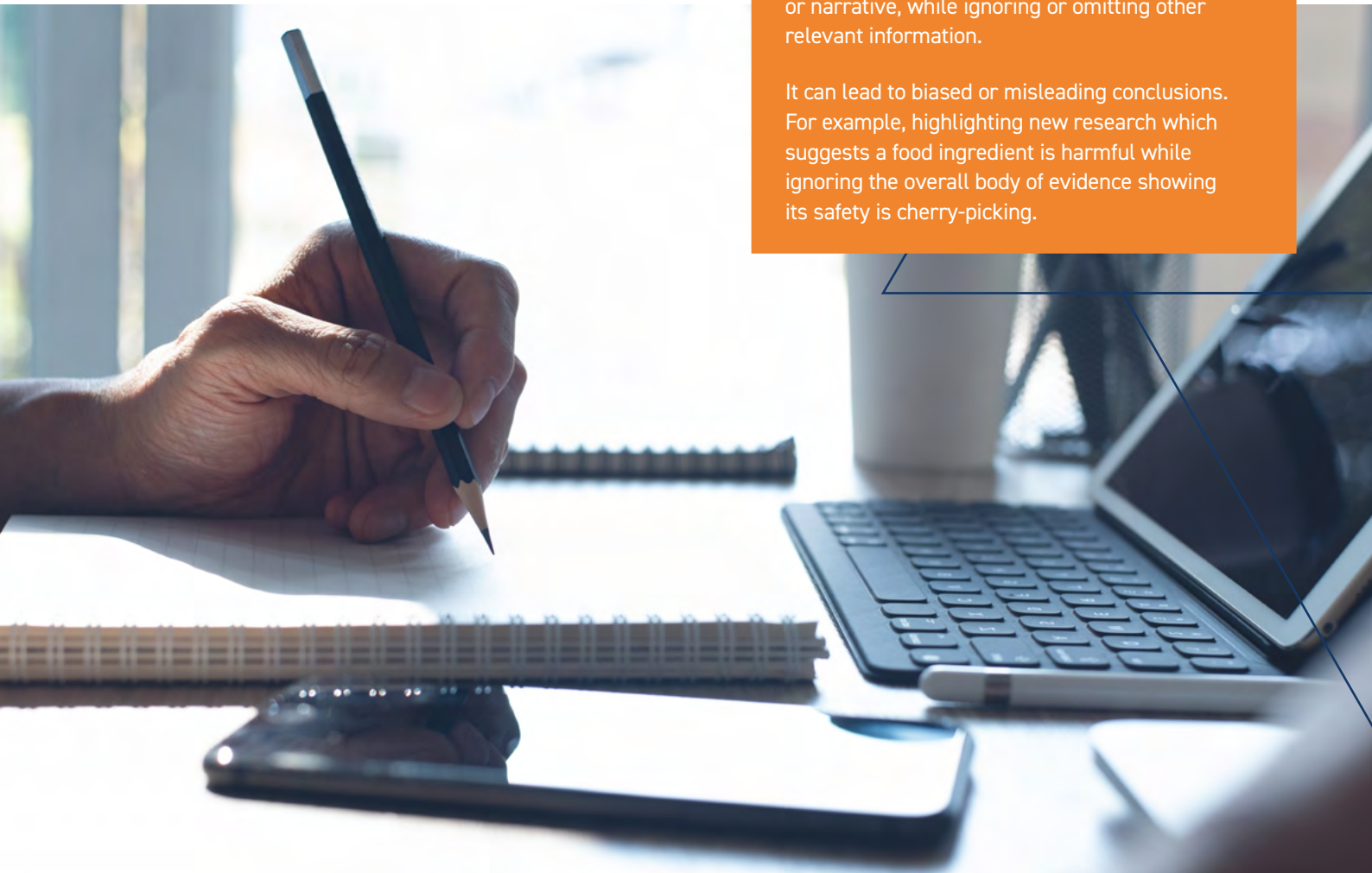
Cherry-picking by mainstream and social media often occurs when new research is published, leading to misinterpretation and unnecessarily alarming consumers. This brochure will help you to avoid the pitfalls of cherry-picking, and gain a better understanding of how to interpret results from scientific research.

- Learn the difference between commonly used research methods and how to interpret them correctly
- Read cautionary examples of how research has been misinterpreted or falsely disseminated, causing needless concern in the past
- Keep a handy checklist as a quick reminder of what to look for when reading new studies or media headlines

WHAT IS CHERRY-PICKING?

