Dietary supplement quality:

Research, procedures, and certifications

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An introduction to dietary supplement quality

The term "quality" is tossed around so much that it has almost lost its meaning. And yet, when it comes to purchasing and recommending dietary supplements, there is nothing more important than quality. But what constitutes a high-quality product? As it turns out, discerning quality is a complex, multi-layered process that requires detailed information about every aspect of the dietary supplement supply chain. Fortunately, there are rules and guidelines in place to make sure that dietary supplements are manufactured properly, labelled clearly, and safe for human consumption.

A great place to start the quality conversation is by looking at why quality is important to you, your practice, and your patients. While this may seem obvious, it's worth asking yourself this question and then making the answer a key tenet of your clinic.

For naturopathic oncologist Tina Kaczor, ND, FABNO, quality dietary supplements help inform her about the efficacy of her clinical protocols. "For example, if I use L-theanine for a patient who is having difficulty focusing, I expect the patient to have improved concentration," she explains. "And if the patient uses a lesser quality L-theanine brand, I won't know if the problem is with the inferior product or if I should recommend a different intervention." Quality helps Dr. Kaczor determine what's working and what's not, so she can achieve the best possible health outcomes for her patients, which is a key tenet of her clinical practice.

Integrative family physician Jeffrey Gladd, MD, agrees that efficacy is key and utilizing high-quality products can lead to much better outcomes. "I've had many patients who are not feeling well and when I switch their dietary supplements to the high-quality brands, they immediately feel better," he says. Both he and Dr. Kaczor feel that utilizing lower quality products can lead to poor outcomes but it may also negatively impact the patient's health.

"When I recommend a high-quality brand, I feel more confident that my patients will get the expected benefits and the potential for side effects or reactions will be minimized," said Dr. Gladd.

It's clear that efficacy and safety are two key drivers when it comes to focusing on quality dietary supplement products. The next step is to clearly communicate this to patients.

Doctor as teacher

The practitioner's role is to not only choose and recommend high-quality dietary supplements, it's also to educate patients about quality. One of the principles of naturopathic medicine is

the concept of docere, the Latin word that means "to teach." [2] The integrative physician puts this concept into action by educating patients, not only about making healthy diet and lifestyle choices, but also about choosing quality products.

"Especially when cost comes up, I explain to my patients that there are multiple ways that companies control the quality of their products and it costs money to employ these critical quality measures," explains Dr. Kaczor. "I talk to my patients about certification, testing, and other quality aspects so they understand why it's important to use dietary supplements from reputable manufacturers."

The pitfalls of third-party purchases

Typically, a discussion about quality dietary supplements may also bring up the issue of online third-party sellers, where cost can be a factor. Both Dr. Kaczor and Dr. Gladd offer significant discounts to patients to encourage them to utilize the higher quality brands and discourage them from third-party purchasing.

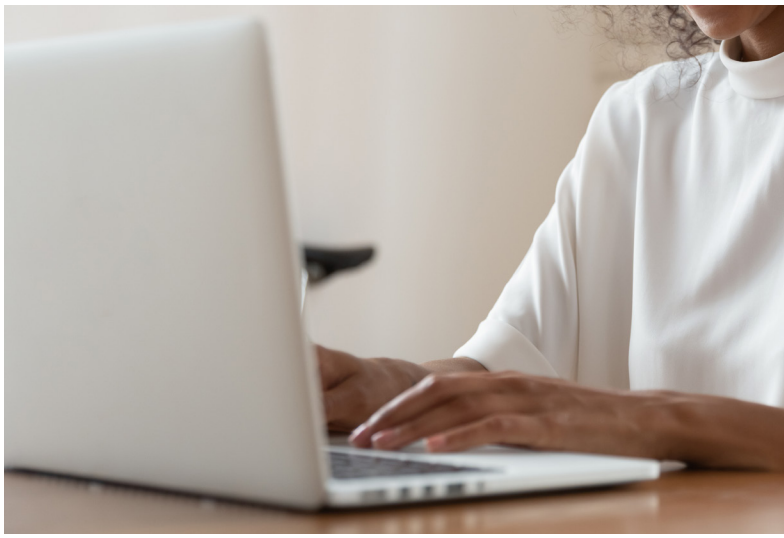
Several quality issues can arise when patients buy dietary supplements from third-party sellers such as Amazon and eBay including:

- The patient doesn't know the company making the product or how the product was manufactured, stored, etc.
- Expired products can be sold because of lack of oversight.
- Products may not be warehoused properly (e.g. probiotics needing refrigeration).
- Products could actually be counterfeit.[13]

"Because of significant quality concerns, buying dietary supplements from Amazon is a scary proposition for patients," says Dr. Gladd.

Integrative medicine expert and host of the podcast Intelligent Medicine, Ronald Hoffman, MD, concurs. "As big as Amazon is, they don't vet the quality of these dietary supplements or have any organized medical oversight of the supplement products they are selling," Dr. Hoffman explained on a recent podcast with Dr. Gladd.

