ADAPT
Health Coach

Guide to Scientific Evidence

Be Your Own Fact-Checker

WHAT IS SCIENTIFIC EVIDENCE?

Scientific evidence is data gathered from scientific research to either support or refute a scientific theory or hypothesis. The data are expected to be factual, unbiased, and interpreted following standardized scientific methods.

Many of us use scientific research studies to make informed decisions, guide important health considerations, and check facts touted by experts. Experts such as public health officials and medical providers use scientific data to predict outcomes, limit harm, benefit people, and make sound recommendations.

So all published scientific studies provide facts, right?

All scientific research is not created equal. Here are some tips to help you learn to make judgments about the quality and strength of scientific evidence so you can feel more confident about the scientific information you are reading. The fact is, there are no perfect scientific studies, but there are validated systems to help us determine the best sources of information (1, 2, 3).

The quality of scientific research is based on many factors that may include:

- Study design such as observational studies or randomized controlled trials (RCTs)
- Study quality, which refers to the detailed study methods and execution
- Consistency, which refers to the strength of the findings to be reproduced when repeated by different researchers
- Directness, which pertains to the ability of the findings to be applied to only specific populations such as older adults or certain genders or broader populations
- Whether or not the study is published and how reputable the journal is if it is published; the impact factor of a journal is a measure of the frequency with which the average article in a journal has been cited in a year; the impact factor is one way to assess the reputability of a journal, with higher-ranked journals having a higher impact factor
- Source of funding, which should be evaluated as some bias can exist if the researchers are directly tied to the source of funding such as a drug company selling a drug that funds a trial or a nutritional study funded by a company with a financial interest in the outcome

WHAT IS *NOT* SCIENTIFIC EVIDENCE?

Often, we have an emotional response to the information we hear. We can be heavily influenced by the landslide of information we receive on a daily basis. Also, human nature tends to aim to find supporting evidence for what we believe, without being willing to also investigate opposing arguments and facts. The beauty of science is that it encourages us to challenge theories, ideas, and hypotheses. Some scientific "evidence" can even be disproven with future information and research. Furthermore, our easy access to information via the news networks, web, and social media often leads us to accept whatever we hear or read. At the Kresser Institute, we encourage you to be willing to explore information and think critically about what you hear and read.

A presentation by the Institute of Coaching shared this informative list guiding us in being more discerning as to what is **not** considered scientific evidence or fact. (4) Please check out this list, and then read on to learn how you can use search engines to review scientific studies from a more discerning vantage point:

- Googling a few terms and reading the top hits
- Drawing conclusions from Wikipedia, Facebook, Twitter, or other social media sites (without a research design)
- Reading trade articles and echoing the "takeaways"
- Summarizing a book someone else wrote
- Writing your opinion in an article or blog
- Drawing conclusions based on personal experience (without a research design)

HOW IS SCIENTIFIC EVIDENCE GRADED?

Regulators have decided on the following grading levels after assessing research studies based on the above factors.

Studies can be graded as:

- Grade A - strong evidence: further research is unlikely to change confidence in the predicted outcome
- Grade B - moderate evidence: further research is likely to change confidence and may change the predicted outcome
- Grade C - weak evidence: further research is very likely to change confidence and will likely change the predicted outcome
- Grade D - very weak evidence: any estimate of effect is very uncertain
- Ungraded - no evidence such as stated opinions

Summarizing Grades of Scientific Evidence with Examples

Evidence Type	Level/Grade of Evidence	Comments
Systematic reviews of multiple, high-quality RTCs	Grade A	Be aware that reviewers might cherry-pick only certain trials in reviews and leave out trials that do not fit their hypothesis
Randomized double-blind controlled trials	Grade B	If repeated with very consistent results over multiple trials, then they may be upgraded to strong evidence
Non-randomized controlled trials	Grade C	A trial where participants are not assigned by chance to different treatment groups, or may choose their group or are assigned by the researched (not blinded)
Observational/ epidemiological studies with a relative risk (RR) of >2	Grade C	An example is a high-quality prospective cohort study or with a very large population with consistent findings across studies
Observational/ epidemiological studies with an RR of <2	Grade D	A RR of <2 often results in a correlation that is misleading or even false and causes confusion
Observational/ epidemiological studies with an RR of >2	Grade C	A RR of >2 in high-quality prospective cohort studies or in a very large population sample
Observational/ epidemiological studies with an RR of >5	Grade B	Evidence found in several high-quality studies with no other obvious explanation such as smoking and lung cancer
Consistent clinical experience	Grade C	Seen with several experienced practitioners and when no RTCs contradict the finding

