To the Graduate Council:

I am submitting herewith a thesis written by Bethany Hope Brown entitled "Perceptions Related to Dietary Supplements among College Students." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Nutrition.

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Perceptions Related to Dietary Supplements among College Students

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Abstract

Introduction: Prior research has shown that dietary supplement use is a common practice among college students. Most of these studies used surveys and questionnaires to provide an overview of supplement use in the U.S. However, in-depth information on college students' perceptions and/or concerns related to dietary supplement use is lacking. The aim of this study was to capture a deeper understanding of how college students perceive dietary supplements.

Methods: A qualitative case study design was used, which allowed a greater understanding of the case through content analysis. The study used a secondary database, which consisted of web log (blog) posts completed as an assignment in an undergraduate introductory nutrition course. Students were asked to describe their experiences with and beliefs about the use of dietary supplements in a discussion format using a blogging tool. Blog posts were coded and analyzed using QDA Miner computer software. The most commonly mentioned topics were then explored in their original context.

Results: Final coding of the blog data revealed four main categories: supplements used, rationale for use, sources of information, and perceptions about the safety of dietary supplements. The most commonly mentioned supplements were multivitamins, diet pills, creatine, and protein supplements. Blog data revealed that a common reason students took dietary supplements was a perceived lack of nutrients in their diet. Information about dietary supplements came mainly from friends' or family members' experiences with supplements. Many students had misconceptions about supplements, were not familiar with them, and/or questioned their effectiveness.

Conclusions: Based on the study findings, educational programs for college students should focus on common misconceptions; the safety and efficacy of supplements, especially diet pills and protein supplements; critical analysis of supplement information; and the appropriateness of supplement use.

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Section 1: Literature Review

Introduction

Since the Dietary Supplement Health and Education Act (DSHEA) was passed in 1994, dietary supplements are more available to consumers than ever before [1]. The sales of dietary supplements have risen from an estimated $4.0 billion in 1994 to $23.7 billion in 2007 [2-3]. With the increased access to supplements, many questions have arisen about who is using supplements and what drives their decisions regarding supplement use.

Supplement use nationwide has been studied using various nationally representative surveys. Responses to these surveys indicated that vitamins or minerals were used by 35.0% to 52.0% of the respondents and between 14.8% and 18.6%, or an estimated 38.2 million adults in the U.S., used herbal supplements within the previous year [4-6]. Multivitamins/multiminerals were the most reported type of supplement used, followed by vitamin E, vitamin C, and calcium [6]. The most commonly used herbal supplements reported were Echinacea, ginseng, and Gingko biloba [5]. Approximately half of supplement users took two or more different supplements [5-6]. Women were more likely than men to use dietary supplements, including herbals [5-6]. Supplement use was found to be higher in those who reported good health as opposed to fair or poor health [5-6].

Additionally, several studies that have looked at supplement use by college students revealed that 26.3% to 79.0% of the students surveyed had engaged in nonvitamin, nonmineral supplement (NVNM) use within the past year [7-10]. About 35.0% of college students reported no knowledge or thoughts regarding supplement use [9]. The average number of different

supplements taken by students was greater than two, with Echinacea, ginseng, and Gingko biloba listed as the most commonly used NVNM supplements [7-10].

Neuhouser and colleagues, in 1999, and Kennedy, in 2005, studied the rationale for use of dietary supplements in the U.S. Their findings revealed that participants took supplements for many different reasons, including difficulties encountered when trying to consume a balanced diet, to feel better, and for preventive purposes [11]. Use of herbal supplements was found to be an alternative to traditional medical care, used when conventional treatment was not working, or to treat conditions including colds, stomach illness, arthritis, and anxiety [5]. Participants indicated that they obtained information about supplements from family members, friends, or from healthcare professionals [5, 11].

Studies that focused on college students' beliefs about dietary supplements reported that the rationale for use included general health promotion, prevention of depression, and immune function enhancement [7-8]. Other reasons cited were weight loss promotion, energy level elevation, diet enhancement, and increased muscle development [7, 9]. Ambrose and Samuels found that herbal supplement users had a stronger belief in the safety of herbal supplements over prescription medications compared to nonusers [8]. The most common sources of information on dietary supplements for college students were from family members or friends, health food stores, media sources, or their physician [7-9].

The aim of this study was to capture a deeper understanding of college students' perception of dietary supplements. A thorough review of the literature revealed that all previous studies about dietary supplement use and rationale for use were quantitative studies,

using surveys or questionnaires with closed-ended, forced-choice questions. However, in this study qualitative research methods were used for an analysis of an observation beyond simple calculation [12]. The reasoning behind people's perceptions and emotions about an experience or issue can become more clearly understood through a qualitative study compared to quantitative methods [12]. To do this, a qualitative case study design was used as an appropriate method to provide a more in-depth exploration of the perceptions of dietary supplements among the college-aged population.

This qualitative study was an exploration of online web logs (blogs) from an introductory nutrition course. When blogging, which is an online journaling process, is used in courses, students are able to read and comment on each others' information [13]. By encouraging reflection on one's own thoughts and opinions, blogs are useful for sharing personal ideas and beliefs [14]. Blogs provide an open, uninhibited environment for students, allowing them to think and write freely, while sharing with classmates from personal experiences [15]. By focusing on a single case, the blog posts of an introductory nutrition course, a thorough description of college students' perceptions of dietary supplements was produced.

Literature Review

Dietary Supplements

The Dietary Supplement Health and Education Act of 1994 (DSHEA) defined a dietary supplement for the first time by law as:

"a product (other than tobacco) intended to supplement the diet that bears or contains one or more of the following dietary ingredients: a vitamin, a mineral, an herb or other botanical, an amino acid, a dietary supplement used by man to supplement the diet by increasing the total dietary intake, or a concentrate, metabolite, constituent, extract, or combination of the preceding ingredients. A dietary supplement is a product that is labeled as a dietary supplement and is not represented for use as a conventional food or as a sole item of a meal or the diet. Also described are the variety of forms—capsule, powder, softgel, gelcap, tablet, liquid, or other form—in which these products can be ingested." [16, p.1-2]

DSHEA, which is an amendment to the Federal Food, Drug, and Cosmetic Act, provides that the U.S. Food and Drug Administration (FDA) does not have to approve dietary supplements before they go on the market, except for supplements that contain a new dietary ingredient [17]. Supplements are regulated more like food products, which is less restrictive than for products such as drugs [18]. Under these regulations, a dietary supplement can be marketed without any verification of product safety or efficacy provided by the manufacturer [19]. After a supplement is marketed, the burden of proof that it is "unsafe" is on the FDA. Only with evidence from the FDA can a supplement be removed from the market or restricted

[17]. With the implementation of DSHEA, dietary supplements are more accessible to consumers than ever before [1].

Supplement Use in the U.S.

With increased accessibility to supplements, questions began to arise about how many people were actually using supplements. A study by Fennell analyzed the data from the 2000 National Health Interview Survey (NHIS), which is a survey conducted by household interviews each year in the U.S. using a nationally representative sample of the U.S. population. One section of the survey asked questions related to dietary supplement use in the previous year. Responses indicated that vitamins or minerals were used by 52.7% of the participants (n=24,834), and herbal supplements were used by 14.8%. Vitamin and mineral use increased with age in this sample as 40.2% of 18-24 year olds used vitamins or minerals compared to 61.0% of 55-69 year olds [4].

Another study using NHIS data looked at responses to a supplemental questionnaire of a 2002 survey about complementary and alternative medicine (NHIS CAM). Of the adults that participated in the survey (n=31,044), 18.6% (5,787) reported the use of herbals in the past year; 79.3% (24,625) reported no use of herbals; 2.0% (632) did not recall herbal use or did not respond to the question, and therefore were left out of further analysis in the study. Using these data, it was estimated that in 2002, 38.2 million adults used herbal supplements. The most widely used herbal supplements reported were Echinacea, ginseng, and Gingko biloba. Forty-eight percent of herbal supplement users indicated the use of two or more of the herbals listed on the survey [5].

Herbal use was more likely to occur in women than men, as 21.0% of all female respondents and 16.7% of all male respondents (P<0.001) indicated herbal use in the previous year. Survey participants aged 45-64 years were more likely to indicate herbal use (21.9% of that age group, P<0.001) than any other age group. Areas of residence in the country differed in herbal use, with adults living in the western U.S. having the most herbal users (24.9% of residents, P<0.001), followed by the Northeast (19.4%, P = <0.001). Also, herbal supplements were more likely to be used by adults who described their health status as "excellent" (19.3%) or "very good" (19.6%) as compared to those who indicated "fair" (17.4%) or "poor" (14.3%) health status ($P \leq 0.001$ for all) [5].

Another survey representative of the U.S. population, the National Health and Nutrition Examination Survey (NHANES), used an in-depth questionnaire as well as an interview in the home, to collect data. It included a wide range of questions regarding demographics and health, some of which addressed the use of dietary supplements. A list of supplement examples were given to the participants along with the questionnaire and any use was recorded for the past month [6].

Of the 4,862 adults over 20 years of age who completed the dietary supplement section of NHANES, 52% (SE=1.4) used a supplement in the last month. Thirty-five percent (SE=1.3) of respondents used a multivitamin/multimineral, making it the most reported supplement, followed by vitamin E (12.7%, SE=0.9), vitamin C (12.4%, SE=0.9), and calcium (10.4%, SE=0.8). Women were more likely to use dietary supplements than men (56.7%, SE=1.7 vs. 46.9%, SE=1.5), as were respondents over the age of 60 years (63.3%) compared to ages 20-39 years

(43.3%). Those who reported excellent to very good health reported higher supplement use (54.9%, SE=1.7) than those who reported fair to poor health (46.7%, SE=2.1). Of all reported supplement users (2,399 adults), 52.7% took two or more different supplements. Almost 25% of all respondents who took vitamin C or calcium/antacid had done so for ten or more years. Almost 50% of multivitamin/multimineral users had used them for two or more years [6].