One way that healthcare practitioners can help ensure they are purchasing a high-quality product is by interacting directly with the manufacturer. That's another quality aspect that's missing when purchases are made through a third-party seller—no direct interaction with the manufacturer.



Buyer beware

Dr. Kaczor illustrates the importance of being diligent when buying and recommending even high-quality products: "Several years ago, a highly reputable enzyme company could not get an important raw ingredient for their flagship product, which was a pain reliever. As a result, it was off the market for a while. During that time, someone duplicated the label and made tablets that looked similar and started selling the fraudulent product as if it were authentic. Eventually, the fraudulent company was sued but not before many patients ended up taking the useless product and did not get the pain relief they deserved." Dr. Kaczor goes on to say, "As an interesting aside, enzymes containing protease are easily tested because they irritate the tongue. So, at the time, I broke open both tablets to do my own test. The authentic enzyme brand burnt my tongue for hours after contact and the knock off did nothing."

This emphasizes that buying from reputable suppliers is absolutely critical. Even well-known retailers can be problematic as illustrated by a 2015 claim that four national retailers—GNC, Target, Walgreens and Walmart—were accused of selling fake and potentially harmful herbal supplements.[33]

Interacting with manufacturers

Finding quality dietary supplement products begins with a conversation with the manufacturer and then progresses from there. Lori Bestervelt, PhD, who was Executive Vice President and Chief Science Officer with NSF International and directed the NSF Standards Development and Toxicology Services Department, says "I think it's important to ask a lot of questions up front because the quality of the finished product starts with the quality of the raw materials and the manufacturing facilities." Dr. Bestervelt was also in charge of all labs and testing at NSF as well and she says the information received from the manufacturer is critical to the decision-making process.

When it comes to questions to ask, healthcare practitioners should focus on these key areas:

- Testing
- Third-party certifications
- Current Good Manufacturing Practices (cGMPs)
- Audits

It can also be helpful and eye-opening to tour the facility including the lab where on-site testing takes place. Strict testing procedures should be in place to ensure purity, safety, and efficacy. Without this information, you could get stuck buying or recommending

an inferior product. And sometimes the due diligence process requires extra effort.

For example, Dr. Hoffman once had a manufacturer try to sell him on private labelling their green tea product. "Since I was going to back the product with my reputation, I arranged to have it assayed by an independent commercial analytical laboratory," explains Dr. Hoffman. "The results showed it contained negligible amounts of the active ingredient, EGCG. Needless to say, I passed on the opportunity."

High quality dietary supplement manufacturers are transparent, freely provide information requested, and should work to exceed your expectations. For a list of red flag warnings to watch out for from prospective manufacturers, see the section below. These red flags will also help you create questions to ask the manufacturer during the vetting process.

Manufacturer red flags to watch for

Lori Bestervelt, PhD, created the dietary supplement certification program at NSF. She is presently the Director of Business Development & Partnerships at ChemFORWARD, a company that focuses on proactive chemical management.

She has identified these key red flags to be aware of when evaluating a dietary supplement manufacturer:

- Lacks an internal and external audit program
- Lacks testing
- Lacks third-party certifications
- Participates in "dry labbing," which falsified test results[6]
- Non-compliant with Current Good Manufacturing Practices (cGMP)
- Uses fake or non-sanctioned GMP certification logos
- Prohibits site visits to their manufacturing facility or lab
- Has a poor reputation in the industry

Dr. Bestervelt also recommends asking if the manufacturer has received any 483 forms from the FDA. "The 483 is issued at the end of an on-site inspection by the FDA," she explains. "If the FDA investigator observed any deficiencies in quality systems or violations of cGMPs, they fill out a 483 form that can trigger required process changes, additional training, or other measures that can be expensive to the manufacturer. Manufacturers don't want to get a 483, but these forms can provide insightful information to the potential purchaser."

Regulating dietary supplements

In Canada, dietary supplements are regulated by Health Canada under the Natural and Non-prescription Health Products Directorate (NNHPD), which mandates that every Natural Health Product be registered for a Natural Product Number (NPN) prior to entering the market.[10]

In the United States, the Federal Food and Drug Administration (FDA) has established guidelines to help manufacturers produce quality products. According to the FDA, quality is reflected when a dietary supplement consistently meets established certifications for identity, purity, strength, and composition, while limiting adulteration and contamination.[18]

In 1994, Congress established the Dietary Supplement Health and Education Act (DSHEA) which gave dietary supplements a special classification of regulation within the food category that is separate and distinct from pharmaceuticals.[19]

With the passage of DSHEA, a new regulatory framework for labeling and safety was created. Dietary supplements were never regulated in the same fashion as pharmaceuticals and now with DSHEA, they are no longer regulated as foods. With their special classification within the food category, manufacturers are strictly prohibited from marketing supplement products that are unsafe or contain an unsafe ingredient. According to a 2018 review paper in Nutrients, "This includes assuring that safe upper levels of intake for nutrients or maximum dosages for other constituents are not exceeded and ensuring that toxic contaminants are absent."[7]

