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INVITED COMMENTARY

The Marketing of Dietary Supplements: A Canadian Perspective

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Abstract Dietary supplements are widely used in Canada. This paper presents an overview of commonly-used supplements, including their purported health benefits, as well as the best current evidence as to the accuracy of these claims. Types of supplements discussed include herbal products, glucosamine, chondroitin, weight-loss products, and exotic fruit juices. The paper also discusses possible harmful side effects from various supplements, especially herbal products. It then examines the major methods by which supplements are marketed, including health food stores (HFS), pharmacies, and supermarkets; newspaper, magazine, and TV advertising; and multilevel marketing. Most of the marketing of supplements is concentrated on products that are expensive but where supporting evidence is quite weak, and misleading and dishonest marketing strategies and claims are widespread problems. Dietary supplements are regulated in Canada by the Natural Health Products Directorate, an agency of the federal government. The new regulations came into force in 2004, but misleading and dishonest marketing is still widespread.

Keywords Supplements · Health food stores · Herbs · Multilevel marketing · Marketing methods · Advertising

Introduction

Dietary supplements refer to any substance taken in addition to regular food. Supplements include vitamins, minerals, amino acids, herbs, enzymes, and various substances extracted from plants and animals. As they are bioactive substances, they therefore pose a risk of adverse side effects. Three-quarters of Canadians take supplements, and one in three uses them every day [1].

Hundreds of different supplements are sold in Canada. Claims are routinely made that these supplements deliver various benefits, but in the large majority of cases, the supporting evidence is weak or even non-existent. Only in a small number of cases is there strong supporting evidence of the benefit of supplements. We see this most clearly with micronutrients. Multivitamins – meaning pills containing a broad spectrum of vitamins and minerals – may be recommended for various groups of people, such as the elderly, whose diets are low in nutritional quality. Iron and folic acid supplements may be of value for many women during their reproductive years. There is strong evidence that most people in Canada have inadequate vitamin D status. Supplements may improve bone health and enhance resistance to cancer – especially colon cancer – and other diseases [2, 3]. The case for vitamin D supplementation is strongest among the elderly, people with dark skin, and those who expose little skin to the sun. Canada's Food Guide now recommends that all people over age 50 take a supplement of 400 IU (10 μg) of vitamin D per day. There is evidence that many people need a significantly higher dose, at least 1000 IU (25 μg) per day [2, 3], although this area is controversial.

Most of the marketing of supplements is concentrated on products where the supporting evidence is far weaker but the profit potential is far greater. Here, we examine a selection of examples. The paper then surveys the main methods of marketing supplements in Canada and documents the widespread problem of misleading and dishonest marketing strategies and claims.

Regulating the supplement industry and protecting consumers from fraudulent and misleading claims presents many challenges. The paper reviews the current regulatory status of dietary supplements in Canada.

Hope springs eternal in the human breast.
A. Pope, Essay on Man, Epistle i.

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Supplements that are Widely Marketed: Does the Evidence Support the Claims?

Herbal Supplements

Each of the following herbal supplement assessments is based primarily on information from two reliable Internet sites – the Mayo Clinic and the National Center for Complementary and Alternative Medicine [4, 5] – as well as specific references cited.

Curcumin, a substance found in the spice turmeric (*Curcuma longa*). This supplement has been claimed to provide antioxidants for "good health," as is stated in certain promotional advertising, and to help relieve joint inflammation. Limited clinical evidence suggests that it may have some value for the treatment of arthritis [6, 7].

Echinacea (Echinacea spp) Products containing this herb have become popular for treating or preventing colds, flu, and other infections. Echinacea appears to contain substances that stimulate the non-specific immune system [8, 9], which is the probable explanation for any benefit seen against infections. There have been several randomized double-blind controlled studies (RCTs), but results have not been consistent [5]. In some studies, the herb was reported to shorten the duration of a cold by about half a day and to slightly reduce symptom severity, but in other studies no benefit was observed. Based on this rather weak evidence, echinacea cannot be recommended for the treatment or prevention of either colds or flu.

Evening Primrose Oil (Oenothera biennis) This is used for eczema and other conditions involving inflammation, such as rheumatoid arthritis. It is also used for conditions affecting women's health, such as breast pain associated with the menstrual cycle, menopausal symptoms, and premenstrual syndrome (PMS). The herb appears to have no value in the treatment of eczema [10], but it may be useful for rheumatoid arthritis and breast pain. Study results are mixed, however, and most studies have been small and poorly designed [5]. Evening primrose oil does not appear to affect menopausal symptoms [5], although a small study from Iran did report improvements in hot flashes [11]. The herb contains gamma-linolenic acid (GLA), an omega-6 essential fatty acid, which appears to be the active ingredient.