Overall, according to the various surveys, supplement use in the U.S. was reported by a large portion of the population (about 50%), with many reporting the use of two or more supplements. Even though supplement use was found to be more likely in older age groups (45-64 or 60+ years of age), around 40% of adults aged 18-24 reported supplement use as well. Supplement use in this specific population, focusing on college students, is reviewed below.

Supplement Use by College Students

A study by Newberry and colleagues in 2001 looked at college students' use of non-vitamin, non-mineral (NVNM) supplements. The study sample consisted of 272 randomly selected Washington State University undergraduate students who responded to a questionnaire by mail (68 of which completed by telephone) that addressed NVNM supplement use in a forced-choice format. Participants indicated use of NVNM supplements in the previous year by choosing from a list of supplements. Also, the option to select "other" was available [7].

Analysis of the questionnaires revealed 48.5% (132) of the students had engaged in NVNM use within the past year, with 58% (77) of users taking two or more individual supplements. The most commonly used NVNM supplements were Echinacea, ginseng, St.

John's wort, and Gingko biloba, respectively, and were usually taken daily or weekly. Adverse reactions, such as elevated blood pressure and heart rate, trouble sleeping, irritated skin, and sore muscles, were reported by 14% (19) of NVNM supplement users [7]. Eleven of the students that reported adverse effects used supplements that contained ephedrine, a substance that was banned by the FDA in 2004 due to such adverse events as psychiatric symptoms, GI problems, and heart palpitations associated with its use [7, 20]. Many of these students continued NVNM use even though they experienced undesirable side effects [7].

A study addressing herbal supplement use at Rutgers University used surveys as well. Of the 1,754 (median age=21 years) students who completed the questionnaire, 51% (891 students) indicated use of herbal supplements. The number of supplements taken by each student varied from one to eight and the average number of different supplements taken by students was 2.2 [8].

A study by Perkin and colleagues looked at NVNM supplement use at an urban, mid-sized university using a 15-question survey given to 1,000 students with a mean age of 26 years. NVNM supplement use was indicated by 26.3% of participants, while 34.7% reported no knowledge or thoughts regarding supplement use. Students used an average of 2.7 (SD=2.4) different supplements each. The most commonly reported supplements used included ginseng, Echinacea, protein powder and/or amino acids, and Gingko biloba, respectively [9].

Johnson and Blanchard conducted a survey of 506 students at a large university in the Southeast U.S. who were enrolled in an introductory psychology course (n=410) as well as other classes (n=126). The herbal questionnaire consisted of 39 herbal supplements, to which the

students were to indicate regularity of use on a scale from 0 (never) to 3 (frequently). Results of the survey found that within the previous year, 79% of students had taken an herbal supplement. Researchers noted that green tea, ginseng, chamomile, ginger, and Echinacea were the most commonly taken herbals and that herbal use increased with age (B=.15; P=.001) [10].

Overall, use of supplements by college students (26.3% to 79%) was indicated as a fairly common activity by these studies, which also showed that many students took two or more different supplements. Use of supplements by some students continued even after they had experienced adverse effects. On the other hand, in one study, over one third of the students reported a lack of knowledge regarding dietary supplements and indicated that they had no thoughts about ever using them. These differing views on supplements raise the question of why people use supplements. The rationale behind the decision to take a dietary supplement is explored in several studies below, first broadly in the U.S. population and then focusing on college students' rationale.

Rationale for Dietary Supplement Use in the U.S.

The rationale for dietary supplement use was investigated in a study by Neuhouser and colleagues published in 1999. The study was done secondary to the Washington State Cancer Risk Behavior Survey of 1995-1996. Participants of the state survey were contacted by telephone to assess eligibility for the auxiliary study, which included taking a dietary supplement three or more times per week and living in the Seattle, Washington area. Qualified and willing participants (n=104, mean age of 44 years $\pm$ 13) completed a questionnaire related

to their motivations for using dietary supplements, such as why the participant started taking the supplement, what their health reasons were for supplement use, and why they took supplements instead of getting their nutrients from food. The survey contained one open-ended question that addressed how the participant obtained health information in the five years preceding the questionnaire [11].

The answers to these questions varied, but almost half of respondents said that they took multivitamins to feel better and because it was difficult to eat a balanced diet. Of all the multivitamin users (n=83), 42% reported that their main decision to take a supplement was based on information from a family member or friend, while 21% began supplement use based on advice from a health professional. The majority (75%) of vitamin C users (n=53) indicated prevention of colds and flu was their primary reason for taking the supplement. Vitamin E (58%) and calcium (81%) were most likely used for prevention of chronic diseases [11]. Those who only took herbal supplements were not included in this study, so the motivations for herbal supplement use alone were not addressed. This questionnaire consisted of only closed-ended questions with a list of responses from which to choose [11].

A study by Kennedy, using data from the 2002 NHIS CAM survey, looked at participants' reasons for herbal supplement use beyond the aforementioned demographics related to supplement use. Analysis of the data found that herbal supplement use was more common for those who delayed (27.7%, $P<0.001$) or evaded (27.2%, $P<0.001$) medical care compared to those who did not avoid medical care. Kennedy pointed out that this indicated probable use of herbals as an alternative to traditional medical care. In 2002, an estimated 21.4 million U.S.

adults took herbals to treat at least one condition. The most commonly reported conditions treated with herbals were head/chest cold (29.7%) and stomach/intestinal illness (10.6%). Other conditions treated with herbals included arthritis, anxiety, insomnia, and back pain. Approximately 36% of herbal users reported that herbal supplements helped them with their condition "a great deal." Over half (51.5%) of herbal users reported that one of their reasons for supplement use was because they "thought it would be interesting to try." The next most common reason, given by 47.0% of users, was that they believed it would help to combine herbs with conventional treatment. Other reported reasons for herbal supplement use included the belief that conventional treatment did not work and that a healthcare provider suggested use of the supplement(s) [5].

Overall nationwide, supplements were reportedly used for a variety of reasons including both as treatment and preventive measures. Specific rationale for use differed with specific supplements, such as calcium supplementation to prevent chronic disease and vitamin C supplementation to prevent a cold/flu. Different herbals were taken to treat problems such as back pain, anxiety, and stomach illness. Many of the supplement users began their use on the advice of others, such as family, friends, or healthcare professionals. Although these studies provided great insight into the rationale for supplement use in the adult population, these reasons may not apply to college students. Studies that have been done more specifically looking at the rationale for college students' use of supplements, with their unique time of life in college, are reviewed below.

College Students' Beliefs about Dietary Supplements

In addition to supplement use, the 2001 study by Newberry and colleagues looked at perceptions and beliefs of college students on the benefits and efficacy of supplements. Twenty-three reasons for supplement use were listed along with an "'other" response category, while efficacy was measured on a Likert-like scale. The most commonly reported (54% of 132) reasons for NVNM use were health promotion, disease prevention, and immune function enhancement. Other reported reasons included prevention of depression, weight loss promotion, energy level elevation, and increased muscle development. Nearly 78% of users believed that NVNM supplement use was effective. Less than 10% of NVNM users obtained information about dietary supplements from their physician, while 38.6% indicated that they received information from media sources. Lack of knowledge about the product was indicated as the most frequently reported reason for abstaining from NVNM supplement use [7].

In the study previously mentioned by Ambrose and Samuels at Rutgers University, the questionnaire included items with a Likert-like scale that indicated agreement or non-agreement with the statements on students' views of herbal supplements. Although uncertain of the effectiveness of herbal supplements over prescription medications, herbal users indicated a stronger belief in the safety of herbal supplements over prescription medications as compared to nonusers ($t=3.83$, $P=.001$). Students indicated that a family member or friend was the most common source of advice on herbal supplement use and for information about herbals. The next most common sources of information were the supplement users themselves and the media, respectively [8].

Expectations of herbal supplement use included improved general health, improved symptoms, and increased emotional stability. Of those who expected health improvements or emotional stability, over 60% indicated that those results occurred. Improvements in symptoms occurred for 92.5% (382) of the 413 students who expected this outcome. No change was experienced by 21.1% of supplement users, while 3.8% of those who took supplements experienced adverse effects [8].

Perkin and colleagues found, in their study of 1,000 college students, that friends and family were students' main information source on NVNM supplements (51.7%), followed by health food stores (43%). Students' most common rationale for NVNM supplement use included to increase energy, help weight loss, burn fat, and supplement a perceived inadequate diet. More women than men indicated that they took NVNM supplements to help with weight loss ($X^2(1)=24.44$, $P<.001$), stress ($X^2(1)=11.68$, $P=.001$), and the treatment or prevention of colds and/or sore throats ($X^2(1)=8.13$, $P=.004$). A greater percentage of men indicated that they took NVNM supplements for increased muscle mass ($X^2(1)=49.22$, $P<.001$). Over 35% of those students who took NVNM supplements gave reasons for supplement use that were not listed as a choice on the survey [9].

Overall college students in these studies who reported supplement use, had reasons similar to the U.S. adult population, such as supplementation of a perceived inadequate diet, advice from a family member or friend, and disease prevention. Some of the rationale that occurred more so in the college population than in older adults were weight loss, muscle gain, and increased energy. A greater portion of college users (60-78%) reportedly viewed their

supplements as effective compared to older users. Along with family and friends, the media was reported by students to be their source of information on supplements, while very few reported that they obtained information/advice from their physicians. Without advice from a healthcare professional or other reliable source, especially for supplements used for weight loss or muscle gain, students may not know all they should about the supplements they are taking and could be at risk for misinformation and/or harmful side effects.