The FDA monitors safety of dietary supplement products and under DSHEA has the enforcement authority to immediately remove products from the marketplace that pose an imminent hazard or significant risk to the general public.[20] Manufacturers are also required to report serious adverse event information to the FDA. Product recalls relating to adverse effects or potential contamination is often voluntary, though the FDA may request a recall based on facility inspection, independently received adverse event reports, or requests issued by the Center for Disease Control and Prevention.[21]

Pharmaceuticals versus supplements

Because of the implied safety profile of dietary supplements that contain vitamins, minerals, amino acids, herbs, and other natural substances, they are not regulated as strictly as pharmaceutical drugs. Prior to market release, pharmaceuticals need FDA approval on parameters of safety, efficacy, manufacturing compliance, labeling/packaging, prescribing information, and marketing materials.[5] Pharmaceuticals undergo an extensive research and development process that includes pre-clinical, and clinical phase I, II and III trials before

undergoing a review for approval by the FDA. After the drug has been released to the market, the FDA continues to be involved in monitoring pharmaceutical integrity and safety, new studies, labelling, information updates, and marketing.

Dr. Bestervelt explains the regulatory difference between dietary supplements and drugs this way: "Dietary supplements are considered safe until proven otherwise, whereas drugs are considered unsafe until proven safe through clinical trials."

The Council for Responsible Nutrition states, "If dietary supplements were regulated like drugs, there would likely be no dietary supplement industry and the products that did exist would cost what drugs cost."[4]

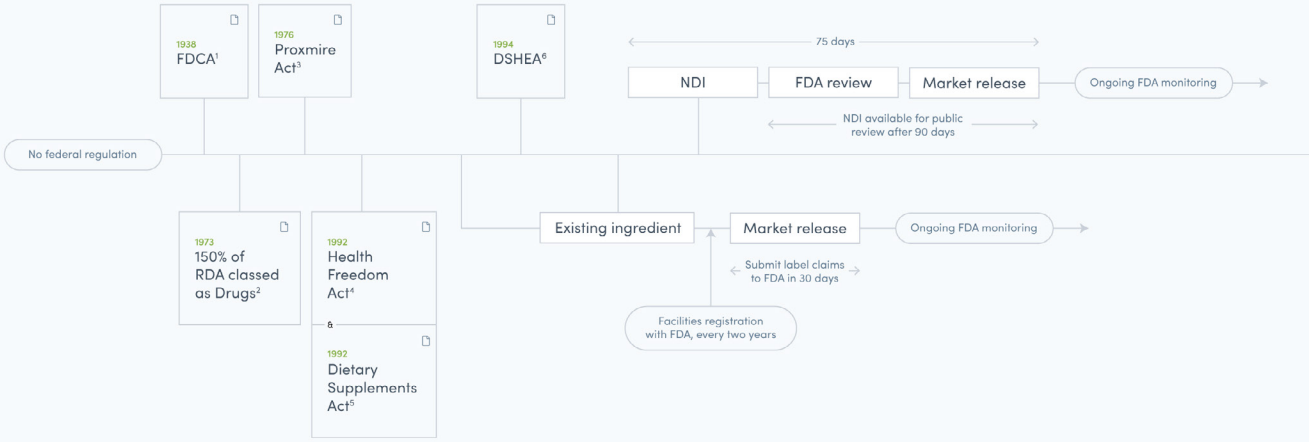
New dietary ingredients

If an ingredient was not marketed in the United States prior to October 15, 1994, it is considered a New Dietary Ingredient (NDI) that requires special FDA notification at least 75 days prior to being released into the marketplace.[22] Information about the new ingredient must include how the ingredient will be used, amount included in the product, history of use, safety data, and recommended usage with supporting documentation.[23]

In addition to NDI requirements, FDA created Current Good Manufacturing Practices (cGMPs) that dietary supplement manufacturers must follow to help ensure their products are the highest quality possible. These cGMPs form the bedrock of all dietary supplement quality programs.

Ingredient approval process

An overview of the approval process in the United States for both existing ingredients and new dietary ingredients (NDI).



1 Supplements are classified as drugs 2 Supplements containing 150% RDA classified as drugs 3 No limit to RDA on supplements – classified as food additives and subject to pre-market approval if not GRAS 4 Herbs as supplements 5 1-year moratorium on nutrient content, health and label claims 6 Supplements classified under foods – ingredients exisiting in food systems grandfathered into market without need for premarket approval, NDIs require approval

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The Importance of cGMPs

All domestic and foreign companies that manufacture, package, label, or hold dietary supplements for sale in the United States must follow the FDA's cGMP guidelines—it's the law.[24] These companies must also register with the FDA, which makes their facilities subject to FDA inspections.[25] Foreign suppliers also have specific requirements. To further illustrate and confirm high-quality practices, many manufacturers have a third party professional or company perform an independent audit to confirm cGMP compliance.