Cherry-picking refers to selectively choosing specific data, results, or examples from a piece of research that support a particular argument or narrative, while ignoring or omitting other relevant information.

It can lead to biased or misleading conclusions. For example, highlighting new research which suggests a food ingredient is harmful while ignoring the overall body of evidence showing its safety is cherry-picking.



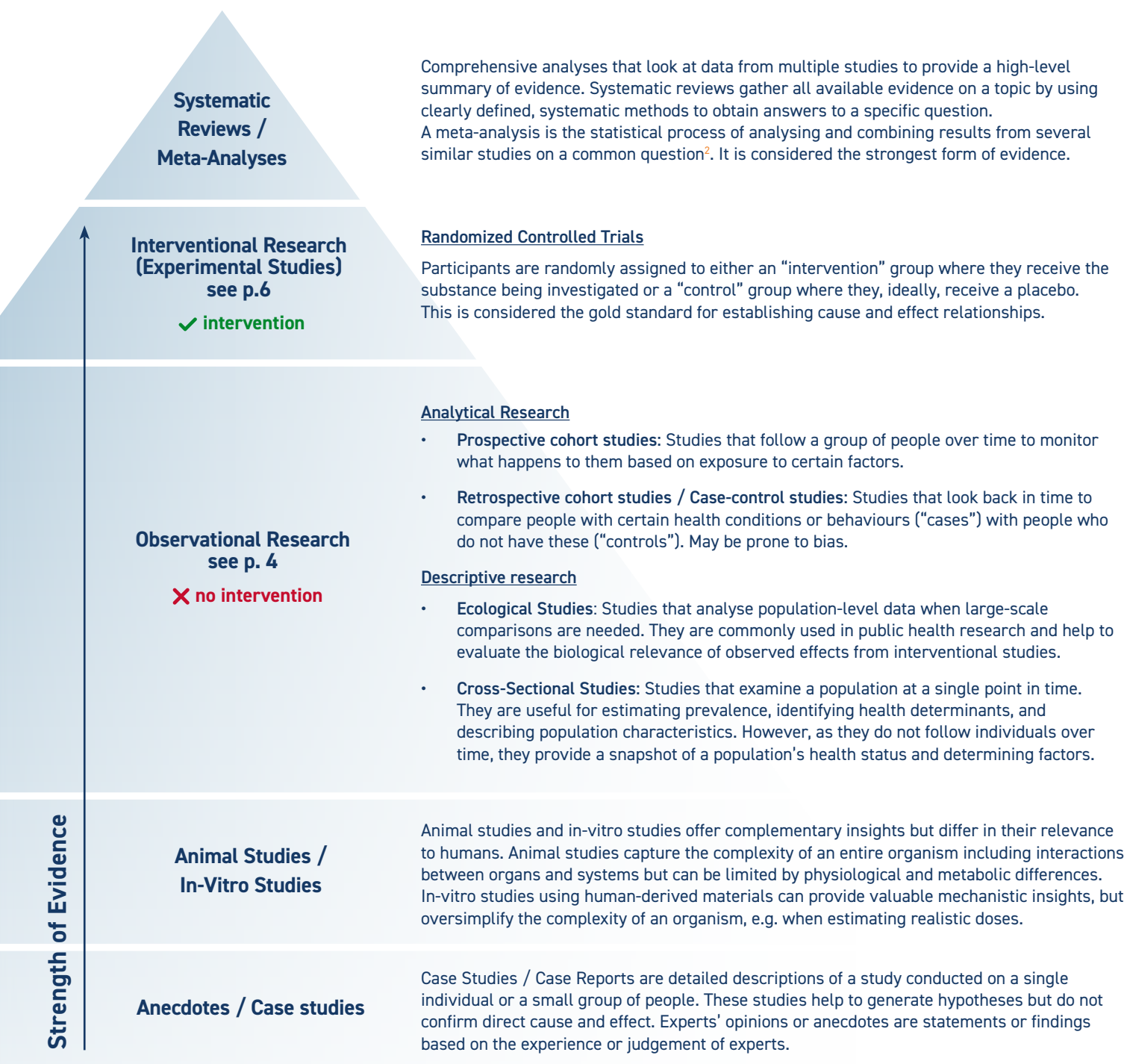
GRADING THE EVIDENCE

Research studies are conducted on food ingredients in a variety of ways¹ — some of which are more reliable than others. So how can we understand the different methodologies and their scientific relevance?