Safety Evidence of Dietary Supplements

Serious adverse effects of dietary supplements have been reported to the FDA. An increasing number of reports, ranging from mild to severe, prompted the U.S. Government Accountability Office (GAO) to express concern about the safety of dietary supplements as well as the availability of reliable information about the products for consumers [21]. Despite the lack of consumer understanding regarding dietary supplements, the GAO noted that the FDA made only small efforts, such as brochure distribution and guides on its web site, to provide consumers with education on supplement labeling, efficacy, and safety [21].

In a 2006 study on adverse effects of supplement use in the U.S. population, Timbo and colleagues reported that adverse events were more likely to be reported by supplement users who took a combination of multivitamins/minerals, single vitamins/minerals, and herbals, than supplement users who took only one or two of those defined categories [22]. The lowest numbers of adverse events were reported by those who took a single herbal, vitamin, or mineral supplement. These data were obtained from the 2002 Health and Diet Survey

sponsored by the FDA. Of the 2, 101 reported dietary supplement users, a total of 4% experienced adverse effects that they contributed to supplement use [22].

Many events of adverse side effects of supplements may go unreported. A review of the National Institutes of Health, Office of Dietary Supplements website revealed current safety evidence of some of the most common dietary supplements taken in the U.S. Ginseng, a common herbal supplement, is often used for immune system enhancement and overall health maintenance. Side effects reported included headaches, GI upset, and sleep problems [23]. Gastrointestinal problems are commonly reported side effects of herbal supplements. Many herbal supplements may be labeled "natural" and therefore equated with "safe," but the safety of herbals can depend on their purposed action, potency, and dosage amount [23].

Another common dietary supplement taken in the U.S. is the multivitamin. Multivitamins can vary in their composition from brand to brand as there is no set definition of what a multivitamin should contain. Even the amount of each vitamin or mineral printed on the label is not always accurate, as manufacturers are only required to have the "actual" level of vitamin or mineral be equal or greater than what it says on the label [24]. Because of this, limited research is available on the efficacy or safety of multivitamins. A report released by the Agency for Healthcare and Quality in 2006 indicated that multivitamin use among individuals with poor nutrition status may be helpful in prevention of certain diseases, such as cancer [25]. However, other studies found that multivitamin use had no preventive effects. Further, though no adverse effects were consistently found, harmful side effects were evident when excessive amounts of some micronutrients were consumed [25].

The safety of some dietary supplements, such as protein supplements and other ergogenic aids, remain a safety concern. As with all supplements, as long as the label on one of these products identifies all of the ingredients, it can make a claim that it will enhance performance, even without scientific evidence to support the claim. Safety and efficacy do not have to be proven [26]. Even though some ergogenic aids, such as creatine, have been shown to improve performance, there are often adverse side effects. Nausea, weight gain, and cramping are common with creatine, and still unknown are the effects of long-term use. Evidence on many other ergogenic aids, including protein powders, show that they do not seem to be any more or less effective than a regular diet appropriate for gaining lean body mass. These products may, however, contain illegal substances [26].

Few studies have investigated the safety or efficacy of over the counter diet pills and other weight loss supplements, but these products are heavily promoted to consumers. A study by Pillitteri and colleagues found that many people had misperceptions about the safety of weight loss supplements, including the perception that the supplements had to be proven safe before they were placed on the market [27]. These supplements, like any dietary supplement, do not have to be approved by any government agency for safety or effectiveness, nor are they mandated to list side effects that may occur on the product label. Weight loss supplements are more readily available than prescriptions and with their misleading promises of great weight losses in short amounts of time, raise concern about the increasing number of users [27].

Summary of Dietary Supplements

In the previously reviewed studies, dietary supplement use was examined using surveys and questionnaires. Dietary supplements were found to be used by as much as 52% of the U.S. population and up to 79% of college students. Rationale for supplement use was found to vary among respondents, but many reported that they used supplements for preventive and/or treatment measures. Sources of information on dietary supplements included family members, friends, the media, and physicians. Although studies that used surveys and questionnaires have provided an overview of supplement use in the U.S. and among college students, in-depth information about students' perceptions and/or concerns related to dietary supplement use is lacking. More in-depth information will allow nutrition and other healthcare professionals to better understand how and why college students use dietary supplements. With this knowledge, college students' misconceptions, use of supplements in potentially harmful ways, and inaccurate and/or unreliable sources of information about supplements can then be better addressed. One way to obtain information from college students is through the use of technology in their classes. Blogging fits this description.

Blogging

Blogs

Qualitative methods with open-ended formats are viable alternatives to data collection techniques that use surveys. In this study, analysis of web logs, or blogs was used. By definition, a blog is an online web page made personal by the writer recording his thoughts, observations, and/or providing links to other websites the author declares noteworthy [28]. In

other sources, a blog is referred to as an online diary [14], a site of dated entries in a conversational or "story-telling" format [29] as well as a small website consisting of time-stamped posts made by the user [13]. Posts, or entries are listed in reverse chronological order, with the most recent post appearing at the top of the page [29]. For reactions to a post, there is usually a place to make a comment, also time-stamped, which is linked with all the other comments back to the original post and is available for all viewers to read [13-14].

Use of Blogs in the Classroom

Blogs can be used as an online forum for a group, where each person in the group can read the entries, add comments, and post entries of their own with free expression of thoughts and information. Blogs can be used in colleges and universities in this way, where students and professors are the ones posting and commenting as a means to promote group learning [13]. Courses have used the online blogging format for students to showcase their work, ideas, information, and interesting resources they may have found, in a public setting that allows feedback from other class members and provides an active learning environment [15, 30].

The ease of accessing fellow classmates' blogs and making posts of their own allows students to interact and form a small online community for discussion [13-14]. The lack of immediate interaction in blogging as part of a course is overshadowed by its advantages. For students who do not like to speak up in class, posting insights on a topic in a class blog could give those students an excellent opportunity to participate more comfortably in discussion than in the classroom [13]. Blogs encourage reflection on one's own thoughts and opinions, giving students time to think through a topic and then share their personal ideas and beliefs [14].

A case study by Zeng and associates looked at blog use in an introductory information and communication technologies online course. The researchers examined the creation of a group blog for the class as well as its different uses in this educational arena. Using the blog, the researchers tried to provide an online opportunity for the instructor and the students to engage in discussion of topics brought up in class, and for the students to participate in peer learning, or learning from one another [13].

A survey that evaluated how students felt about using the blog as part of the course was given at the end of the class. Of the twenty students in the class, 55% (11) indicated that using the blog as part of the class facilitated learning. Fifty percent (10) of the students felt the blog increased the interaction of students in the course. Comments from students on the survey indicated that despite lack of face-to-face communication and immediate feedback, blogging was helpful in expressing one's thoughts and allowed time to get thoughts in order before submitting a post [13]. Not all students enjoyed blogging, though; especially those who do not like to write and would rather express themselves verbally. Another problem Zeng and associates commented on was the possibility of plagiarism in posts on the blog if all students were responding to the same question [13].

A study by Halic and colleagues used a similar survey research technique to look at undergraduate students' experiences with blogging [31]. Students in a nutrition class were to discuss an assigned topic by making at least one post and one comment in the blog each week for nine weeks. A survey was then given with questions addressing perceived learning and sense of community. Analysis of the survey responses indicated students had a positive

experience with blogging and that blogging really helped them to reflect on topics outside of the classroom. When it came to peer feedback on their posts, though, the students did not always seem to value these comments. Having computer expertise at the start of the course was shown to be related to greater perceived learning. The sense of community among students created by the blog allowed the students to feel connected and positively affected their learning experience [31].

Goldman and colleagues conducted a study in which they evaluated **"**seminar blogs." The investigators used this term to describe small online discussion groups made up of students in a higher education course who informally dialogued about different cases and happenings in the news. After reading and commenting on the blogs each week, students were given a survey at the midterm and the end of the course that addressed use of the blog, student interaction, how blogging compared to discussion in class, as well as the good and bad aspects of using the blogs [15].

Of the 52 (midterm) and 50 (course end) students who completed the survey, 85% expressed ease in starting use of the blog. Seventy-eight percent of students whose native language was not English reported that participating in the blogs was useful in learning course material "quite a bit." Students expressed how using the blogs allowed learning from diverse perspectives of classmates. Over half of the survey respondents felt that posting on the blog was easier than speaking up in class. The good qualities of the blogs expressed by the students were the diverse points-of-view, how they could work on their own time when it was

convenient for them, the interaction with other students, and being able to contribute to discussion without having to talk in class [15].

Goldman and colleagues found that some students had a misunderstanding of what comments on a blog post should be. These students thought that they needed to provide a researched response, instead of just a short comment that possibly provoked further thought, similar to comments that would be made in a classroom setting [15]. Some students expressed negative qualities of the blogs, such as that there were too many assignments or posts to make in the blog as well as feeling "forced" to make a comment on blog posts. With both the positive and negative feedback from the surveys, the overall impression was that the seminar blogs provided an open, uninhibited environment for the students, allowing them to think and write freely, while sharing with classmates from personal experiences [15].

In addition, using blogs in qualitative research regarding college students has been shown to be a very informative approach in collecting data. A case study by Paulus and colleagues focused on how students transfer learning from the classroom to their everyday lives by examining students' blog conversations [32]. The participants (n=9 students), who had attended an introductory nutrition class the previous semester, made posts on the blog as well as commented on other students' posts on topics in nutrition. The text from seven weeks of blogging was then analyzed by the researchers. While most of the blog posts revealed great insight, some of the blog posts were noted as off topic, too short, and/or without any real information [32].

The students were interviewed after the seven weeks of blogging was complete. These interviews revealed that the students believed that they could be candid and open in blog posts and the assignment gave them the opportunity to get to know others in the blog. From the blog conversations, the researchers were able to see in the students' posts and comments, how and what they were applying from the course to everyday life. From these insights, the educators gained insight about what information was understood and what concerns or questions remained for the students [32].