According to Dr. Bestervelt, the addition of a third-party audit provides an important level of transparency between the manufacturer and the customer. She says, "An actual GMP audit of the manufacturer's facility done by a third party is necessary to provide a true sense of their degree of ongoing GMP compliance and the ability of the manufacturer to produce high quality products."

What cGMPs cover

The cGMPs established by the FDA are incredibly comprehensive and detailed. Here are examples of what is included in the cGMPs:[18]

Personnel

- Prevention of microbial contamination from sick or infected personnel
- Rules regarding hygienic practices
- Production job description functions

Physical plan and grounds

- Sanitation and cleanliness
- Appropriate facility conditions (temperature, light, etc)
- Water supply

Equipment and utensils

- Proper use, installation, and operation
- Routine maintenance and periodic checks

Production and process control systems

- Quality control specifications in place throughout the manufacturing process
- Quality control personnel review and approval
- Data available to support quality parameters including identity verification, testing, and expiration date
- Corrective action plans in place

A big emphasis in the Production and Process Control System section of the cGMPs is on quality and the people in charge of quality oversight. Verifying, certifying, and guaranteeing ingredients is also a focus in this section of the cGMPs, which includes the establishment of a unique identifier, certificates of analysis, quarantine, master manufacturing records, and batch production records. There are also detailed requirements for laboratory operations. Packaging and labeling operations are included and covers cleanliness, accuracy, and tracking.

Foreign supplier requirements

The FDA requires importers of dietary supplements to develop Foreign Supplier Verification Programs (FSVP) for each product imported to ensure the foreign suppliers meet U.S. safety standards. Unless otherwise exempt, companies importing ingredients or finished products from other counties are required to: [26]

- Develop and Perform FSVPs with a qualified employee
- Perform hazard analyses
- Evaluate product and supplier performance risk
- Verification that hazards have been minimized or prevented
- Take corrective actions and reevaluate the FSVP if necessary
- Reevaluate the supplier every three years or more frequently if new safety performance information or hazards arise
- Provide supplier identification to the U.S Customs and Border Protection

Identification and validation of ingredients

The finished product is only as good as the starting material. That's why proper identification and validation of all ingredients is critical. And that process begins with ingredient sourcing. Optimal safety and efficacy rely on accurate sourcing, identification, validation, and processing. This is especially true with botanicals.

Safety and efficacy issues associated with botanical extracts can include: [17]

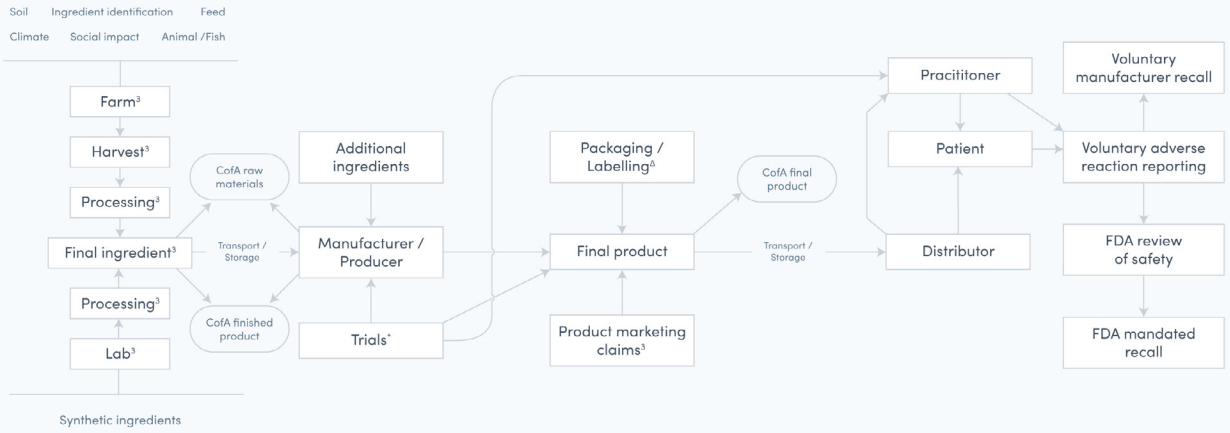
- Misidentification of the initial plant source
- Adulteration with other plants
- Environmental contamination (e.g., with heavy metals and pesticide or herbicide residues)
- Biological contamination (mycotoxins, micro-organisms)
- The addition of illegal substances

The World Health Organization (WHO) has established guidelines on good agricultural and collection practices for medicinal plants that help to improve the quality, safety, and efficacy of the finished product.[35] WHO guidelines state that characteristics of ingredient sources, as well as information about harvesting methods, should be obtained. In addition, the WHO states that any processing techniques used to remove microbes should be documented by method and material.

Similar steps may be taken with ingredients of non-plant origin. For example, chondroitin sulfate may be derived through synthetic processes or from a variety of animal sources, each of which have their own molecular properties.[32] In addition to the source, variation in extraction and purification protocols can lead to differences in properties and purity. Source and extraction methods may also cause variations in bio-availability and efficacy.