THE HIERARCHY OF EVIDENCE

The hierarchy of evidence helps us to gauge the reliability of scientific research. It can be visualized as a pyramid:

- The higher a method of research is on the pyramid, the stronger and more reliable it is.
- Studies from lower down the pyramid provide useful initial insights but their findings need to be confirmed by higher level studies.



¹ Some of those studies are mandatory requirements for the safety evaluation in some jurisdictions like the European Union.

² Source: Ahn E, Kang H. Introduction to systematic review and meta-analysis. Korean J Anesthesiol. 2018 Apr;71(2):103-112. doi: 10.4097/kjae.2018.71.2.103. Epub 2018 Apr 2. PMID: 29619782; PMCID: PMC5903119.

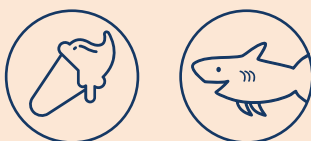
OBSERVATIONAL RESEARCH

Observational research involves the monitoring of a selected group of people for a certain period of time without any researcher intervention. It is useful for identifying associations (“correlations”) between variables and showing what happens when people are exposed to certain factors over time. However, there are some challenges with this kind of research. The results can be affected by biases, which means that the findings might not accurately reflect the actual relationship between what the population is exposed to and the outcomes they experience. For example, some people might not report their habits accurately, which can make it hard to understand how much they were exposed to a certain factor.

While observational studies can reveal patterns and associations between variables, they can't demonstrate direct causality because researchers don't have control over all the other factors that might influence the results.

CORRELATION VS. CAUSALITY: an important difference

Example: Ice cream sales and shark attacks



Research shows that both ice cream consumption and shark attacks increase during the summer. Does this mean that if you eat more ice cream in summer you are more likely to be attacked by a shark? Of course not!

CORRELATION:

There is a correlation (relationship) between the two variables (ice cream sales and shark attacks) because both increase in the summer.



CAUSALITY:

There is no causality because eating ice cream does not cause shark attacks.

This example shows that it is vital to correctly identify direct causal relationships before drawing conclusions about any piece of research. If the research doesn't confirm a direct cause and effect between one thing and another, other variables (“confounders”) are likely to be at play. In this case, summer is the confounder.



WHAT ARE CONFOUNDERS?

Confounders are variables that are not the focus of the research but do have an impact on its outcome. For example, in a study looking at the effect of a food ingredient on heart disease, the age and previous medical history of the study participants are confounding factors that have to be considered before conclusions can be drawn about causality.

PROS AND CONS OF OBSERVATIONAL STUDIES



PROS

- **Identifying Patterns and Risk Factors**
Help to examine associations between what people are exposed to and their health.
- **Assessing Disease Prevalence**
Provide data on the frequency and distribution of diseases within a given population.
- **Hypothesis Generation**
Valuable for generating hypotheses or theories that can later be tested in clinical trials.
- **Cost-Effectiveness**
Can be less expensive than other types of studies.
- **Rare Outcomes / Long-Term Effects**
Useful for helping scientists to study rare diseases and the long-term effects of exposure to different variables.



CONS

- **Cannot Establish Causality**
Can identify associations but cannot prove causality because there is no control over confounding variables.
- **Susceptibility to Bias**
Prone to bias (e.g., the way people are selected for the studies, how they are recalled and what questions they are asked).
- **Data Quality Issues**
Heavy reliance on self-reported data from participants, which may not always be accurate or complete, or gathered using methods which are not gold standard.
- **Temporal Ambiguity**
It is not always clear whether the exposure precedes the outcome or vice versa.
- **Reverse Causation**
The "effect" of something could actually be its cause (e.g. depression could lead to a high BMI, but a high BMI could also lead to depression).



INTERVENTIONAL RESEARCH

In interventional studies, researchers actively introduce a specific intervention (e.g., food ingredient or dietary change) and then monitor its effects on a predefined outcome (e.g., blood pressure or energy levels).

Depending on the protocol adopted, interventional research can be:

- **Randomised:** Participants are randomly divided into groups.
- **Controlled:** There is a “control” group that does not receive the intervention but, ideally, a placebo; a substance designed to look, taste, and feel the same as the intervention but with no active ingredients.
- **Single-blind:** The people in the study do not know which group they are in (intervention or control).
- **Double-blind:** Neither the research team nor the people in the study know who is in which group.

The highest level of reliability is generally associated with randomised controlled trials (RCTs) conducted in a double-blind manner.

