



Acne Supplements Sold Online

Emily Burns¹, Milbrey Parke¹, Ariadna Perez-Sanchez², Dina Zamil¹, Rajani Katta³

¹ Baylor College of Medicine, Houston, TX, USA

² Department of Internal Medicine, University of Texas Health Science Center at San Antonio, San Antonio, TX, USA

³ Department of Dermatology, McGovern Medical School at University of Texas Health Science Center at Houston, Houston, TX, USA

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Corresponding author: Rajani Katta, MD, Department of Dermatology, McGovern Medical School at University of Texas Health Science Center at Houston, Houston, TX, USA. E-mail: info@kattamd.com

ABSTRACT **Introduction:** As no centralized database of acne supplements is available, we aimed to provide an overview of these products, with a focus on safety.

Objectives: The objectives of this study were to document the number, formulation, contents, and marketing strategies utilized by acne supplements sold online.

Methods: An online search was conducted between March and May 2020. Products were included in the study if they used the terms: “whitehead”, “blackhead”, or “acne”. Data were extracted from the website, box, and Supplement Facts label.

Results: 49 products were identified, which contained 146 unique ingredients. These included vitamins, minerals, food extracts, botanical extracts, amino acids, animal products, and distinct microbial strains. Few (4.1%) products were tested by third parties.

Conclusions: This survey of acne supplements available online raised concerns regarding lack of warning labels, teratogenicity, exceedingly large levels of vitamins and minerals, and lack of third-party testing. Given the limited regulation and oversight of dietary supplements, it is imperative that physicians educate patients on the potential risks of these products.

Introduction

Dietary Supplements in the US

Dietary supplements are becoming increasingly popular in the U.S. Studies estimate that approximately 50% of the US population consumes some form of dietary supplement [1]. The number of American people who consume acne supplements is unknown.

The Role of Dietary Supplements in Acne

Acne affects up to 50 million American residents each year, and its prevalence has been reported to be as high as 85% among people aged 12-24 years [2,3]. The role of diet and dietary supplements in the development and treatment of acne is an evolving field of study. A recent systematic review including 53 articles revealed that acne-promoting factors include high glycemic index food, dairy, fatty food, and chocolate. Acne-protective factors include fruits and vegetables. The possible varying degrees of acne-promotion of specific subtypes of these foods (eg full-fat milk vs. low-fat milk) is unknown [4].

High doses of oral zinc have been shown to reduce severe and inflammatory acne in double-blind randomized control trials (RCTs) [5,6]. Successful trials have used different dosages and forms of zinc as well as zinc in combination with other ingredients [7]. Therefore, future research is needed to elucidate the best zinc dose and form associated with improved acne outcomes.

Other vitamins and minerals have been studied, but double-blind RCTs are lacking [5,8]. Low selenium levels have been documented in patients with acne; however, the clinical significance of low selenium and acne development is unknown [5,9]. A cross-sectional study comparing blood levels of vitamins A and E in 100 patients with acne and 100 patients without acne showed that subjects with acne had significantly lower plasma concentrations of these vitamins compared to the control subjects [5,10].

Other naturally occurring compounds have been evaluated in animal and in vitro studies but human studies are lacking. These compounds have exhibited antioxidant and antibacterial properties, such as (–) epigallocatechin-3-gallate from green tea and nobiletin from *Citrus depressa* (a green citrus fruit native from Taiwan and Japan) [5,11,12]. In hamsters, these compounds have been shown to reduce sebum production and inhibit cell proliferation of sebaceous glands respectively.

The flavonoids kaempferon and quercetin from the *Inpatiens balsamina* flower as well as resveratrol found in several other plants have been shown to possess antibacterial properties against *Propionibacterium acnes* in vitro [5,13,14].

Objectives

The objective of this study was to document the number, formulation, contents, and marketing strategies utilized by acne supplements sold online.

Methods

We conducted a search of acne supplements sold online between March 2020 and May 2020 using Google, Amazon, Twitter, and Instagram. Acne supplements were defined as those featuring the words “whitehead”, “blackhead”, and/or “acne” (Figure 1). Data were extracted from the Supplement Facts label, manufacturer website, and/or third-party seller website for each product. Third-party sellers include Amazon and online supplement retailers.

Results

Ingredients

Forty-nine products were identified, which in total contained 146 unique ingredients including vitamins, minerals, food extracts, botanical extracts, amino acids, animal products, and distinct microbial strains (Table 1). Products contained an average of 3.18 vitamins, and the most common vitamins included in descending order were vitamins A, E, B3, B5, and B6 (Table 2). Products contained an average of 2.6 minerals, and the most common minerals included were zinc and selenium (Table 3). Many products contained supraphysiologic doses of vitamins and minerals (Table 4), (Figure 2).



