

Science in Liquid Dietary Supplement Promotion: The Misleading Case of Mangosteen Juice

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Abstract

Liquid dietary supplements represent a fast growing market segment, including botanically-based beverages containing mangosteen, acai, and noni. These products often resemble fruit juice in packaging and appearance, but may contain pharmacologically active ingredients. While little is known about the human health effects or safety of consuming such products, manufacturers make extensive use of low-quality published research to promote their products. This report analyzes the science-based marketing claims of two of the most widely consumed mangosteen liquid dietary supplements, and compares them to the findings of the research being cited. The reviewer found that analyzed marketing claims overstate the significance of findings, and fail to disclose severe methodological weaknesses of the research they cite. If this trend extends to other related products that are similarly widely consumed, it may pose a public health threat by misleading consumers into assuming that product safety and effectiveness are backed by rigorous scientific data.

Keywords

Dietary supplement, mangosteen, nutraceutical

Introduction

Nutraceutical juice beverages containing tropical botanicals such as acai, noni, and mangosteen are a fast growing portion of the \$23 billion “functional and natural ready-to-drink beverage” market.¹ While they look like everyday beverages in packaging and appearance, these so-called “super food” beverages may also be classified and promoted as liquid dietary supplements.² Some of their botanical ingredients may also contain potent pharmacologically active ingredients. Xanthone derivatives from mangosteen (*Garcinia mangostana*), for example, have been investigated in-vitro for their potential antifungal, antibacterial, and cytotoxic effects.³ Reliable evidence that such beverages are safe or promote health when consumed frequently by humans, however, is currently lacking.³⁻⁵

The larger field of nutrition research has been criticized for over-emphasizing health claims that are based on methodologically weak research and pseudoscience,⁶ and the dietary supplement sector appears to follow this practice also. Nutraceutical juice beverages are widely marketed across all media as “super foods,” with the Internet providing a convenient venue for sophisticated multimedia marketing presentations and easy product purchase. Central to the marketing of many products is the citation of “scientific studies” supporting the product’s health claims. While these studies seem deliberately created for marketing purposes, their findings and quality are generally presented in a manner that appears designed to mislead potential consumers. This practice of using manufacturer funded, methodologically weak studies characterized by short duration and small sample size has been previously identified among dietary weight loss supplements, a closely related class of products.⁷

The Food and Drug Administration (FDA) has noted growth in this sector, and has voiced concerns about marketing practices, noting in guidance to industry that they “have seen an increase in the marketing of beverages as dietary supplements, in spite of the fact that the packaging and labeling of many liquid products represent the products as conventional foods.”⁸ Further, “FDA has seen a growth in the marketplace of beverages and other conventional foods that contain novel ingredients, such as added botanical ingredients or their extracts.”⁸

Product websites offer rich marketing potential for dietary supplements, including the ability to quickly and easily purchase the advertised product. While labels for both dietary supplements and foods and beverages must comply with FDA regulations,⁸⁻¹⁰ website marketing practices have much freer reign. Yet there are compelling reasons why misleading online promotion may be more influential than labels. For example, consumers may purchase a product after reading online marketing, or after “researching” healthy beverages online. Commonly used search engines such as Google may direct consumers seeking health information to such commercial sites. Also, consumers are likely to spend longer periods of time engaged with the often media-rich online environment than they do with a static product label. Further, the addresses for product websites are often prominently displayed on product labels, thus serving the function of virtual label extensions.

This case study presents examples of how widely marketed and consumed liquid dietary supplements use exaggeration and pseudoscience to bolster their web promotions of product effectiveness and safety.

Methods

Marketing claims from two leading producers of mangosteen dietary supplement were compared with the underlying published research that they cited.

Results

Mangosteen fruit juice is made from the fruit of the *Garcinia mangostana* plant, found in tropical climates of South East Asia.⁴ The beverage is widely marketed for potent yet unproven health benefits attributed to its high antioxidant content.⁵ These include claims, generally theoretical in nature and unsubstantiated by rigorous human trials, that the product ingredients: protects against free radicals, increase energy and stamina, support the immune system, promote a healthy digestive system, assist in recovery after exercise, and support joint and cartilage functionality.¹ A comparison of select marketing claims and the evidence cited in those claims is presented in Table 1.