STUDY SIZE AND TIMING IS CRUCIAL



STUDY POPULATION SIZE

Study size is an important factor, but it should be scientifically and ethically justified. A well-designed study recruits enough participants to detect a meaningful effect, but not more than necessary. Over-recruitment can unnecessarily expose people to research risks and does not improve the quality of evidence beyond a certain point.



STUDY PERIOD

The appropriate duration of an intervention study depends on the outcome being measured. Some effects (such as postprandial blood glucose responses) can be captured within hours in acute studies, while others (like changes in HbA1c, cholesterol levels, or body composition) require sustained intake over weeks or months. Study duration must be aligned with the physiological timeframe needed for the investigated parameter to respond meaningfully.

CLINICAL RELEVANCE VS. STATISTICAL SIGNIFICANCE

CLINICAL RELEVANCE:

It refers to the real-world impact of the findings. It is used to guide decisions about public health.



STATISTICAL SIGNIFICANCE:

It is used to assess the reliability of research findings, and whether they have happened by chance or were caused by the intervention (e.g., food ingredient) being studied.

NB:

A result can be statistically significant but not scientifically relevant. Conversely, a result can be scientifically relevant but not statistically significant.

PROS AND CONS OF INTERVENTION STUDIES

+ PROS

- **Establishing Causality**
Intervention studies, especially randomized controlled trials, allow researchers to determine whether a particular intervention (e.g., food ingredient) directly causes a specific outcome.
- **Control Over Variables**
Researchers can standardise and control conditions to minimise confounding variables.
- **Randomisation and Blinding**
Randomisation ensures balanced groups and prevents researchers from consciously or subconsciously placing people into certain groups. Blinding minimises the placebo effect and enhances objectivity.
- **Direct Measurement of Effectiveness**
Allows for clear assessment of intervention outcomes.
- **Advancing Personalisation**
Help to identify subgroups of people who may benefit most from specific food types or nutritional ingredients.

- CONS

- **Cost and Time Intensive**
Randomized controlled trials in particular require significant resources and time to design, implement and analyse.
- **Limited Generalisability**
Results may not fully apply to real-world settings due to strict controls and study participants who are unrepresentative of the general population.
- **Participant Dropout**
Long or demanding trials can result in people dropping out, potentially introducing what is known as attrition bias (i.e., participants who remain may share characteristics the ones who left did not have, such as being of a particular age or gender).

SUMMARY: OBSERVATION VS. INTERVENTION

Observational studies and intervention studies are different but they complement each other. Observational studies identify potential risks and associations, formulating an hypothesis to explore, while intervention studies put these potential risks and associations to the test under controlled conditions with the aim of proving – or disproving – a direct cause and effect. Moreover, data from observational studies can be used to judge the biological relevance of findings from intervention studies.

GOLD STANDARD: META-ANALYSIS AND SYSTEMATIC REVIEW

Meta-analyses and systematic reviews are a powerful tool in scientific research that combines the results of multiple studies to provide a more comprehensive and reliable understanding of a specific question. A systematic review follows a structured process to identify, evaluate, and synthesize all relevant studies on a topic, minimizing bias. When performed, a meta-analysis uses statistical methods to pool data from studies on a common question, increasing the overall power and precision of the conclusions. These reviews sit at the top of the evidence hierarchy and are especially useful for identifying patterns, resolving uncertainties, and guiding evidence-based decisions.

MISINTERPRETATIONS & MISUNDERSTANDINGS

The following examples show how scientific research data can be misinterpreted in the media and even deliberately faked.

IS ASPARTAME CARCINOGENIC?

Aspartame (E 951) is a low-calorie sweetener that is widely used in products such as diet soft drinks, chewing gums and yoghurt.

In 2023, the International Agency for Research on Cancer (IARC) — a research body part of WHO, not a food safety authority — classified aspartame as “possibly carcinogenic”, based on limited, inconclusive evidence. The international body evaluating the safety of food additives, JECFA (the joint WHO/FAO Expert Committee on Food Additives), in its concurrent safety assessment examined IARC’s conclusions and found that aspartame posed no concern for human health at its acceptable daily intake (40 mg/kg body weight per day).



MEDIA MISINTERPRETATION

Many media reports at the time suggested aspartame was carcinogenic without clarifying the difference between “hazard”, reviewed by IARC, and “risk” properly assessed by JECFA, nor explaining that the IARC statement was based on limited evidence. They also failed to mention that JECFA believed the IARC’s evidence was unconvincing.