In summary, blogging has been shown to help students express themselves by allowing them to reflect on a topic and get their thoughts in order before sharing a comment. Blogs can provide a sense of community where students feel connected and can be open to write freely and share from personal experiences. Not all students enjoyed blogging, though, especially those who prefer to express themselves verbally and face-to-face. Reviewing conversations in student blogs has been shown to be a good way for researchers to gain insight into what students are thinking or how they perceive a certain topic. This can be especially useful in conducting qualitative research. Qualitative research is further reviewed below.

Qualitative Research

Description of Qualitative Research

Qualitative research is an in-depth investigation of a human situation or phenomenon, often using field observations, case studies, interviews, focus groups, artifacts, and/or cultural texts [33]. The subject is usually studied in its natural environment, in an attempt to understand or give meaning to situations from the perspective of the subject [34]. It is a field

of research with varying methods, all connected in some way, to try and get the best idea or understanding of that which is being studied [34].

The four major components of qualitative research design are the research strategy, sampling method, data collection technique, and data analysis [12]. The more comprehensive the detail in describing these components, the more validity is added to the research. Reliability, or repeatability, can be improved in a study by having multiple researchers analyze the data, instead of only one. The relevance of the research must be established as well [12].

Qualitative research strives to understand "how social experience is created and given meaning" [35, p.8]. Quantitative methods, in comparison, can not easily portray the perception of a subject as quantitative research uses a more concrete process [34]. Qualitative work can compliment quantitative work, but can also stand on its own.

Qualitative research is useful and necessary in the study of happenings that cannot be simply calculated, in evaluating a process or when the reasons for outcomes must be determined [12]. Just as with quantitative research, detailed attention must be paid to the sample, study design, methods, and conclusions, among other fundamentals of the study in order to ensure reliability and validity [12]. The findings are not produced in a quantitative fashion using statistics, but rather as descriptions, themes, patterns, or concepts of the data. People's perceptions and emotions about an experience or issue can be more completely understood through a qualitative study compared to quantitative methods. Certain types of qualitative studies can affirm or disprove current theories, or generate new ones [12].

Case Study Design

One type of qualitative research strategy is the case study. A case study, by definition, is an examination of great depth and detail concentrated on a single entity or point in time, focusing on the changing situations in the social setting [36]. The 'case' is a distinct, limited entity, and could be an individual, group, or other situation/setting [34]. Because a case study focuses on a single case and what can be learned from it, this type of study is more effective for providing a greater understanding of a case than for generalization beyond that individual case [34, 37]. A case study's main purpose can be descriptive, exploratory, or provide explanation [38]. It can narrate, portray, illustrate, train, test, or prove [39]. The purpose of the research directs the approach and design of the case study [39].

Data Analysis and Coding

Data analysis is the transformation of accumulated data into an organized, meaningful state [39]. The main step in qualitative data analysis is coding, or categorizing and sorting the data [38]. The raw data collected in a qualitative study, including words, pictures, and/or sounds, are rarely immediately ready to be analyzed, but first must be 'processed' [12, 33]. To do this, classification codes must be created. These codes can be created either before data collection or during the analysis [12]. Qualitative coding is much different than quantitative coding, in which uniformity is key. In qualitative coding, organization of the data is the main concept, where coding can vary throughout depending on the documented text [38]. Validity of the research can be affected by a difference in interpretation of the data by coders, so definitions of all terms should be stated clearly [12, 38].

Data can be imported into a computer analysis program for coding and further study. The organizing and coding of data can be time-consuming, but computer programs can greatly assist in categorizing and retrieving data in context [38]. A summarization of the themes, interrelationships, or meanings discovered during data analysis is then written to describe the findings [12].

Secondary Data Analysis

Secondary data analysis involves a researcher analyzing data that were previously collected for analysis by someone else. Secondary analysis is usually performed with data for a reason other than for what the data were originally collected [38]. The major drawback to this type of data analysis is the possible issue of validity. If the data were originally collected for a different purpose, there is the question of whether or not the data are suitable for the purpose of the secondary use. Advantages of using secondary data analysis, though, include being less expensive and faster than collecting original data [38].

Conclusion of Literature Review

Previous studies have identified dietary supplement use by college students [7-10]. It was found that a good portion of college students (26% to 79%) engaged in dietary supplement use and that the average number of different supplements taken by a student was greater than 2.0. Some studies have considered students' reasons relating to supplement choices, such as their health beliefs and information they received from family and friends [7-9]. Recent studies on supplement use and reasons for choosing supplements have used quantitative research, such as surveys or questionnaires with closed-ended, forced-choice questions, which provides

little depth about how college students choose and perceive dietary supplements. This study aims to capture a deeper understanding of college students' perception of dietary supplements in a qualitative case study design.

Many students are using supplements according to previous findings, but there is little known on how or why the students are using them. Furthering our knowledge about their perceptions of safety, rationale for use, and their source of information regarding supplement use can provide nutrition professionals a basis for an educational program/curriculum or event focused on educating on this topic. This may prevent harmful behavior or irrational use of supplements. Nutrition education programs can help clear up any misunderstandings about supplements and their proper use, as well as provide evidenced-based research and resources that can be used as reliable sources of information on supplement use. The findings can also be used to help guide practitioners in addressing misconceptions and advising clients on supplement use.

Section 2: Manuscript

Abstract

The aim of this study was to gain a deeper understanding of how college students perceive dietary supplements, including their beliefs and understanding of supplements, as well as the types of supplements being discussed. A qualitative case study design was used, which allowed a greater understanding of the case through content analysis. This study used a secondary database, which consisted of web log (blog) posts completed as an assignment in an undergraduate introductory nutrition course. Students were asked to describe their experiences with and beliefs about the use of dietary supplements in a discussion format using a blogging tool. Blog posts were coded and analyzed using computer software. The most commonly mentioned topics were then explored in their original context. Final coding of the blog data revealed four main categories: supplements used, rationale for use, sources of information, and perceptions of the safety of dietary supplements. The most commonly mentioned supplements were multivitamins, diet pills, creatine, and protein supplements. The most frequently reported reason for dietary supplement use among these students was a perceived lack of nutrients in their diets. Information about dietary supplements came mainly from friends' or family members' experiences. Many students were not at all familiar with dietary supplements and some questioned their effectiveness. Based on the study findings, educational programs for college students should focus on the safety and efficacy of supplements, especially diet pills and protein supplements. Also, reliable sources of information on dietary supplements should be addressed.

Introduction

After the Dietary Supplement Health and Education Act (DSHEA) went into place in 1994, dietary supplements became more available to consumers than ever before [1]. Sales of dietary supplements rose from an estimated $4.0 billion in 1994 to $23.7 billion in 2007 [2-3]. With the increased access to supplements, many questions have arisen about who is using supplements and what drives their decisions regarding supplement use.

Supplement use nationwide has been studied using various nationally representative surveys. Responses to these surveys indicated that vitamins or minerals were used by 35% to 52% of the respondents, and that between 15% and 19%, or an estimated 38.2 million adults in the U.S., used herbal supplements within the previous year [4-6]. Approximately half of supplement users took two or more different supplements. Women were more likely than men to use dietary supplements, including herbals [5-6]. Further, supplement use was found to be more frequent in those who reported “good health” as opposed to “fair” or “poor health” [5-6].

In addition to nationwide data, studies have looked at supplement use specifically by college students. These studies revealed that between 26% and 79% of the students surveyed had engaged in nonvitamin, nonmineral supplement (NVNM) use within the past year. The average number of different supplements taken per student was greater than two [7-10].

Studies on the rationale behind the use of dietary supplements in the U.S. revealed that participants took certain vitamins to feel better and because they thought that it was difficult to eat a balanced diet. In addition, participants indicated that they used supplements as preventive measures [11]. Use of herbal supplements was found to be an alternative to

traditional medical care, used when conventional treatment was not working, or to treat conditions such as colds, stomach illness, arthritis, and anxiety [5]. Participants indicated that they obtained information about supplements from family members, friends, or from healthcare professionals [5, 11].

Studies that focused specifically on college students' beliefs about dietary supplements reported that the rationale for use included general health promotion, prevention of depression, and immune function enhancement [7-8]. Other reasons included weight loss, increased energy levels, supplement to an inadequate diet, and increased muscle development [7, 9]. Ambrose and Samuels found that, among college students, herbal users had a stronger belief in the safety of herbal supplements over prescription medications compared to nonusers [8]. The most common sources of information on dietary supplements for college students were, in descending order, family members or friends, health food stores, media sources, or their physician [7-9].

A thorough review of the literature by the researchers revealed that all of the previous studies on dietary supplements employed quantitative research methods, such as surveys or questionnaires with closed-ended, forced-choice questions. The purpose of this study was to explore the perceptions that college students have about dietary supplements using qualitative methods. This study aimed to gain further understanding of students' perceptions through analysis of students' free responses about dietary supplements in an online web log (blog) forum. When blogging, which is an online journaling process, is used in courses, students are able to read and comment on each others' information [12]. By encouraging reflection on

one's own thoughts and opinions, blogs are useful for sharing personal ideas and beliefs [13]. Blogs provide an open, uninhibited environment for students, allowing them to think and write freely, while sharing with classmates from personal experiences [14].

This study used a qualitative case study research method, which allowed a greater understanding of the case through content analysis and provided a thorough description of college students' perceptions of dietary supplements. The aim of this study was to gain a deeper understanding of how college students perceived dietary supplements, including their beliefs and understanding of supplements, as well as the types of supplements that were discussed.

Methods

Data

The data for this study were extracted from a secondary database collected as part of a larger study regarding instructional approaches for large lecture courses. Both the larger study and this study were approved by The University of Tennessee Institutional Review Board. The data set consisted of blog posts completed as an assignment in an undergraduate introductory nutrition course that met as a large lecture class twice a week and in a smaller discussion section once a week during Spring semester 2008. For one of the assignments in the discussion sections, students were asked to describe their experiences with and beliefs about the use of dietary supplements in a discussion format using the blogging tool on Blackboard, the University's online course management system.