Dietary supplement sourcing, manufacturing, and distribution

An overview of dietary supplement origin, manufacturing, labeling and distribution from source to consumer.



*Optional pre-clinical and clinical trials to improve safety, efficiency, and effectiveness [Δ]Allergens, source claims, excipients [3]3rd party certification

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Allergen and source claims

Accurate labeling is a big part of the FDA-established cGMPs. When it comes to dietary supplement safety, labeling of allergens and claims related to the sourcing of ingredients is critical because it reduces the risk of allergic reactions and unintentional consumption of dietary restricted items. The Food Allergen Labeling and Consumer Protection Act (FALCPA) created by the FDA in 2004 requires eight major allergens to be listed on supplement labels when they are contained in the product: milk, egg, fish, Crustacean shellfish, tree nuts, wheat, peanuts, and soybeans.[27]

Examples of allergen and source claims can include:

- 100% plant source
- Corn
- Dairy
- Egg
- Fish
- Gluten (certified)
- Gluten (non-certified)
- Glyphosate Residue Free
- Lactose
- Peanut
- Sesame Seed
- Shellfish
- Soy
- Starch
- Sugar
- Sulphite
- Tree nuts
- Wheat
- Yeast
- Vegan
- Vegetarian

Regulations for labeling a product as "gluten-free" requires that manufacturers abide by a standard for the maximum detectable content for gluten. For a product to be labeled as gluten-free, there must be less than 20 ppm of gluten, or the item does not contain or was not derived from any type of wheat, rye, barley, or crossbreeds.[28] Gluten-free labeling is not permitted when ingredients derived from these grains have not been processed to remove gluten, or if processing resulted in the item containing more than 20 ppm.

Understanding excipients

In addition to full disclosure regarding allergens and ingredient sources, excipients can also impact the buying and prescribing decision, so full label transparency is required by the manufacturer. Excipients in dietary supplements, as well as pharmaceutical drugs, are therapeutically inactive ingredients added to aid in the manufacturing process, increase bio-availability, contribute to improved patient compliance, or to protect, support, or enhance product stability.[9]

While these added ingredients are considered inactive, they are not inert substances as some of these ingredients can interact with other ingredients in the formulation or lead to adverse or hypersensitivity reactions in patients.[11]

The FDA requires that excipients comply with food additive regulations or they have GRAS status, which stands for Generally Regarded as Safe.[29] There are a variety of different types of excipients that can be derived from natural or synthetic sources. Natural excipients come from plant, animal, or mineral sources and are considered less toxic compared to synthetic excipients.[16]

Here are some examples of the various types of natural excipients:

- **Fillers:** plant cellulose, gelatin, lactose, sucrose, glucose
- **Binders:** acacia, alginic acid, corn starch, alginate, polymers
- **Coating agents:** gelatin, arabi, natural polymers
- **Lubricants:** castor oil, mineral oil, paraffin oil
- **Preservatives:** clove oil, cinnamon, turmeric, cocoa
- **Flavorings:** ginger, raspberry, lemon, orange, peppermint
- **Colorings:** caramel, chlorophylls, carotenoids, red beetroot, turmeric, saffron
- **Solvents:** purified water, oils
- **Buffering agent:** lemon juice
- **Emulsifying agents:** acacia gum, gum ghatti

Common synthetic excipients include cellulose, dyes, magnesium stearate, parabens, and silicon dioxide. It's important to clarify what role excipients are playing and that the manufacturer is not using excipients simply as fillers.

Excipients in dietary supplement products should be evaluated on risk to benefit ratio with a leaning toward natural excipients whenever possible.

Supply chain scrutiny

Transparency is a key characteristic of an effective quality control program. This requires manufacturers to provide a clear picture of every step of the supply chain. Dr. Bestervelt says the manufacturer/customer relationship needs to be nurtured on an ongoing basis. "For example, manufacturers often switch suppliers and QA professionals can change on a yearly basis," she explains. "The healthcare professional needs to develop a trustworthy long-term relationship with the manufacturer."

When it comes to transparency within this ongoing relationship, blockchain sourcing is key. This involves a secure, step-by-step verification process from the original source of the ingredient(s) to the end-user. Blockchain decentralizes the supply chain so the process is not controlled entirely by one person or group. Each "block" is a time-stamped transaction that is uploaded into the supply chain of events for anyone within the network to see.[8] It provides a clear roadmap as to how ingredients become finished products.

Testing and certification documentation is also important to transparency and vital to supply chain scrutiny.

Key testing procedures and third-party certifications

Third-party certification companies are independent auditing agencies that inspect and verify ingredient sourcing, product manufacturing standards, distribution channels, and accurate labeling. Utilizing these companies is completely voluntary by the manufacturer. Supplement ingredient suppliers, manufacturers, and distributors who have third-party certifications give their customers an added layer of confidence that the company is adhering to high-quality standards throughout the supply chain process.