Evidence Type	Level/Grade of Evidence	Comments
Case reports and anecdotes	Grade D	Not used as evidence unless there is a lack of higher-quality evidence available. This may include success stories, but can still add value, even though it is very weak evidence
Animal studies	Grade D	If no human studies exist and it is the only evidence available, it may be considered evidence
Cell culture	Grade D	Cell culture studies can be used as a starting point for further research, but cannot be cited as evidence
Opinions of world or health leaders	No evidence	Opinions are not evidence, no matter who has the opinion. To be evidence-based, an opinion must be supported with scientific evidence

Additional factors that can impact evidence:

- **Evolutionary considerations** where consistency with what is evolutionary probably can strengthen evidence and inconsistency can weaken evidence. An example is that humans have been eating saturated fat for millions of years, so it is unlikely that it has a negative impact on health. Alternatively, high sugar consumption is new to the human race and may have negative implications due to low ability to adapt in such a short amount of time. This idea is considered context rather than scientific evidence.
- **Grades C and D (weak or very weak evidence) are considered beneficial for future studies.** These types of evidence are usually the catalyst to build on with ideas and observations that scientists can use to create formal hypotheses and then formal scientific studies in the future—they are considered the birthplace of scientific studies, and our evidence would be very limited without these initial steps.

HOW CAN I REVIEW SCIENTIFIC STUDIES?

Here are some tips to help you look up topics that have been researched by scientists. We encourage you to be an investigator, especially when you hear advice from health practitioners, political leaders, well-intentioned friends and family members, or even social media posts that you are uncertain about. We all have a right, and possibly a responsibility, to be as informed as possible.

Use a web search engine that provides access to a wide variety of scientific journals such as Google Scholar or PubMed. See the reference links for tips on searching both of these sites (5, 6):

- **https://scholar.google.com/**
- **https://pubmed.ncbi.nlm.nih.gov/**

Both of the sites above provide search options to allow you to type in keywords. Here are some additional tips to help you with your searching:

- Choose keywords instead of complete sentences. Use nouns and then the terms "AND" and "OR." Example 1: covid-19 AND vitamin D. Example 2: anxiety OR low carb diet AND sleep.
- Once you have a list to review, look beyond the first page of articles.
- Use any filter available (for example, at PubMed, choose certain dates or authors to limit your search).
- Many articles will have a citation button to create a citation for you.
- Some articles will only list an abstract. The full article might require payment. If an article is really interesting to you and you want to fully understand it, get the full article instead of relying only on the abstract or look for another article or study with similar findings that is free. Full text is a filter option at PubMed.
- Use the reference list for articles that speak to you to look for additional similar topics.
- Google Scholar allows you to search by date easily.
- Both sites can link to libraries that might be able to provide you with access to articles that are not free.
- Be willing to tuck in and spend some time looking for scientific articles, the type of study, and who funded the study, and enjoy expanding your knowledge base.

Additionally, Chris shares on the topic of scientific evidence, so be sure to check out these links:

- **https://chriskresser.com/a-beginners-guide-to-scientific-research/**
- **https://chriskresser.com/how-to-read-and-understand-scientific-research/**
- **https://chriskresser.com/why-you-should-be-skeptical-of-the-latest-nutrition-headlines-part-1/**

Examples of reliable Evidence-Based Information:

Books:

- *The Paleo Cure* by Chris Kresser
- *The Disease Delusion* by Dr. Jeffrey Bland
- *Eat Fat, Get Thin* by Dr. Mark Hyman
- *The Paleo Approach* by Sarah Ballantyne

Websites:

- Chris Kresser: **https://chriskresser.com/**
- Chris Masterjohn: **https://chrismasterjohnphd.com/**
- Linus Pauling Institute - Oregon State University: PDF with micronutrients functions and sources, not exclusively Paleo: **https://lpi.oregonstate.edu/sites/lpi.oregonstate.edu/files/pdf/mic/micronutrients_for_health_revised_2020.pdf**

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2. Gerstein HC, McMurray J, Holman RR. Real-world studies no substitute for RCTs in establishing efficacy. *Lancet*. 2019;393(10168):210-211. doi: 10.1016/s0140-6736(18)32840-x.
3. Trepanowski JF, Ioannidis JPA. Perspective: limiting dependence on nonrandomized studies and improving randomized trials in human nutrition research: why and how. *Adv Nutr*. 2018;9(4):367-377. doi: 10.1093/advances/nmy014.
4. Ensign T. "Coaching with Science in Mind: How to Bring Evidence-based Research into Your Practice" presentation, November 2020. Institute of Coaching. https://www.instituteofcoaching.org/resources/coaching-science-mind-how-bring-evidence-based-research-your-practice#l.
5. Google Scholar. Search tips. https://scholar.google.com/intl/en/scholar/help.html
6. Johns Hopkins University & Medicine. Welch Medical Library. https://browse.welch.jhmi.edu/searching/pubmed-search-tips