The students had five days to make at least one initial post about their experiences with and beliefs about the use of dietary supplements. Students were instructed to then contribute at least five additional posts, commenting on other students' posts, to engage them in conversation. There was minimal facilitation by the course professor or teaching assistants. Each blog entry was marked with a date and time stamp. Only posts made prior to a class lecture on dietary supplements were analyzed. Student posts made after the lecture may have been influenced by professional opinion and may not have been their own perceptions. Because this was a secondary data analysis, the blog data were anonymized, with student names replaced with a letter and number, the lines numbered on each page of data, and posts by non-consenting students struck through to indicate the data were unusable for research and should be deleted from the coding document.

Blog data used for analysis consisted of seven discussion sections for the introductory nutrition course. Students in each section had been assigned to one of two blogging groups, group A or group B. This resulted in a total of fourteen blogging data files, with a total of 759 posts by students. The discussion sections ranged from 19 to 30 students, with 9 to 15 students per blogging group. There was almost double the amount of female (n=108) than male (n=55) participants. A preliminary read-through of the data was conducted by the primary researcher to direct the methods of the study.

Data Coding and Analysis Procedure

The data for this study were coded and analyzed using QDA Miner (version 3.2.3, 2009, Provalis Research Corp, Montreal, QC, Canada) computer software. Each member of the

research team participated in a QDA Miner training prior to beginning data coding and analysis. Following the training, two researchers, the primary researcher and an assistant, independently coded the data that were imported into the computer software from the blogging files, using an open/inductive coding process. Open coding was used initially to identify key ideas in each blog post, with progression to iterative coding, which regrouped the data into more conceptual categories [15]. Periodic meetings were held so that the researchers could discuss codes and reconcile coding differences. The emergent coding process allowed for adaptations of the coding as further understanding of the data developed. A note-taking technique called memoing was used to record thoughts, ideas, and related ideas during the coding process [15].

Units of analysis were decided to be a single thought, so one blog entry may have had several codes assigned to it if the entry contained more than one thought. Only relevant main ideas regarding supplements were coded. Having two coders was important to make sure that the codes were being assigned in a reliable way. The percentage of agreement between the coders could be calculated for each code, but a small portion of agreement could always occur by chance [16]. Therefore, Scott's pi adjustment (similar to Cohen's Kappa statistic) was used to correct for this and to provide a stronger measure of inter-rater reliability, which should be a least .70 [16]. This was done by the QDA Miner software, one of the main reasons this particular analysis software was chosen for this study.

The frequency of each code throughout all blogging files was reported by the software, to yield the most commonly mentioned topics. These topics were explored using the coding retrieval application to list all segments of the text that were labeled with a certain code. The

researcher was then able to review all coded segments in its original context and compare student comments to previous literature findings.

Results

The initial inter-coder agreement was 62.7% when using the most stringent agreement criterion in QDA Miner. Scott's pi adjustment yielded 0.225. However, after meeting to discuss coding techniques and code definitions, and to reconcile code names, the inter-coder agreement was 99.5% with a Scott's pi of 0.713. Final coding of the blog data revealed four main categories: the types of supplements that students were discussing; the rationale students mentioned for using or not using supplements; the sources of information about supplements that students discussed; and the students' perceptions of the safety of dietary supplements. Each of these categories is examined below.

Dietary Supplements

Students discussed a wide variety of supplements in the blog. The most commonly mentioned supplements were multivitamins, diet pills, creatine, and protein supplements. Other supplements mentioned included many herbals as well as supplements such as flaxseed pills and Nitric oxide (NO) supplements. Table 1 lists all supplements mentioned by students in the blogs.

Rationale for Use

The blog posts revealed a variety of reasons for students' use or nonuse of dietary supplements. Students' main reasons for taking dietary supplements were a perceived lack of nutrients in their current diet or for help getting the nutrients they needed. Other reasons

Table 1 - List of Dietary Supplements Mentioned by Students in Blogs*

Vitamins/Minerals (45%)	**N**	**Herbals (5%)**	**N**	**Ergogenic Aids (29%)**	**N**	**Other (21%)**	**N**
Multivitamin	86	Black cohosh	1	**Amino acid**	5	**Diet pills**	56
Vitamin A	2	**Echinacea**	1	**Creatine**	39	**Energy drinks**	3
Vitamin B	17	**Garlic**	1	**Endurox®**	1	**Omega 3**	8
Vitamin C	25	Gingko	2	**Glutamine**	3	**Airborne®**	2
Vitamin D	8	**Ginseng**	10	**Muscle Milk®**	5	**Fiber**	2
Vitamin E	5	**Green tea pills**	4	**NaNO (Nitric Oxide)**	4	**Flaxseed pills**	2
Fat soluble	1	Herbs, general	2	**Preworkout**	1	**Juice Plus+®**	1
Prenatal vitamins	3	St. John's wort	1	**Protein bar**	2	**Slim Fast®**	2
Vitamins, general	6			**Protein supplement**	31	Steroids	10
Calcium	20			**RicePro®**	1	**Emergen-C®**	1
Iron	11			**Shakes**	13	**VIACTIV®**	1
Magnesium	2			**Whey**	15	**BOOST bars®**	1
Minerals, general	2						
Zinc	3						

*Supplements in bold indicate that students mentioned using these supplements
N=number of times the supplement was mentioned in the blog posts

included the perception that they could "really" tell a difference when they took supplements, claiming to feel better or claiming that they believed the supplement worked well in the way that it was intended. Additionally, students claimed that their reasoning for using dietary supplements was for a certain function. For example, to have more energy or focus and to build muscle or mass were identified as the two main function claims beyond nutrients needed.

The most common rationale stated for why the students did not use supplements was the simple fact that they found supplements to be ineffective. They claimed the supplements that they had tried had not worked as intended or that they could not tell any difference after taking the supplement. Along those same lines, some students reported that they had learned from their friends' experiences that supplements did not work, and therefore chose not to use supplements themselves.

Sources of Information

While many students wrote about their personal experiences with dietary supplements, some students wrote about a family member or friend's experience with supplements. Table 2 lists examples of quotes from the blogs on this topic. A friend's experience with a dietary supplement was the most common source of information about supplements discussed in the blogs. Family members were mentioned throughout the blogs as sources of information about dietary supplements for the students, both as family members who used supplements and as family members, mainly mothers, who encouraged the student to take a certain dietary supplement. Many students stated that people should consult a doctor before taking any dietary supplements to ask about the appropriateness of supplement use.

Table 2 – Sources of information on dietary supplements mentioned by students in the blog

Sources*	**Examples from Blogs**
Friend (mention friend taking a supplement) N= 47	*"I know from experience with a friend that once she dropped all the weight in a month she a regained more weight than before she had started the supplements."* M056 *"On the supplements side, I know that they are harmful; my fiance had to be rushed to the ER for heart complications due to supplements he was taking;"* F105 *"Most of the guys I know that lift weights on a regular basis also use Vitamin C and Creatine. They all seem to love it and are always happy with the results."* F051
Student Advice (student giving advice to other students) N= 47	*"I think you should experiment with some vitamins and see how you feel"* MI028 *"I also know that biotin promotes hair and nail health, so if you get a bad haircut and want it to grow out, I suggest biotin"* F065 *"If you are trying to lose weight try using Hydroxycut."* F025 *"Well if you're just starting to workout and take supplements then a good Whey protein would probably be your best bet. Try to find one that has at least 40 grams of protein and take it within 30 minutes of your workout. This will allow you to take in all the protein when your muscles need it the most. I would also take one before you go to bed if you're trying to gain weight."* M001
Family (mention family member taking a supplement) N= 33	*"My mom takes a calcium supplement also. My dad and brother are big on the protein supplement thing."* F002 *"My cousin takes fish oil tablets for her hair and nails."* M007 *"Ever since I was small I remember seeing my dad scoop out a powdery substance from a display of large jars covering the kitchen counter. Soon after retrieving just the right amount, he blended his drink and downed the fruity smelling concoction pre and sometimes post workout. I never fully understood the purpose of these thick drinks, but concluded that they were important by the way my dad drank them religiously. The supplements he takes seem to work extremely well."* M024
Consult Doctor N= 28	*"I think dietary supplements are great when recommended by a doctor. For example, many doctors suggest that woman take Calcium supplements, which is great for future bone and joint health. I think before taking any supplement including protein one should consult a doctor"* F014 *"I did it once and I did not see any results. Maybe it was because it was not exactly what I needed. So now I know that I will not take supplements without consulting a doctor or nutritionist. I do not think it is completely safe."* F016 *"I think people should be informed and talk to a health care professional before they start a supplement routine."* F080
Family Advice N= 18	*"My mom gave me a multi-vitamin to use daily"* F005 *"My mom has always suggested that I take vitamins to help me not become tired"*F055 *"My dad had also suggested that I take vitamin E pills to help clear up my skin"* F090
TV/media N= 14	*"Dietary supplements are very pervasive in today's society. Every time you turn on the TV or get on the internet, messages about a new "miracle" pill is being broadcast to the public. Generally, all of the positive effects are announced over and over, yet the negative side effects are generally saved for the very end and presented in a very misleading fashion."* F057 *"I think a lot of people just go with what the media is telling them and what seems to be the cutting edge of the market."* F089 *"I haven't researched dietary supplements at all, but it seems the media only portrays the negatives."* F102

*Sources as defined by codes used in data analysis; N= frequency of code used in the blog

Throughout the blogs it was noted that the students gave each other advice about supplements in their posts. Students would either state their advice in their initial post, or as a comment in response to someone else's post. This advice usually included a student recommendation for taking a certain supplement based on the stated desired results or a suggestion for using a supplement that the student had found to be helpful based on personal use.