This end-to-end transparency begins with the starting material because after all, a high-quality product must have high-quality raw materials. "You can't make a good product with bad ingredients," says Dr. Bestervelt. "Raw material testing and certification is critical." She says this is perhaps the most important information you can get from the manufacturer.

A Certificate of Analysis (CofA) is a key way to verify ingredient quality because this certification indicates the product meets these criteria: [1]

- The product contains the ingredients stated on the label
- The ingredients are in the stated amounts on the label
- Ingredients meet acceptable limits for suspected or known contaminants, toxins, and/or marker compounds

A CofA confirms the identity, strength, purity, and quality of the raw material used in the dietary supplement. It should include a description of the analysis used, any test

limitations, and the actual test results, which must be repeatedly confirmed.[30] These certifications should be done for each batch as skip lot testing is not adequate to confirm the consistent quality of the raw material used.[3]

Finished products should also be tested and certified. Just as with raw materials, each batch should be tested to ensure there are no toxins or contamination of the individual batch. Utilizing a third-party organization to test finished products is highly recommended. When it comes to testing finished products, NSF and USP are the leading organizations doing this testing. For a complete list of organizations that do third-party testing.

Be sure that the certifying organization is not just evaluating data from the manufacturer but actually does testing in an independent accredited lab, and that testing and retesting is done on an ongoing basis.[14] NSF and USP also ensure the products are manufactured in accordance with FDA-established cGMPs and that quality is consistent from batch to batch.[31]

Appreciating the role of research

Of course, before a product is even a product, there is an idea that an ingredient or group of ingredients will somehow enhance health. That's where research comes in. In addition to illustrating efficacy, research can also confirm safety and quality as it describes the form of the ingredient that was used in the research.

While manufacturers have a legal obligation to ensure that their products are safe and labeled truthfully before they are introduced to the market, they do not need to submit scientific evidence to the FDA regarding efficacy. In the dietary supplement industry, manufacturers use published research about an ingredient to help illustrate the logic as to how that ingredient or product will influence health.

The onus to vet the manufacturer's research falls directly into the lap of the healthcare practitioner. And when the research is vetted properly, it can really make a difference in the decision-making process.

Beware of borrowed science

Everyone in the dietary supplement industry knows that performing original research on a natural substance can be expensive and challenging because oftentimes that substance cannot be patented and the high cost of research cannot be recouped. But in lieu of conducting original research, some manufacturers have gone to the opposite extreme by utilizing "borrowed science" in their marketing materials.

What is borrowed science? It's when research findings are "borrowed" and the results are applied to an ingredient or product that may bear little or no resemblance to what was actually used in the study.[12] This is much different than shared science where the ingredient in the study matches the ingredient on the label. In order to shine a light on the borrowed science issue, the healthcare practitioner must really dig into the material provided by the manufacturer.

In addition to being a naturopathic oncologist, Dr. Kaczor is the Editor-in-Chief of the Natural Medicine Journal, a peer-reviewed online research publication for integrative healthcare professionals. She says, "Scrutinizing research provided by manufacturers is not always easy, and yet it's really critical when evaluating the scientific rationale and clinical relevance of a dietary supplement." Dr. Kaczor says healthcare professionals should, "get the PDF of the full published paper whenever possible and make sure the ingredient used in the study matches the ingredient in the product." She says to look for form, dosage, standardization, and any other distinguishing characteristic of the ingredient to help match the study with the label. That's really the only way to uncover borrowed science.

It's important to note that research associated with vitamins, minerals, herbs, amino acids, and other natural substances has gained momentum, and the quality of that research has improved. Typically for most natural substances, research focuses on first establishing mechanistic plausibility and then moves on to in vitro and/or in vivo studies with an eventual progression to smaller human clinical trials.[7]

For a comprehensive evidence-based approach, the three factors to consider when choosing a dietary supplement product are: [15]

- Clinical experience
- Patient values and expectations
- Research that is available

In addition to research, other potential factors to keep in mind when making supplement buying decisions is the manufacturer's environmental and social impact.

Environmental and social considerations

Many healthcare practitioners and their patients are socially-minded buyers so a manufacturer that focuses on the environment will likely be deemed a higher quality company. The same is true for fair trade companies because fair trade ensures better trading conditions while securing the rights of marginalized workers by focusing on transparency, respect, and greater equity in international trade.[34]

"When making buying decisions for the clinic, choosing a socially-minded company is very important," says Dr. Hoffman. "For example, we want to know that the fish oil was harvested in a sustainable fashion from species that are not endangered. Or that an herb was obtained without reliance on exploitive child labor." Dr. Hoffman says having these values will also help ensure he is getting safer, high-quality products. "Buying organically sourced products is important to minimize exposure to contaminants like glyphosate," he says.