Table 1. Fact Check of Marketing Statements Against Published Research, from Leading Mangosteen Juice Liquid Dietary Supplement Producers		
Website Marketing	Published Study	Comments
Case Example 1		
<ul style="list-style-type: none"> • “8-week double-blind placebo-controlled human clinical” trial that have demonstrated an ability to reduce C-reactive protein levels at all 3 dosages.” • “product was shown to be safe at all dosages tested. There were no adverse events (clinical, laboratory, or vital sign) attributed to the product during the course of the study.” • Highest dosage cited: 9 oz. • States that product is “safe for everyone,” suggests concomitant use of mangosteen supplement pill (see below). • Qualifications of lead researcher touted, but no mention of study funding source 	<ul style="list-style-type: none"> • Study contained 40 participants randomized to 4 arms.¹¹ • Only the highest dosage and placebo demonstrated statistically significant “comparison of change from baseline.” • Highest dosage: 18 oz. (9 oz twice daily). • Study funded by manufacturer. 	<ul style="list-style-type: none"> • Study is underpowered to detect adverse events that might occur even as frequently as in 1% to 2% of users. • Suggesting that a product is safe because an underpowered study failed to report adverse events is inappropriate, especially when at least one published case report links mangosteen juice to a serious adverse event,¹² and a botanical relative (<i>Garcinia caombogia</i>) is a suspected hepatotoxin.¹³ • Value of non statistically-significant trends overstated. • Underreporting actual daily dosage makes product appear more potent. • Not reporting financial conflicts of interest may bolster study’s face validity.
Case Example 2		
<ul style="list-style-type: none"> • Abstract titled “The potential ‘fat burning’ effects of the liquid dietary supplement...” • Claims listed under heading “Science” and subhead “Most Requested Current Topic” 	<ul style="list-style-type: none"> • Study is an unpublished conference presentation. • Findings are in-vitro effects theoretically linked to processes that may affect weight gain and loss in humans. 	<ul style="list-style-type: none"> • Marketing claims may mislead consumers by suggesting that preliminary lab findings provide scientific support for weight loss associated with product use.
Mangosteen Dietary Supplement Pill		
<ul style="list-style-type: none"> • A “4-week placebo-controlled human clinical study” finds the supplement: • helps “maintain a healthy respiratory system in participants...demonstrated a significant extension of the participants’ overall wellness when compared to the placebo group.” 	<ul style="list-style-type: none"> • The study is unpublished¹⁴ • No information provided about study size, whether differences were statistically significant or not, or funding source. 	<ul style="list-style-type: none"> • Marketing claims may mislead consumers by suggesting that there is rigorous scientific support for product effectiveness.

Discussion

Using methodologically weak studies, sometimes containing undeclared conflicts of interest, to validate dietary supplement use is nothing new.⁶ That it may be done with a new class of liquid dietary supplements containing potentially potent pharmacological agents, whose outward appearance as fruit juice may inspire frequent consumption by consumers, is, however, a new and worrisome trend. In the interests of consumer safety and fair marketing, several stakeholders share a role in mitigating potential adverse effects. Manufacturers should abide by ethical marketing practices that do not misrepresent or overstate research findings or presumed safety of their products. This includes full disclosure of the size, duration, funding, and quality of research pertinent to claims supporting their products. Marketing practice that is compliant with current law is legally sufficient to avoid litigation, but lacking in basic social responsibility and good business practice. Clinicians need to be aware of the potential health risks associated with use of dietary supplements, inquire about the consumption of such products, and when necessary document cases of suspected adverse events both to the FDA and in the medical literature. Government regulators should examine industry use of scientific data and provide guidance about recommended use of such information for marketing purposes. Scientific publications should redouble their efforts

to clearly and comprehensively disclose conflicts of interest. Consumers should avoid the temptation of looking to the latest super food as a solution for perceived or real health concerns, and of believing the frequent over-promotion of such products.

Conclusion

Liquid dietary supplements that are essentially fruit juices containing novel botanical ingredients may also contain pharmacologically active constituents. Though the true nature of health benefit and safety of these products has not generally been established in humans, some are widely implied as being of benefit, which is substantiated by “science.” Limited, low quality research in the form of manufacturer-funded studies characterized by short duration and small sample size is frequently used to bolster marketing claims and allay fears of potential risks, and may amount to a misleading use of science. If this trend extends to other related products that are similarly widely consumed, it may pose a burgeoning public health threat by misleading consumers.

Conflict of Interest

The author reports no conflicts of interest related to this research.

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