Perceptions of Dietary Supplements and their Safety

Frequency of code analysis revealed that one of the most often used codes throughout the blogs was "not essential." Many students discussed that supplements are not a necessity to being healthy and that one can achieve health through eating right and exercising. Comments referring to this idea were made by both those who took supplements and those who did not. Table 3 lists some examples of quotes from the blogs.

Specifically referring to the safety of dietary supplements, students discussed that people should be informed about the supplement that they are taking, including information about the supplement's ingredients and how much active ingredient is in the supplements. Students often mentioned side effects that they had experienced from taking a dietary supplement, as well as side effects that they had heard about from a friend or other source. Many students expressed that they were not familiar with dietary supplements and questioned the use of supplements all together. Some wondered if supplements really worked at all. The safety of supplements was questioned by many students, who expressed doubt about really knowing how safe supplements are because of a lack of evidence regarding safety.

Table 3 – Overall perceptions and safety of supplements mentioned by students in the blog

Perceptions*	**Examples from Blogs**
Not essential N= 117	*"If you have a well balanced diet I don't see the need for any supplement. A supplement is supposed to compliment your diet any way so it's not essential."* M002 *"I believe that they can be helpful, but I also think that they aren't a necessity to living a healthy life"* M004 *"I work out a couple times a week and run some too. I don't really use any supplements or anything because I'm one of those people I guess that believes that it if you have a healthy diet, your body will maintain itself. I know this is just a point of view but I've just never found a real need to take dietary supplements"* M008
Be informed N= 72	*"The weight gainers must be used correctly, and the consumer should be well-educated about the product."* F111 *"I think that people need to know exactly what supplement they are taking and exactly what they are for. I believe that there are many people who start taking supplements without even knowing what they are for and the effect it will have on them. That might be dangerous!!"* F016
Side effects N= 66	*"I really don't like diet pills. I took one for a week and all it did was make me anxious and not sleep."* F031 *"My mom tried some weight loss supplement one time, and she noticed her heart would beat faster a little while after she took it."* M017 *"I have a guy friend that used creatine before and he said that he noticed having muscle cramps and occasionally got nauseated and he eventually stopped taking it"* F090 *"A lot of the supplements may work at the time, but consider when you are older. Many of these supplements are really hard on your kidneys."* F089
Question N= 62	*"I think it would be really interesting to compare the people who take multivitamins daily to those who don't. Do people who take daily vitamins actually stand a better chance of not getting sick compared to those who do not take the vitamins?"* M019 *"Do you really need supplements in order to get your results from your work-out? If you just continue to work hard in the gym then you should see results. Are the supplements really necessary?"* M030
Not familiar N= 50	*"I feel uneducated when it comes to dietary supplements."* F087 *"I don't think that most people know what they're talking about or doing when it comes to taking supplements. "* F079 *"I always thought dietary supplements were just weight loss pills and low-fat foods. I guess I never realized how much there actually is. I would have never thought of vitamins as dietary supplements until it was mentioned in class."* F066
Safety questioned N= 42	*"Yeah multi viatmins with excess caffine and such to energize you scare me"* F103 *"I have heard many negative things about dietary supplements and I am afraid that I could be taking something that is not beneficial to my goals."* M038 *"It seems like most of the people that are taking diet pills are taking them because they are trying to take the easy way out. Instead of just dieting and exercising they think that they can just take a supplement and be thin. I think that they are really dangerous and should not be messed with."* F066 *"I have always been uneasy and untrusting of supplements,"* F054

*Perceptions as defined by codes used in data analysis; N= frequency of code used in the blog

Discussion

This study identified multivitamins as the most commonly mentioned supplement in the blogs. This is consistent with other literature in which multivitamins/multiminerals were the most commonly reported supplement used by all ages nationwide [6, 11, 17, 18]. This could be because, as many students mentioned, they had been taking multivitamins since they were very young and have continued to do so over the years. As one student wrote, *"Taking one multivitamin a day, I've been told is just a good idea. That's been drilled into my head since I was in the second grade."* A multivitamin is considered by most people to be a safe supplement and therefore are more likely to use them. *"I would think that a multi-vitamin would never hurt anything,"* stated one student. In addition, the Multivitamins and Public Health workshop reviewed the current literature on multivitamins in 2004 and published a report that advised all U.S. adults to take a multivitamin daily [3]. The limited research available on the efficacy and safety of multivitamins does not clearly show adverse effects [19].

Diet pills were the second most commonly mentioned supplement in the blogs. In the studies reviewed, diet pills were more likely to be in studies that investigated college students' supplement use rather than in those that reported on nationwide dietary supplement use. One national study, though, that focused solely on the use of weight loss supplements, reported that although use appeared across all age groups, it was highest in those aged 18 to 34 years, where likelihood of use increased with BMI [20]. Newberry and colleagues, however, found that the majority of the students taking weight loss supplements, including the dangerous Ephedra products, were already within a desirable weight range [7]. The latter of these two

studies had similar findings to those found in this study, as one student wrote, *"A few of my friends have taken weight loss supplements and had great results. None of them were necessarily 'overweight,' they just wanted to shed a few unwanted pounds."*

Previous literature found Echinacea, ginseng, St. John's Wort, and Gingko biloba to be among the most commonly used herbal supplements in college students as well as the adult population nationwide [5, 7-10]. Conversations from the blogs revealed similar findings, with ginseng, green tea pills, and Gingko as the herbals most often mentioned.

A previous study that looked at motivations for supplement use among adults in the U.S., reported that supplements were taken to feel better and because it was difficult to eat a balanced diet [11]. Likewise, blog posts revealed that many students took supplements to counterbalance a perceived lack of nutrients in their diets. Many posts were similar to one that stated, *"I think that by taking the vitamin I'm getting the nutrients that I don't always get from just my diet."* While mentioning a hectic college lifestyle, university meal plans, and avoidance of certain foods such as dairy or meat, students seemed aware that their overall diets probably did not meet nutrient recommendations. As one student wrote, *"If you know you don't get your daily recommendation, which is the case for most [A]mericans, [then] do something about it if possible. Dietary supplements can be a huge aid."*

In addition, supplements were used by many students to achieve a specific goal, whether it was for increased energy or increased muscle mass. One student wrote, *"…I have also taken B vitamins to try to improve my energy level."* Another wrote, *"I take a protein [supplement] before I work out to help build muscle."* Previous studies that focused on

supplement use in college students reported similar reasons including weight loss promotion, improved energy, and increased athletic performance [7, 9]. It makes sense that college students would be likely to take supplements with these goals in mind as opposed to older adults who have been shown to take supplements as treatment for chronic health problems [7].

Blog posts revealed that while many students found that supplements worked as intended, others claimed that they could not tell a difference in how they felt when they were taking supplements or when they were not. Prior research found that 73% – 78% of supplement users reported that supplements were at least somewhat effective [5, 7]. These studies looked mainly at herbal use, whereas this study had a broader scope including all supplements. Most of the students who blogged that the supplements they took in the past did not work, were referring to protein or weight loss supplements. One student's post stated, *"I take some protein supplements daily which are supposed to help you build muscle a lot quicker. Honestly I have been taking it for about 6 months now almost every day and unfortunately I have not noticed much results."*

Students mentioned a friend or family member in their posts often. A great number of blog posts began with a description of supplements used by someone besides themselves ranging in closeness from, *"my mom…"* or *"my friend…"* to *"one of my brother's teammates…"* Even if students did not state that a family member or friend suggested that they use a dietary supplement, just seeing or hearing about other people's experiences with supplements provided students with information and ideas about the products. These findings are similar to those in previous literature that found that the main source of information about supplements

and/or the decision to take dietary supplements was primarily based on family or friend advice [9, 11]. Contrary to what some other researchers have found to be a major source of information for supplement users, information from health food stores was rarely mentioned as a source of information for students in the blogs [7, 9].

Many students revealed that they believed it would be a good idea to consult a doctor before taking a dietary supplement, while some had been advised by their physician to begin supplement use for a variety of reasons. Examples of this include: *"I think that you should always consult a doctor before taking something, especially when you don't know much about it. Everyone's body reacts differently to different things so I would get a second opinion before taking something,"* and *"I only take iron because the doctor suggested it."* Previous literature has shown that a physician or other healthcare provider is a source of information for some adults, but well behind other nonprofessional sources such as family, friends, or coaches [7-9]. A study by Kennedy found that being advised by a healthcare professional to take supplements was only mentioned by 15% of adults surveyed [5]. This could be related to the common thought that there is less need to consult a physician because you can get supplements without a prescription. A study by Ambrose and Samuels found that students who took herbals were more likely to believe their supplements were safer than prescription drugs [8].

Students stated a number of different side effects they experienced, but interestingly, similar to other studies on supplement use, students who mentioned experiencing side effects did not always discontinue use of the supplement [7, 18]. For instance, one student talked about her friends who had great results with diet pills, ended her post with, *"BUT the downside*

is that they experienced nervousness and were sometimes a little shaky so I'm not sure that the benefits actually outweigh the consequences." Another student referred to some side effects as "normal" saying, *"it can result in a lot of the normal side effects, such as: dizziness, nausea, headaches, anxiety, and several people have said that they get very jittery and can't stay still."* Some students stated they specifically used creatine *"because of less side effects than many other supplements. Gastrointestinal problems are the most common side effect with users, along with weight gain."* It appeared many students expected to experience side effects when taking a dietary supplement. As long as the side effects were tolerable and they achieved desired results, they continued using the supplement.

Previous studies with college students found similar results about students' perceptions that they had a lack of knowledge about supplements [7, 9]. Many students stated in their posts that they were unfamiliar with dietary supplements and were unsure what would be classified as a supplement as well as uncertainty about the safety of their use. Simple questions such as, *"so does taking a daily vitamin have any real value or would I be just fine without it?"* or just stating, *"I don't really know much about supplements,"* occurred throughout the blogs. An overall feeling of those questioning supplements in the blogs could be summed up with one student's post saying, *"I have heard that no one really knows how safe they are."*

From these findings, nutrition educators and practitioners can gain ideas about topics on dietary supplements that need to be addressed in educational programs for college students. This would allow students to be able to make an informed decision on their

supplement use. The students had many unanswered questions about the safety and efficacy of several controversial supplements.