Figure 1. Example of product image of an acne supplement sold online

Table 1. List of Selected Ingredients

Methylsulfonylmethane (MSM)
Coenzyme Q10 (CoQ10)
Horsetail powder
Pepper extract
Grape seed extract
Turmeric
Diindolylmethane (DIM)
Licorice root extract
Bovine Adrenal Powder
Bacteriophages
Bovine Colostrum

Table 2. Vitamins Included in Acne Supplements Sold Online

Vitamin	% of Products
A	53.1
B3 (niacin)	34.7
B5 (pantothenic acid)	34.7
B6 (pyridoxine)	34.7
E (tocopherol)	34.7
No Vitamins	32.7
C	30.6
B7 (biotin)	24.5
B2 (riboflavin)	16.3
B12 (cobalamin)	14.3
D	14.3
B1 (thiamine)	12.2
B9 (folate)	10.2
K	4

Table 3. Mineral Content (%) of Acne Supplements Sold Online

Mineral	% of Products
Zinc	65.3
Selenium	40.8
Chromium	32.7
Copper	28.6
Magnesium	28.6
No Minerals	26.5
Calcium	14.3
Manganese	12.2
Sodium	8.2
Potassium	8.2
Iron	6.1
Sulfur	6.1
Iodine	4.1
Phosphorus	4.1



Figure 2. Example of Supplement Facts label image from an acne supplement sold online

Table 4. High Doses of Vitamins and Minerals from Selected Acne Supplements

Nutrient	Labeled Dose	% of Daily Values
Vitamin A	21,000 mcg RAE	2,333%
Vitamin B2 (Riboflavin)	25 mg	1,923%
Vitamin B3 (Niacin)	500 mg	2,500%
Vitamin B5 (Pantothenic Acid)	350 mg	3,500%
Vitamin B6	50 mg	2,500%
Vitamin B7 (Biotin)	7500 mcg	2,500%
Vitamin B12	500 mcg	20,833%
Vitamin C	280 mg	467%
Chromium	250 mcg	714%
Zinc	50 mg	333%

Many products contained botanical and food extracts. The most common extracts included were methylsulfonylmethane (MSM, 20%), coenzyme Q10 (CoQ10,13%), horsetail powder (10%), pepper extract (10%), grape seed extract (8%), turmeric (8%), diindolylmethane (DIM, 7%), and licorice root extract (6%).

Formulation

Capsules were the most common formulation, followed by tablets and gummies.

Dosing

47.9% of products did not provide clear labeling for total daily dose. For example, the Supplement Facts box included the dose for one capsule, but the recommended dose is two capsules.

Pricing

Pricing varied from \$10-204 per month supply. The median price per month was \$31.

Third-Party Seals of Approval

Approximately 4% of products displayed seals of approval from third-party testing centers recognized by the US Office of Dietary Supplements.

Marketing and Claims

The most common marketing claims included gluten free (67%), vegan or vegetarian (45%), made in the USA (43%), natural (43%), hormonal balance or regulates hormones (43%), detoxify (41%), inflammation (39%), antioxidant (37%), proprietary blend (26%), and cruelty free (20%). Most (55.1%) products used the terms “research” or “clinical study” in the marketing materials. Some (8.2%) products cited a clinical study. Most (55.0%) of products had an auto-delivery or subscription option available upon checkout. Most (55.1%) of products had a coupon available upon checkout. Other marketing techniques included before-and-after photographs (51.1%) and video testimonials (12.2%). Most (83.7%) supplements were reviewed on Amazon.

Labeling

Some (20.8%) products had different information provided by multiple sources. In these instances, labels provided by Amazon sellers conflicted with third party sellers and/or manufacturers. For the purposes of the data collection of this study, the label from the manufacturer website was used. Supplement manufacturers are required by law to include the phrase “This statement has not been evaluated by the FDA. This product is not intended to diagnose, treat, cure, or prevent any disease” on the bottle if a structure/function claim is made. 12.2% of products did not have this phrase clearly visible online. A 53.1% of products did not list a phrase containing or similar to “Consult your doctor or health care practitioner before use” and 30.6% of products failed to include any type of pregnancy warning.

Conclusions

Acne supplement manufacturers use a wide variety of ingredients and health claims. There is little consensus among these products regarding the number or dosing of vitamins,

minerals, extracts, and other ingredients. They are sold on manufacturer websites and third-party websites. This study raises concerns about lack of US Food and Drug Administration (FDA) oversight, lack of third-party testing, teratogenicity potential, marketing practices, untested ingredient profile, supraphysiologic vitamin dosing, vulnerable patient population, and consumer confusion.

The US FDA regulates supplements as foods, not drugs [15]. There is no requirement to prove safety or efficacy prior to sale, and there is no limit on dosages of vitamins or minerals, even for those with defined tolerable upper limits. There is also no requirement to test or document interactions between ingredients and/or other medications [16].

Although the US FDA requires that supplements sold in stores display the Supplement Facts label, this requirement does not apply to supplements sold online. On some websites, including Amazon and other third-party sellers, this label was not visible.

The FDA has issued Good Manufacturing Practices (GMPs), which are a set of guidelines for safe manufacturing of dietary supplements. The FDA expects manufacturers to comply with GMPs but does not regularly investigate for compliance with these rules [15].