Ginkgo (Ginkgo biloba) This herb has gained much popularity based on claims that it improves the memory and may be helpful in the treatment or prevention of Alzheimer's disease and other types of dementia. Most trials that generated positive findings were small and had a relatively short period of follow-up [5]. A large longitudinal study from France reported that persons who took a product containing ginkgo had a slower rate of cognitive decline [12]. However, as this study was observational, there may have been errors caused by confounding. The most reliable results came from a RCT carried out across the USA on 3,070 people aged 72 to 96 [13], who were given either the herb or placebo and were then monitored for six years. Findings from this large RCT revealed no benefit in either memory function or rate of cognitive decline.

Taken as a whole, these findings provide little solid evidence that ginkgo has real value in either improving memory in older adults or helping to prevent dementia. Limited evidence suggests that the herb may improve memory and speed of mental processing in healthy young or middle-aged people.

Ginseng This is among the most popular of herbs, and it is used for a variety of reasons, the most common of which are increased sense of well-being, stamina, and improved mental and physical performance. As with several other herbal products, there are many conflicting studies regarding the medicinal benefits of ginseng. One issue is that much of the supporting evidence rests on its use in traditional Asian medicine over many centuries, and such anecdotal evidence is notoriously unreliable. Another major issue concerns the particular species of ginseng being studied. There are several plants that are called ginseng, notably Asian ginseng (*Panax ginseng*) and Siberian ginseng (*Eleutherococcus senticosus*). It seems likely that many products called "ginseng" are made from cheap substitutes. Processing methods may also be an important source of variation between products. Overall, there is very little solid evidence that ginseng lives up to the many lofty claims of its efficacy [5, 14].

Goldenseal (Hydrastis canadensis) This is used for several disorders, particularly infections such as colds and other respiratory tract infections. However, there is little solid evidence supporting its use for any health disorder [5].

Milk Thistle (Silybum marianum) This herb is claimed to have protective effects on the liver and to improve liver function. It is given as treatment for liver cirrhosis, chronic hepatitis, and gallbladder disorders. Although there is some supporting evidence of efficacy, it is far from conclusive [5].

Saw Palmetto (Serenoa repens) This is most commonly recommended for treating benign prostatic hypertrophy (BPH). Findings from clinical studies have been contradictory. The largest studies saw no benefit [5].

Sea Buckthorn This preparation contains omega-7 fatty acids that will, according to promotional advertising, help to retain "healthy, vibrant young skin," No relevant information could be found in any database.

St. John's Wort (Hypericum perforatum) In recent years, there has been much interest in this herb as a treatment for mild to

moderate depression, and it has been reported to have fewer side effects than conventional drugs [5]. However, evidence as to its effectiveness is mixed. Several trials reported that the herb was effective [15], while other studies generated negative results [5]. Therefore, no definite conclusion is possible.

The examples above illustrate a common story line with herbal products: a strong claim that the herb has important benefits, withsupporting evidence from a few studies, most of which are small and poorly designed, but failure to confirm these results in larger, well-designed RCTs and other studies.

Unlike conventional drugs, herbal supplements generally lack standardization of active ingredients, and there can be a great deal of variation between different brands of what is ostensibly the same herb due to factors such as the species of plant or part of the plant that is used and the extraction method. For example, there have been wide variations reported in the concentration of active components among different samples of ginseng [16] and St John's wort [17]. It is also entirely possible that some manufacturers may simply be using cheap ingredients in place of expensive herbs. For these reasons, an herb that was effective in a published study may be of no value when used by consumers.

Herbal Cocktails

Some products comprise a dozen or so herbs, each with a Latin name. As very little research has been conducted on herb mixtures, there is no good reason to be confident that such supplements will achieve any clinical benefit. Moreover, such herbal cocktails pose the risk of inducing harmful side effects that would be very difficult to relate to any specific herb or herb combination. Polypharmacy is always hazardous, whether it is based on conventional drugs or herbal cocktails.

Potential Hazards of Herbal Supplements

Herbs often have harmful side effects. For example, the use of ginkgo has been linked to headaches, nausea, gastrointestinal upset, diarrhea, dizziness, and allergic skin reactions [5]. Even more seriously, many deaths have been reported from the use of herbs [18]. Another potential hazard is an herb's interaction with various drugs. This occurs most commonly with St John's wort and to a lesser extent with ginkgo [19]. The problem is exacerbated by the fact that supplement users often fail to tell their physician that they are using a supplement. An American survey, for example, reported that among herbal and dietary supplement users with chronic conditions, less than 51 % disclosed the use of supplements to their healthcare provider [20].