Limitations

There were several limitations in this study. As with any study using qualitative data, bias in analysis of the data by the researcher is a common concern [21-22]. This study was designed to have two researchers code the dataset to ensure greater reliability of the findings. Questions of study procedures and repeatability can arise as well [21-22]. Through our thorough description of the methodology of this study, including the source of data, coding procedure, and analysis, the ability of another researcher to repeat the study is improved, which promotes validity.

Validity of research can be affected by a difference in interpretation of the data by coders, so definitions of all terms were stated clearly [15, 21]. Periodic meetings were held so that the researchers could discuss codes and reconcile coding differences. The meetings allowed the researchers to review the definitions of codes, to discover any differences in the use of codes between the researchers, as well as for merging codes that were deemed to be too similar to distinguish between. The researchers also discussed how the units of analysis, mainly the length of each coded segment were defined, to help make more precise rules for the coding procedure. Great care was taken in an effort to increase validity of the findings.

The blog posts analyzed for this study were completed as an assignment in an introductory nutrition course. This was an effective way to let the students freely express their perceptions of dietary supplements. However, the students' blog posts were ultimately

completed as a graded course assignment which may have impacted their responses. A study using blog posts that were not graded or were not part of a course assignment may have yielded greater insight into students' perceptions of dietary supplements. Further, the data used in this study were collected from blogs in a nutrition course. Students who enroll in a nutrition course may have more knowledge than the general college population regarding dietary supplements.

Another major limitation of this study was the use of secondary data. The data were defined as a set of blog entries, which did not allow for further data collection if data saturation was not reached. Although this study focused on a specific group of college students and there may be limited application to the general population, the in-depth data collected can be used to generate ideas for needed topics of student education about supplement use.

Implications

This study focused on gaining a better understanding of college students' perceptions of dietary supplements, including which supplements they were discussing, their rationale for use, their perceptions of the safety of dietary supplements, and their sources of information on supplements. Many college students expressed uncertainty about the safety of dietary supplements, but some of these students continued to take supplements anyway. This should be noted by health and nutrition professionals as a topic that needs to be addressed. Much of what students seemed to know about supplements came from sources other than healthcare professionals, such as friends, family, and commercials/media. Information from a reliable

source can help students who choose to use dietary supplements to do so in a healthy and safe way, and help them feel confident in their knowledge.

Diet pills and protein supplements were two of the main products students focused on in the blogs and therefore would be important topics to address in education. Students need to be made aware of the lack of government regulation on these dietary supplements. It is important to point out to students that the safety and efficacy of these products do not have to be proven before the product can be sold. Misleading claims on supplement labels, especially on products that could have adverse side effects, are important to address with students as well.

Conclusions

The most commonly used dietary supplements by the college students in this study were multivitamins, diet pills, creatine, and protein supplements. Students' main reason for taking dietary supplements was a perceived inadequacy of nutrients in their diet. The most common reason for students to not use supplements was that they found supplements to be ineffective. Information about dietary supplements mainly came from friends' or family members' experiences with dietary supplements. Many students believed that supplements were not a necessity to being healthy and that one could achieve health through eating right and exercising. Students discussed that people should be informed about the supplement that they are taking. Many students were not familiar with dietary supplements and some questioned the effectiveness of supplements. The safety of supplements was also questioned by many students.

With the in-depth information gained from this study on which dietary supplements college students are using and the reasons they are using them, practitioners and educators have a place to start the discussion with students on supplement use. Additionally, it is important to address supplement users' perceptions of safety and their sources of information. Further research should focus on studying supplement use by college students in disciplines outside of nutrition courses to see if any further insights can be found.

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Appendices

Appendix 1: Expanded Methods

Expanded Methods

The purpose of this study was to explore the perceptions that college students have of the use of dietary supplements. Beyond the insights quantitative studies have shown in this area, this study aimed to gain further understanding of students' perceptions through analysis of students' free responses about dietary supplements in an online web log (blog) forum.

Research Question

The question this study sought to address:

1. What are the beliefs, understandings, and other perceptions related to dietary supplements among college students?

Study Design

This study was conducted using a qualitative case study design. This research method allowed a greater understanding of the case through content analysis and provided a more thorough description of college students' perceptions of dietary supplements. The outcome of the study was a comprehensive description, or thick description, of one introductory nutrition class and their understandings (perceptions, attitudes, beliefs) of dietary supplements prior to covering the topic in class. The description can be useful in augmenting what is known from quantitative studies and provides nutrition educators and practitioners with areas to focus on in current and future programs for educating the college students about dietary supplements.

Data

The data for this study were extracted from a secondary database collected as part of a larger study regarding instructional approaches for large lecture courses. Both the larger study and this study were approved by The University of Tennessee Institutional Review Board. The data set consisted of blog posts completed as an assignment in an undergraduate introductory nutrition course that met as a large lecture class twice a week and in a smaller discussion section once a week during Spring semester 2008. For one of the assignments in the discussion sections, students were asked to describe their experiences with and beliefs about the use of dietary supplements in a discussion format using the blogging tool on Blackboard, the University's online course management system.

The students had five days to make at least one initial post about their experiences with and beliefs about of the use of dietary supplements. Students were instructed to then make at least five additional posts commenting on other students' posts to engage them in conversation with minimal facilitation by the course professor or teaching assistants. Each blog entry was marked with a date and time stamp. The professor's expert opinion of dietary supplements was given in lecture on February 20, 2008 at 9:05 A.M. Only posts made prior to this lecture were analyzed as student posts made after the lecture may have been influenced by professional opinion and may not have been their own perceptions. Because this was a secondary data analysis, the blog data were anonymized, with student names replaced with a letter and number, the lines numbered on each page of data, and posts by non-consenting

students struck through to indicate the data were unusable for research and should be deleted from the coding document.

Blog data used for analysis consisted of seven discussion sections for the introductory nutrition course. Students in each section had been assigned to one of two blogging groups, group A or group B. This resulted in a total of fourteen blogging data files (total of 759 posts by students). The discussion sections ranged from nineteen to thirty students, with nine to fifteen students per blogging group. There were almost double the amount of female participants (n=108) than males (n=55). A preliminary read-through of the data was conducted by the primary researcher to direct the methods of the study.

Data Coding and Analysis Procedure

The data for this study were coded and analyzed using QDA Miner (version 3.2.3, 2009, Provalis Research Corp, Montreal, QC, Canada) computer software. Each member of the research team participated in a QDA Miner training prior to beginning data coding and analysis. Following the training, two researchers, the primary researcher and an assistant, independently coded the data that were imported into the computer software from the blogging files.

An open/inductive coding process was used. The primary researcher read through each blog, identifying the main ideas in each post. A classification code was created for each new idea, with the definition of the code recorded in the description section of the code definition screen in the computer program. Each coder assigned codes to the data starting at the bottom of the blog as that is where the first post was located, and worked up from there in time order. Codes were added to the codebook as each new idea developed.

Open coding was used initially to identify key ideas in each blog post, with progression to iterative coding, which regrouped the data into more conceptual categories [1]. Codes were modified, merged, and/or split using the software tools, as the researcher became more familiar with the data and the coding categories. The emergent coding process allowed for adaptations of the coding as further understanding of the data developed. A note-taking technique called memoing was used to record thoughts, ideas, and related ideas during the coding process [1].

Units of analysis were decided to be a single thought, so one blog entry may have had several codes assigned to it if the entry contained more than one thought. The coded segment could be one word, a phrase, a sentence, or several sentences. Only relevant main ideas regarding supplements were coded.

The research assistant coded identical blogs as the primary researcher, but did not view the already coded blogs. The same codebook was used by both researchers (for the final codebook, please see Appendix 2). Periodic meetings were held so that the researchers could discuss codes and reconcile coding differences. The meetings allowed the researchers to review the definitions of codes, to discover any differences in the use of codes between the researchers, as well as merging codes that were deemed to be too similar to distinguish. The researchers also discussed how the units of analysis, mainly the length of each coded segment, were defined to help make more precise rules for the coding procedure.

Having two coders was important to make sure that the codes were being assigned in a reliable way. The percentage of agreement between the coders could be calculated for each

code, but a small portion of agreement could always occur by chance [2]. Therefore, Scott's pi adjustment, which is similar to Cohen's Kappa statistic, was used to correct for that and provide a stronger measure of inter-rater reliability, which should be a least .70 [2]. This was done via the QDA Miner software, one of the main reasons this particular analysis software was chosen for this study. The initial inter-coder agreement, calculated after both coders had completed coding the first blogging file, was 62.7% when using the most stringent agreement criterion in QDA Miner. This agreement criterion was called Code Overlap and focused on the agreement of coders on the location of the code, beyond just looking at if the code was present or the frequency of the code. Scott's pi adjustment initially was 0.225. However, after meeting to discuss coding techniques and code definitions following the completion of coding each consecutive blogging file, the inter-coder agreement was 99.5% with a Scott's pi of 0.713. Working as a "check" on the codes that were assigned to the blogs by the primary researcher, the research assistant only coded blogs until a Scott's pi of greater than .70 was reached (for a complete list of inter-coder agreements, please see Appendix 3).

Next, the data for this study were analyzed further using the QDA Miner software. The frequency of each code throughout all blogging files was reported by the program, to yield the most commonly mentioned topics. These topics were explored using the coding retrieval application to list for the researcher all segments of the text that were labeled with a certain code. The researcher was then able to review all coded segments in its original context and compare student comments to previous literature findings.