Companies and leading organizations are realizing the importance of the social and environmental impact of their purchasing and manufacturing processes. In fact, the WHO guidelines on good agricultural and collection practices for medicinal plants encourage sustainable cultivation and collection practices that include plant rotation and other methods to help promote environmental sustainability.[36]

"Socially and ethically responsible companies always rise to the top of my selection list," says Dr. Kaczor. "These companies are happy to be transparent because there is literally nothing to hide. I think all companies should go in this direction."

Some of the organizations focus on fair trade, sustainability, and other social and environmental issues. If this is important to you and your patients, look for their logos when making your purchasing decisions.

Making quality a priority

When it comes to dietary supplements, embracing quality is easy. Evaluating it is not. That's why taking a comprehensive supply chain snapshot for each individual manufacturer you are considering is critical. The time investment made in the up-front due diligence process and creating a trusted ongoing relationship will pay big dividends when it comes to patient safety and improved outcomes, which translates into long-term practice and business resilience.

Quality at-a-glance checklist

The following is a review of what was covered in this white paper. You can use this checklist when evaluating suppliers and share it with office and clinic personnel. This list can also be given to patients to help illustrate the steps you take to ensure that quality dietary supplements are a priority for your clinic.

- ☐ Purchasing and recommending high-quality dietary supplements is a priority because it helps ensure patient safety and leads to better health outcomes.
- ☐ Third-party sellers should be avoided due to lack of oversight, no direct connection to the manufacturer, and other quality and safety concerns.
- ☐ Our relationship with the dietary supplement manufacturers we choose is trusted, comprehensive, and ongoing.
- ☐ We thoroughly vet each and every manufacturer we purchase from and recommend.
- ☐ All manufacturers we buy from follow FDA-created Current Good Manufacturing Practices (cGMPs).
- ☐ Our manufacturer partners are required to focus on approved testing methods, utilization of third-party certification companies, and ongoing auditing.
- ☐ We value label transparency that includes allergen identification, ingredient source claims, and excipient information.
- ☐ The supply chain is scrutinized from raw material to finished product and we make the manufacturer accountable for all aspects from growing to processing to packaging.
- ☐ We value Certificates of Analysis, batch testing, and full disclosure by our manufacturers.
- ☐ We take responsibility to review and fully vet the research associated with the product we purchase or recommend.
- ☐ Whenever possible, we base buying decisions on the environmental and social impact of the manufacturer.

References

1. Akabas, S. R., Vannice, G., Atwater, J. B., Cooperman, T., Cotter. R., & Thomas, L. (2016). Quality certification programs for dietary supplements. Journal of the Academy of Nutrition and Dietetics, January 13. https://jandonline.org/action/showPdf?pii=S2212-2672%2815%2901642-1

2. American Association of Naturopathic Physicians. (Accessed 2020, June 2). Principles of naturopathic medicine. https://naturopathic.org/page/PrinciplesNaturopathicMedicine

3. Baldwin-lien, B. (2012). Skip lot testing misses the mark. Natural Medicine Journal, 4, 12. https://www.naturalmedicinejournal.com/journal/2012-12/skip-lot-testing-misses-mark

4. Council for Responsible Nutrition. (Accessed 2020, June 2). Dietary supplements—safe, beneficial and regulated. https://www.crnusa.org/resources/dietary-supplements-safe-beneficial-and-regulated

5. Dabrowska, A., & Thaul, S. (2018, May 8). How FDA approves and regulates their safety and efficacy. Congressional Research Service. https://fas.org/sgp/crs/misc/R41983.pdf

6. Daniels, S. (2014, May 14). 'Dry labbing' is still out there, and there is still a market for it, say analytical experts. Nutri Ingredients USA. https://www.nutraingredients-usa.com/Article/2014/05/13/Dry-labbing-is-still-out-there-and-there-is-still-a-market-for-it-say-analytical-experts#

7. Dwyer, J. T., Coates, P. M., & Smith, M. J. (2018). Dietary Supplements: Regulatory Challenges and Research Resources. Nutrients, 10(1), 41. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5793269/

8. Figorilli, S., Antonucci, F., Costa, C., Pallottino, F., Raso, L., Castiglione, M., Pinci, E., Del Vecchio, D., Colle, G., Proto, A. R., Sperandio, G, & Menesatti, P. (2018) Blockchain implementation prototype for the electronic open source traceability of wood along the whole supply chain. Sensors, 18(9), 3133. https://www.mdpi.com/1424-8220/18/9/3133/htm

9. Furrer, P. (2013) The central role of excipients in drug formulation. European Pharmaceutical Review, April 18. https://www.europeanpharmaceuticalreview.com/article/18434/the-central-role-of-excipients-in-drug-formulation-2/

10. Government of Canada. (Accessed 2020, June 2). Natural and non-prescription health products directorate. https://www.canada.ca/en/health-canada/corporate/about-health-canada/branches-agencies/health-products-food-branch/natural-non-prescription-health-products-directorate.html