Herbs can also be harmful to people with certain medical conditions. It is due to this concern that echinacea is contraindicated for use among patients with rheumatoid arthritis, systemic lupus erythematosus, multiple sclerosis, tuberculosis, or HIV infection [19].

The above examples are probably just the tip of the iceberg. It is highly likely that only a small fraction of harmful side effects from the use of herbs are ever diagnosed and recorded by a health professional.

Glucosamine and Chondroitin

These substances are commonly used for the treatment of osteoarthritis. Numerous RCTs have been carried out in which glucosamine and chondroitin were tested on patients with osteoarthritis of the knee or hip. The weight of evidence indicates that these supplements, either separately or in combination, do not bring about a clinically meaningful alleviation of joint pain or reversal of the narrowing of joint space [21].

Cellfood

This product is sold in health food stores (HFS). According to the leaflet that accompanies it, Cellfood "enhances the bioavailability of oxygen though its ability to 'dissociate' water molecules within the body – releasing nascent oxygen and hydrogen directly to the cells." The ingredient list includes almost the entire periodic table, even thallium, polonium, nitrogen, and the inert gases. The only elements missing are the ones well known to the general public as being toxic, such as lead and arsenic. Other ingredients include 16 amino acids and 32 enzymes. Despite this large number of substances, the recommended dose is a mere eight drops. The following words were recently added to the product label: "World's no. 1 selling oxygen & nutrient supplement." Further comment is hardly needed.

Weight-Loss Products

The obesity epidemic has given the supplement industry a perfect opportunity to expand sales in a new direction. A wide variety of dietary supplements are now marketed based on claims of inducing weight loss [22], with advertisements that commonly display the photo of a woman with a BMI of about 21. In a detailed review of supplements that were being sold in the USA, Sharpe and colleagues [22] evaluated evidence of the effectiveness of the most commonly-used ingredients: green tea, chromium picolinate, ginger root (*Zingiber officinale*), guarana (*Paullinia cupana*), white willow (*Salix alba*), Siberian ginseng, cayenne (*Capsicum annuum*), and bitter orange/zhi shi (*Citrus aurantium*). The investigators concluded that there was modest supporting evidence of the effectiveness of chromium and ginger root, but they found evidence for the others to be inadequate or negative. In addition, there was evidence of potential harm from bitter orange and guarana. Trials using hydroxycitric acid

(*Garcinia cambogia*) have reported modest weight loss (an average of 0.88 kg) [23].

Another herb that has been widely promoted for weight loss in recent years is hoodia (*Hoodia gordonii*). However, there is no evidence of its effectiveness, and little is known regarding its safety [5].

Exotic Fruit Juices

Acai (*Euterpe oleracea*), goji (*Lycium barbarum*, also known as wolfberry), mangosteen (*Garcinia mangostana*), and noni (*Morinda citrifolia*) are marketed in the form of juices that are often claimed to provide superior nutrition and enhanced health benefits. However, searches at Medline identified only a handful of clinical studies on these products, and they provide little evidence supporting the claimed benefits. For example, in a review of mangosteen, the marketing claims were found to be overstated and failed to disclose the "severe methodological weaknesses" of the cited research [24]. A clinical study on acai, while reporting positive results, was uncontrolled, included only 10 subjects, and lasted only a month [25]. A study on goji reported a variety of benefits after only 14 days, but the study was carried out by a company that sells the product [26].

Despite the lack of credible evidence of health benefits, these juices are sold at exorbitant prices. Health food stores in Canada charge about $50 to $60 per liter for them. By contrast, supermarkets sell common fruit and vegetable juices for less than $3 per liter.

Marketing Claims

The previous section showed that a wide variety of dietary supplements are marketed in Canada and that they are sold for an equally wide variety of reasons. We will now look at the common marketing claims designed to induce sales of supplements, and a close examination reveals that a handful of such claims occurs with great frequency.

In order for claims to have real credibility, we need to see consistent evidence from well-conducted RCTs with clinical endpoints that show health benefits, and which are published in peer-reviewed journals. Such evidence, however, is seldom available. Instead, what we typically see is weak evidence presented as if it were established fact. Examples of this are: (1) a particular herb that may have been used as a treatment for centuries and therefore, it is argued, must be effective; (2) evidence based on one or two studies that were small or poorly designed; (3) anecdotal evidence, often from an unqualified person with a serious conflict of interest; and (4) the use of testimonials as a variation of anecdotal evidence.