In terms of quality testing, only 4.1% of products in our sample were tested by third-party companies recognized by the Office of Dietary Supplements, including the US Pharmacopeia, National Sanitation Foundation, and Consumer Lab. Without US FDA testing or third-party testing, consumers must rely only on the companies themselves to ensure the safety, purity, and lack of contamination of these products.

To date, there is little data about the quality and safety of acne supplements sold online. Ayurvedic medicines sold online have been documented to contain heavy metals including lead, mercury, and arsenic [17]. In 2015, the New York State attorney general’s office accused four national retailers of selling dietary supplements containing unadvertised, potentially allergenic ingredients. Many products did not contain the advertised herbal ingredients, and some contained allergenic components, such as wheat, while advertising that the product was “gluten-free” [18].

With regards to teratogenicity, prescription medications require a package insert with pregnancy warning categories, which indicate risk to the developing fetus. No such notification is required for supplements, even for compounds that pose a known teratogenic risk. Consumers of child-bearing potential should exercise caution when consuming acne supplements, as some of these products may pose a risk to the developing fetus.

High dietary doses of preformed vitamin A (> 10,000 IU) during early pregnancy are associated with neural crest defects such as cleft lip, ventricular septal defect, transposition of the great vessels, hydrocephalus, and craniosynostosis [19].

In our sample, 6.1% of acne supplements sold online included potentially teratogenic levels of vitamin A. The teratogenic potential of another 8% of products containing vitamin A could not be determined because the products did not specify the form of vitamin A [20].

In terms of marketing strategies, most products (55.1%) included the terms “research” or “clinical study” on the labeling, and some products cited the research used to support the claim. Two studies cited by a product were evaluating magnesium, B6, and a plant extract (*Vitex agnes cactus*) for use in premenstrual syndrome [21,22]. These studies did not evaluate use of these components for acne. One website referenced three articles that were not found online and could not be substantiated. During the editing process, these articles were removed from the product’s website. Another article did not appear in a PubMed-indexed journal [23].

Our survey documented a wide variety of ingredients contained in these products, including many ingredients that have not been tested in human acne studies. The most included ingredients outside of vitamins and minerals were MSM, CoQ10, horsetail powder, pepper extract, grape seed extract, turmeric, DIM, and licorice root extract. The topical application of grape seed extract is associated with decreased sebum content in human skin [24]; however, we were unable to locate research on oral grapeseed extract intake or the other listed compounds in acne.

Interestingly, the few plant compounds (kaempferon, quercetin, green tea extract and nobiletin) that have been studied in hamsters and in vitro were not the most commonly used extracts. Some unique and unexpected ingredients included bovine adrenal powder, a proprietary enzyme blend including digestive enzymes, bacteriophages intended to affect gut bacteria, and bovine colostrum, intended to improve natural defenses.

High-dose vitamins and minerals were used in multiple products and represent another area of concern. Vitamins A, B2, B3, B5, B6, B7, B12, C as well as chromium and zinc were included in very high doses. As zinc has been shown to reduce acne, it was unsurprising that zinc was the most commonly used mineral (65%) [6].

Supraphysiologic doses of vitamins and minerals included in dietary supplements have been linked to multiple side effects [25]. For example, vitamins B6 and B12 have been associated with a worsening of acne in some reports [26]. Surprisingly, products in our sample included both of these ingredients at high doses: vitamin B6 at 2,500% of Recommended Dietary Allowance (RDA) and vitamin B12 at 20,833% of RDA.

As this analysis focused on products sold online, it highlights dangers posed to a vulnerable pediatric population. Many patients suffering from acne are minors. Anyone,

including children, can order acne supplements online. Parents and pediatricians should be wary of these products, as they are readily available online.

Finally, of significant concern is that approximately 1 in 5 (20.8%) supplements sold in multiple outlets (manufacturer, third-party, Amazon) displayed varying doses of ingredients. It is unclear which label consumers should use to evaluate the dose and ingredients included in the supplement.

Limitations

As our study was designed only to investigate products sold online, this represents a limited sample of acne supplements. Further research should evaluate products sold in stores. In addition, the authors could not find any PubMed indexed studies evaluating the components of these products using laboratory testing.

Dietary supplements marketed for acne include supraphysiologic levels of vitamins and minerals as well as food extracts, botanical extracts, amino acids, animal products, and microbes. These products do not require US FDA approval and thus do not undergo the same rigorous safety and efficacy testing as pharmaceuticals; however, most products include the term “research” or “clinical study” on their label. Few products undergo testing by third parties, although they can be pharmacologically active and can be linked to adverse effects. Many of the ingredients included in acne supplements have not undergone RCTs to evaluate their efficacy, and high doses of vitamin A may be associated with birth defects in pregnant patients.

As the US FDA does not routinely monitor supplements sold in stores or online, consumers and physicians reporting is vital for monitoring adverse events. The US FDA has an online Safety Reporting portal, which streamlines the process of reporting product safety issues. The portal may be found here: <https://www.safetyreporting.hhs.gov/SRP2/en/Home.aspx?sid=0506bbbe-42e5-40f9-a58b-742b04d74295>

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