11. Haywood, A., & Glass, B. D. (2011). Pharmaceutical excipients—where do we begin? Australian Prescriber, 34, 112-4. https://www.nps.org.au/australian-prescriber/articles/pharmaceutical-excipients-where-do-we-begin

12. Lassiter, J. (2001, June 1). Borrowed science versus shared science. https://www.nutraceuticalsworld.com/issues/2001-06/view_features/borrowed-science-versus-shared-science/

13. Matsakis, L. (2019, July19). Amazon warns customers: those supplements might be fake. Wired. https://www.wired.com/story/amazon-fake-supplements/

14. NSF. (Accessed 2020, June 2). Supplement and vitamin certification. https://www.nsf.org/consumer-resources/health-beauty/supplements-vitamins/supplement-vitamin-certification

15. Physiopedia. (Accessed 2020, June). Evidence based practice (EBP). https://www.physio-pedia.com/Evidence_Based_Practice_(EBP)

16. Poonam, V., Sagar, G., Abhishek, K., & Yuvraj, S. (2018). Remarkable contribution of natural excipients in finished pharmaceutical products. Int J Pharm Sci Rev, 2, 7-14. http://globalresearchonline.net/journalcontents/v52-1/02.pdf

17. Sansini, E., Badea, M., Dos Santos, A., Restani, P., & Sievers, H. (2011). Quality control of plant food supplements. Food Funct, 2, 740-746. https://pubs.rsc.org/en/content/articlehtml/2011/fo/c1fo10112a

18. US Food & Drug Administration. (2010, December). Small entity compliance guide: current good manufacturing practices in manufacturing, packaging labeling and holding operations for dietary supplements. https://www.fda.gov/regulatory-information/search-fda-guidance-documents/small-entity-compliance-guide-current-good-manufacturing-practice-manufacturing-packaging-labeling

19. US Food & Drug Administration. (2019, July 22). Questions and answers on dietary supplements. https://www.fda.gov/food/information-consumers-using-dietary-supplements/questions-and-answers-dietary-supplements

20. US Food & Drug Administration. (2015, July 15). FDA 101: dietary supplements. https://www.fda.gov/consumers/consumer-updates/fda-101-dietary-supplements

21. US Food & Drug Administration. (2010, May 18). FDA 101: product recalls. https://www.fda.gov/consumers/consumer-updates/fda-101-product-recalls

22. US Food & Drug Administration. (2016, August). Dietary supplements: new dietary ingredient notifications and related issues. https://www.fda.gov/media/99538/download

23. US Food & Drug Administration. (2019, October 4). New dietary ingredients in dietary supplements—background for industry. https://www.fda.gov/food/new-dietary-ingredients-ndi-notification-process/new-dietary-ingredients-dietary-supplements-background-industry#what_info

24. US Food & Drug Administration. (2020, February 5). Frequently asked questions on FSMA. https://www.fda.gov/food/food-safety-modernization-act-fsma/frequently-asked-questions-fsma

25. US Food & Drug Administration. (2018, September 19). Foreign food facility inspection program questions & answers. https://www.fda.gov/food/food-inspection-programs/foreign-food-facility-inspection-program-questions-answers

26. US Food & Drug Administration. (Accessed 2020, June 2). Final rule on foreign supplier verification programs. https://www.fda.gov/media/97893/download

27. US Food & Drug Administration. (2018, September 20). Guidance for industry: questions and answers regarding food allergens. https://www.fda.gov/regulatory-information/search-fda-guidance-documents/guidance-industry-questions-and-answers-regarding-food-allergens-edition-4

28. US Food & Drug Administration. (2018, July 16). Gluten and food labeling. https://www.fda.gov/food/nutrition-education-resources-materials/gluten-and-food-labeling

29. US Food & Drug Administration. (2014, January). Guidance for industry: considerations regarding substances added to foods including beverages and dietary supplements. https://www.fda.gov/media/87680/download

30. US Food & Drug Administration. (2019, April 1). CFR—Code of federal regulations title 21. https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=111.75

31. USP. (Accessed 2020, June 2). USP verified mark. https://www.usp.org/verification-services/verified-mark

32. Volpi, N. (2009). Quality of different chondroitin sulfate preparations in relation to their therapeutic activity. Journal of Pharmacy and Pharmacology, 61, 1271-1280. https://onlinelibrary.wiley.com/doi/full/10.1211/jpp.61.10.0002

33. WebMD. (2015, February 3). Retailers accused of selling fake supplements. https://www.webmd.com/vitamins-and-supplements/news/20150203/retailers-fake-supplements

34. World Fair Trade Organization. (Accessed 2020, June) About us. https://wfto.com/who-we-are

35. World Health Organization. (2003). WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. https://apps.who.int/iris/bitstream/handle/10665/42783/9241546271.pdf;jsessionid=25E347B94181B45CE396210BEBB8F509?sequence=1

36. World Health Organization. (2003). WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. https://apps.who.int/iris/bitstream/handle/10665/42783/9241546271.pdf;jsessionid=25E347B94181B45CE396210BEBB8F509?sequence=1