The marketers of supplements often make claims based on physiological or biochemical changes in the body. In each such case, the biomedical mechanism is so simple that the average person can quickly understand it. Such claims have little credibility. Here are the three most common examples of this marketing strategy.

Many supplements, especially herbs, come with the claim that they stimulate the immune system. In a few cases, such as echinacea, there is supporting evidence, but in most cases, solid evidence is lacking.

Another claim often used with herbal products is that they somehow accelerate the process of detoxification so that the body is cleansed. Detoxification is, of course, a well-established process. However, claims that particular supplements induce detoxification and lead to enhanced health are devoid of supporting evidence.

Many supplements are sold with the claim of being "rich in antioxidants." It is true that many foods, such as fruits and vegetables, are naturally rich in antioxidants and are also excellent for maintaining good health. However, the relationship between foods, their antioxidant content as well as the presence of other substances, and corresponding risk of disease is complex and not properly understood. In actuality, the connection between intake of antioxidants and health outcome seems to be quite weak. This is evidenced by the results of large RCTs in which β-carotene or vitamins C or E were tested and in which the dose used was typically several times higher than the RDA. Taken as a whole, the findings show no meaningful evidence of a reduced risk of cancer or heart disease. Indeed, a meta-analysis concluded that supplementing with these antioxidants led to an *increase* of approximately 2 % to 5 % in all-cause mortality [27]. Based on this evidence, it is therefore misleading to assert that because a product is "rich in antioxidants," it will improve health or prevent disease.

The above overview shows that many of the claims commonly used in the marketing of dietary supplements are either misleading or blatantly dishonest. The supplement industry is obviously exploiting the fact that most people have a weak understanding of biomedical science.

How Dietary Supplements are Marketed

We will now turn our attention to the most common methods employed in the marketing of dietary supplements.

Health Food Stores, Pharmacies, and Supermarkets

Health food stores (HFS) are a major source of dietary supplements. There are several hundred such stores in Canada, and each typically sells a bewildering variety of supplements. Also, in recent years, most pharmacies and supermarkets have given over substantial shelf space to supplements.

Several studies have reported that HFS staff often dispense highly misleading advice. Here we look at two Canadian

studies. In one study, an investigator in Ontario posed as the mother of a child with Crohn's disease [28]. Of the 32 HFS visited, 23 (72 %) offered advice, and the advice was remarkably inconsistent, with 30 different herbs and nutritional supplements recommended.

In a much larger study, visits were made to 260 HFS, pharmacies, and supermarket pharmacies across Canada [29]. The results reveal that when questions were asked of HFS staff, 88 % of the recommendations were either unscientific (6 %) or were poorly supported by scientific literature (82 %). By contrast, this occurred only 27 % of the time in pharmacies/supermarkets. Conversely, in two-thirds of visits to pharmacies/supermarkets, staff gave advice considered to be accurate or fairly accurate, but this seldom occurred in HFS settings (68 % vs. 7 %). These findings reveal a major difference between HFS and the supplement sections of a pharmacies or supermarkets. In the latter, customersrequesting advice are far less likely to be advised to buy useless supplements. This is not surprising, as pharmacists are trained health professionals and must abide by a code of ethics.

The following a realistic HFS scenario. A middle-aged man tells the salesperson that he would like to have more energy, that he sometimes forgets things, has an ache in his knee, and that his father died of cancer. He will probably be advised to take a handful of supplements, each costing between $20 and $60 per month. This could easily add up to between $100 and $200 per month, and it is quite likely that the recommended supplements will have little or no beneficial effect on his health.

Advertising in the Media

Newspapers and magazines are major marketing tools for supplement sales. The Edmonton Journal, for example, regularly includes four- or eight-page supplement advertising inserts, and readers wishing to buy supplements are then directed to either HFS or Internet websites.

Newspapers occasionally carry advertisements for a single supplement, as illustrated in the following example. The Edmonton Journal recently carried a full-page advertisement for a supplement called Soma HGH. In large print, the headline stated: "Experts in the New England Journal of Medicine, Science, Newsweek, Time, and more report human growth hormone makes you look and feel 20 years younger." Most of the page consisted of a detailed account of the fantastic benefits of the human growth hormone (HGH). But buried deep within the advertisement was an indication of what was really being sold. It read: "The 17 botanical extracts combined in Soma HGH are prepared in accordance with the Homeopathic Pharmacopoeia of the United States and are recognized as official medicines….They ….have none of the dangerous or unpleasant side effects of synthetic drugs. They are among the safest preparations known to medical science." In other words, what was being sold was not HGH, but a supplement containing substances in quantities so minute as to be harmless. The seller of this snake oil was promising potential customers that the product had two mutually exclusive features: a pharmacologically active dose of HGH, yet one that was totally harmless.