HAZARD VS. RISK: AN IMPORTANT DIFFERENCE

HAZARD:

Something that has the potential to harm people.



RISK:

the likelihood of a hazard causing harm.

A couple of simple examples illustrate the difference between the two:

1. A shark is a hazard, but the risk of being bitten by one in a bathtub is zero. This hazard therefore poses no risk.
2. When you cross a road, the cars on the road are a hazard. If you cross the road and look at your phone, your risk of being hit by a car is higher than if you were paying attention to the traffic. So the risk is there, but there are steps you can take to minimise it.

CAN EATING CHOCOLATE AID WEIGHT LOSS?

In 2015, science journalist John Bohannon conducted a deliberately flawed study claiming that chocolate aids weight loss. Despite its poor design, the study was published in a predatory journal and widely disseminated by media outlets, showcasing how p-hacking (see below) can mislead the public. This experiment highlighted the ease with which dubious science can be disseminated, and underlined the importance of critical evaluation in health journalism.



MEDIA MISINTERPRETATION

You can read Bohannon's article: "I fooled millions into thinking chocolate helps weight loss" online at gizmodo.com.

APPS AND INFLUENCERS

Social media influencers and health app developers sometimes lack the expertise required to interpret scientific studies properly, yet are presented to the public as authoritative sources.

Some influencers disseminate information or engage in cherry-picking without any nutrition science expertise or scientific context for what they say.

Apps may rate a product poorly because it contains certain ingredients, such as additives, without considering the fact that these have been approved as safe to consume at given levels. This can mislead consumers into thinking these ingredients are unsafe, which is not true.



WHAT IS P-HACKING?

P-hacking, also known as data dredging or data snooping, is the manipulation of data or selective reporting of results.

Researchers may — consciously or subconsciously — tweak the way they conduct their studies in order to obtain the results they are hoping for. They may, for instance, add or remove confounders to influence the outcome, or they may modify the way they analyse the data. Whatever methods are used, p-hacking produces findings that are unreliable and misleading.

Repeating research that has been p-hacked can have far-reaching negative consequences for scientific understanding, as well as for consumers and even future research.

HOW TO READ A SCIENTIFIC PAPER ACCURATELY

Keep this handy checklist as a quick reminder of what to look for when interpreting research studies or reading media headlines about science and food ingredients.

- ☐ What type of study design was used?
- ☐ How big was the study population?
- ☐ How were participants selected (representative of the target group of interest)?
- ☐ How were the participants allocated (randomly or targeted)?
- ☐ Did the intervention have an appropriate duration?
- ☐ Did the study adjust for possible confounding variables?
- ☐ Did it have a control group?
- ☐ Are the results of biological relevance?
- ☐ Are the results correlation or direct causation?
- ☐ Are there potential biases?
- ☐ Was the study published in a peer-reviewed scientific journal?
- ☐ What does the overall body of evidence about this particular ingredient show?

A SAFE REMINDER

Food safety in the EU is managed through a comprehensive regulatory framework designed to ensure the safety and quality of food products. The European Food Safety Authority (EFSA) makes sure that specialty food ingredients subject to a pre-market authorisation are thoroughly checked for safety before they can be used in the food and drinks you can find on the retail shelf.

IN SUMMARY

Reporters and influencers play a key role in helping the public to explore the world around them, to enjoy new nutritional possibilities and to stay safe and healthy. But when reporting on scientific studies, it is essential to be sure that results are interpreted properly, and to avoid making misleading or sensationalized claims.



Science evolves, but its foundation remains the rigorous examination of evidence.

FOR MORE INFORMATION

- [Q&A about specialty food ingredients](#)
- EU Specialty Food Ingredients, [Specialty Food Ingredients: Additives in the safety spotlight](#)
- IFIC, [Understanding & Interpreting Food & Health Scientific Studies: Guidance For Food & Nutrition Communicators](#)
- EUFIC, [How to spot fake nutrition information online](#)

WHO ARE WE?

This handbook has been written and produced by EU Specialty Food Ingredients, the not for profit federation representing the specialty food ingredients industry across the EU. We are committed to science and knowledge sharing, and developing understanding of the benefits that specialty food ingredients can bring today and tomorrow.



The document is designed to provide insights about how to interpret scientific research. As such this document is not, and should not be construed as a guarantee or warranty, nor a part of any contractual or other legal obligations on behalf of EU Specialty Food Ingredients and its member companies. This information is offered solely for the consideration, investigation and verification of interested parties.