Television is another common medium for the advertising of supplements. Often this is done as infomercials, which are advertisements in the form of TV programs that are produced and paid for by commercial companies. Infomercials are typically 30 minutes in length and air during the night.

Multilevel Marketing

The multilevel marketing (MLM) strategy is used in a variety of product sales, such as Avon cosmetics and Tupperware, in which company salespeople recruit additional salespeople, who then sell direct to the public on a commission basis. MLM is often used by dietary supplement manufacturers, and its focus is profit, not consumer health. Based on my own observations, few MLM salespeople hired to sell supplements have any real training in nutrition.

Here is one example of MLM in action. In 2007, advertising leaflets were distributed in Edmonton promoting a public lecture by Dr. Earl Mindell. The goal was to recruit persons to sell goji juice. The leaflet referred to Mindell as "widely regarded as the world's #1 nutritionist" and the product as "the biggest discovery in nutrition in the last 40 years." Both statements were enormous exaggerations.

MLM appears to have become much less prevalent in the last few years. Presumably, it is not generating the desired sales volume, and print media advertising is clearly now the preferred marketing strategy.

The Internet

The Internet is a tool perfectly suited to the marketing of dietary supplements. There are a great many websites that sell supplements, and they send out millions of spam e-mails. However, as very few of these websites are based in Canada, the Internet marketing strategy is beyond the focus of this paper.

Regulations on the Marketing of Supplements

The dietary supplement industry poses many regulatory challenges for federal agencies.

In 1999, the Canadian federal health department, Health Canada, created the Natural Health Products Directorate, an organization designed to regulate dietary supplements [30]. The directorate's mission is to ensure that Canadians have access to natural health products (NHP) that are safe, effective, and of high quality. All manufacturers, importers, packagers, and labelers of NHP must now have site licenses, and any new

NHP must have a product license. The regulations require a pre-market review of products to assure Canadians that label information is truthful and that health claims are supported by the appropriate scientific evidence.

The announcement of these regulations gave the clear impression that there would be greater honesty in the marketing of supplements. In other words, a bottle of herb X sold in Canada should now contain the amount of the herb stated on the label. Furthermore, if marketers claim that herb X detoxifies a person, then there must be good evidence to substantiate that claim.

After the 1999 announcement, the supplement industry was then given several years to implement the regulations, which came into force in January 2004. At the time of this writing (July 2013), the regulations have been in force for nine years, but as has been documented in this paper, dishonest marketing is still very widespread. The regulators appear to be asleep at the controls.

Another organization with a role in this area is Advertising Standards Canada [31], the national self-regulatory body for Canadian advertisers, which developed the *Canadian Code of Advertising Standards*. The code includes the following statements: "Advertisements must not contain inaccurate, deceptive or otherwise misleading claims, statements, illustrations or representations, either direct or implied…..Advertising claims must not imply that they have a scientific basis that they do not truly possess." It is clear, however, that this organization has not stopped the widespread practice of dishonest supplement advertising.

Conclusions

The marketing of dietary supplements in Canada reveals a situation wherein the maximizing of sales and profits are, by far, the leading priorities. At the same time, ethics, honesty, and a sincere desire to improve the health of consumers have been relegated to a minor role. Marketers of dietary supplements frequently use scientific evidence the way a drunk uses a lamppost: more for support than illumination.

The general public needs to be informed of these problems. In particular, they should be told to ignore advertisements for supplements and not to listen to sales staff in HFS. Instead, when people want advice, they should use only credible sources of information. There are a number of Internet sites that provide reliable information. Examples include the Mayo Clinic and the National Center for Complementary and Alternative Medicine [4, 5]. Dietitians are another trustworthy source of information, although most people seldom come into contact with a dietitian. Other health professionals that the public might consult are physicians and pharmacists. Although their level of expertise in the subject is likely to be limited, they can at least provide caution, emphasize that much advertising is likely to be false or misleading, and warn that many supplements, especially herbs, may pose a risk of harm, either directly or by interacting with prescription drugs.

The evidence examined here reveals that regulatory agencies have badly failed in their mission.

Compliance with Ethics Guidelines

Conflict of Interest Norman J. Temple has received book sale royalties from Humana Press, Inc. (Springer), and has received payment for lectures, including service on speakers bureaus, and has been reimbursed for travel/accommodations/meeting expenses by Saskatchewan University.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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