Written Description

Based on the analysis, a written document of the findings was produced to answer the research question. The document consisted of a detailed, or thick, description of the case, coding scheme (list of codes), and the results of the content analysis, which establishes an overview of the dominant topics, along with a description of the relationship between the raw data, dominant topics, and research question [2].

Appendix 2: Final Codebook

Supplement Blog (August 9, 2010) Final Codebook

Category[1]	Code[2]	Description[3]	Count[4]
Dietary Supplements[5]	Diet Pills	Any supplement mentioned that claims to burn fat/help you lose weight or anything referred to as diet pills/weight loss supplement	56
Dietary Supplements\EnergySuppl	Energy drink	Mentions an energy drink	3
Dietary Supplements\Fish oil	Omega 3	Mentions omega 3/fish oil	8
Dietary Supplements\Herbal	Black cohosh	Mentions black cohosh	1
Dietary Supplements\Herbal	Echinacea	Mentions Echinacea	1
Dietary Supplements\Herbal	Garlic	Mentions garlic supplements	1
Dietary Supplements\Herbal	Gingko	Mentions Gingko/ Gingko biloba	2
Dietary Supplements\Herbal	Ginseng	Mentions ginseng	10
Dietary Supplements\Herbal	Green tea pills	Mentions green tea pills	4
Dietary Supplements\Herbal	HerbsGeneral	Mentions herbs/ herbal supplements in general	2
Dietary Supplements\Herbal	StJohnsWort	Mentions St. John's wort	1
Dietary Supplements\Mineral	Calcium	Mentions calcium supplement	20
Dietary Supplements\Mineral	Iron	Mentions iron supplement	11
Dietary Supplements\Mineral	Magnesium	Mentions magnesium supplement	2
Dietary Supplements\Mineral	MineralSuppl	Mentions mineral supplement in general	2
Dietary Supplements\Mineral	Zinc	Mentions zinc supplement	3
Dietary Supplements\Other Suppl	Airborne	Mentions Airborne	2
Dietary Supplements\Other Suppl	BOOST	Mentions BOOST bars	1
Dietary Supplements\Other Suppl	Emergen-C	Mentions Emergen-C	1
Dietary Supplements\Other Suppl	Endurox	Mentions Endurox	1
Dietary Supplements\Other Suppl	Fiber	Mentions fiber/fiber pills	2
Dietary Supplements\Other Suppl	Flaxseed pills	Mentions flaxseed/flaxseed oil pills	2
Dietary Supplements\Other Suppl	Juice Plus	Mentions Juice Plus	1
Dietary Supplements\Other Suppl	NaNO	Mentions a supplement with nitric oxide (NO)	4
Dietary Supplements\Other Suppl	Slim Fast	Mentions Slim Fast	2
Dietary Supplements\Other Suppl	VIACTIV	Mentions VIACTIV chews	1
Dietary Supplements\Protein	Amino Acid	Mentions one of the amino acids as a supplement	5
Dietary Supplements\Protein	Creatine	Mentions creatine	39

Final Codebook continued

Category	Code	Description	Count
Dietary Supplements\Protein	Glutamine	Mentions glutamine	3
Dietary Supplements\Protein	Muscle Milk	Mentions Muscle Milk	5
Dietary Supplements\Protein	PreWkOut	Mentions a pre-workout formula	1
Dietary Supplements\Protein	ProteinBar	Mentions protein bars	2
Dietary Supplements\Protein	ProteinSuppl	The mention of anything the students refer to as a protein supplement	31
Dietary Supplements\Protein	RicePro	Mentions UltraClear, etc.	1
Dietary Supplements\Protein	Shakes	Mentions protein shakes	13
Dietary Supplements\Protein	Whey	Mentions whey protein/wheybolic supplements	15
Dietary Supplements	Steroid	Mentions steroid	10
Dietary Supplements\Vitamin	Fat Soluble	Vitamins A,D,E,K mentioned as a group	1
Dietary Supplements\Vitamin	MultiVit	Mentions a multivitamin	86
Dietary Supplements\Vitamin	PrenatalVit	Mentions a prenatal vitamin	3
Dietary Supplements\Vitamin	Vit A	Mentions vitamin A	2
Dietary Supplements\Vitamin	Vit B	Mentions B vitamin(s)/B-complex vitamins	17
Dietary Supplements\Vitamin	Vit C	Mention vitamin C	25
Dietary Supplements\Vitamin	Vit D	Mentions vitamin D	8
Dietary Supplements\Vitamin	Vit E	Mentions vitamin E	5
Dietary Supplements\Vitamin	Vitamins in general	Mentioned "vitamins" in general- not specific	6
Overall Perceptions & Safety[6]	AskAQuestion	Student asks a question about a supplement	32
Overall Perceptions & Safety	Be informed	Should know what you are taking and how much/be careful	72
Overall Perceptions & Safety	CreatineBreak	Know to go on break from creatine (cycles)	5
Overall Perceptions & Safety	Dehydration risk	Mention dehydration risk when taking Creatine, or other supplements	6
Overall Perceptions & Safety	Does not hurt	Does not hurt to take vitamins, so why not take them if they can provide some benefit/no harm in taking them, do not affect health in a significant way/less likely to cause harm than other things	9
Overall Perceptions & Safety	Extremes	Watch for people going to extremes to look a certain way (bad)	2
Overall Perceptions & Safety\False results	All in your head	Placebo effect/a mind thing/mental	5
Overall Perceptions & Safety\False results	EyeNotPhysiologically	Looks as though you are achieving results, but not actually (i.e. muscles look bigger, but not improving strength)	4
Overall Perceptions & Safety\False results	Not Permanent	Results were not permanent	8
Overall Perceptions & Safety	FDA	Realizes/mentions FDA role in safety of supplements	6

Final Codebook continued			
Category	**Code**	**Description**	**Count**
Overall Perceptions & Safety	Foods	Can get nutrients from different foods, not just supplements	26
Overall Perceptions & Safety	Form	Believes form of supplement makes a difference (i.e. vitamins in liquid form are better for you)	7
Overall Perceptions & Safety	Generic	Generic is the same and cheaper than brand name	3
Overall Perceptions & Safety	Inapp Use	Mention what a problem would be/there should be concern with inappropriate use	20
Overall Perceptions & Safety\Misperception	Incorrect Statement	Incorrect use of terminology	2
Overall Perceptions & Safety\Misperception	Misconception	Feel that people have misconceptions about supplements and/or state something they feel is a misconception about supplements	5
Overall Perceptions & Safety	No dependence	Should not be dependent on a supplement, should not believe the pill will work and nothing else has to change (diet/exercise)	41
Overall Perceptions & Safety	Not essential	Supplements are not a necessity to being healthy/can achieve health through eating right and exercise	117
Overall Perceptions & Safety	Not familiar	Do not know much about supplements/or think others do not in general	50
Overall Perceptions & Safety	NotForWeightloss	Think supplements should not be used for weight loss	11
Overall Perceptions & Safety	Question	Question use of supplements (is it really needed?), wonder, does it work	62
Overall Perceptions & Safety\Safe	CreatineSafe	State that creatine is safest supplement	3
Overall Perceptions & Safety\Safe	HerbsSafe	Believe herbal supplements are safer than other supplements	1
Overall Perceptions & Safety\Safe	MultiVitSafe	Believe nothing bad/no harm in taking a multivitamin	3
Overall Perceptions & Safety\Safe	PrenatalVitSafe	Believe prenatal vitamins are safe	1
Overall Perceptions & Safety\Safe	SupplsSafe	Believe supplements in general are safe	3
Overall Perceptions & Safety\Safe	WheySafe	Believe there is no harm/nothing wrong with taking whey	2
Overall Perceptions & Safety	Safety quest.-unfam ingred.	Safety of supplement questioned as it contains unfamiliar ingredients	4
Overall Perceptions & Safety	Safety questioned	Do not know how safe supplements really are/or are not proven safe	42
Overall Perceptions & Safety	Side effects	supplement causes side effects/quit using or kept using	66
Overall Perceptions & Safety	Suppl def	States what they believe a dietary supplement is/or comment on dietary supplements in general	27
Overall Perceptions & Safety	SupplClaims	Question supplement claims	14
Overall Perceptions & Safety	SupplMedInteraction	Supplements can interact with medications you are taking	5
Overall Perceptions & Safety	TooMuchBad	Could be a bad thing when taking a supplement of nutrients already getting too much of in food, could lead to health problems/too much is bad/people abuse them	40
Rationale for use[7]	AppetiteControl	Help control your appetite	2
Rationale for use\Barriers	BadTasteSmell	Supplements have a bad taste/after-taste or smell	5

Final Codebook continued			
Category	**Code**	**Description**	**Count**
Rationale for use\Barriers	BigPillsHardToSwallow	Supplements that come as large pills are hard to swallow	1
Rationale for use\Barriers	Forget	Hard to remember to take everyday/forget to take supplement	14
Rationale for use\Barriers	HardToKeepMotivated	Hard to keep motivated to take supplements when results are slow	1
Rationale for use\Barriers	HardToKeepUpWithInCollege	Hard to keep up with pills	1
Rationale for use\Barriers	OtherBarrier	Someone else's priority	3
Rationale for use	Bone strength	Strengthens/helps bones	2
Rationale for use	circulation	Take supplements to help with poor circulation	6
Rationale for use\College	CollegeEating	The way college students eat and university meal plan offerings	12
Rationale for use\College	CollegeRoutineTime	College routine/life/time	5
Rationale for use	Combo Rec	Combination/pair of supplements recommended to be taken together	2
Rationale for use	Curious	Was curious, so tried supplement	1
Rationale for use	Depression	Supplements help with depression	1
Rationale for use	diet	Lack of nutrients on current diet, help get nutrients needed (even if don't eat or like certain foods)	79
Rationale for use	DietExerNotWorking	Diet and exercise do not seem to be working, diet pills give that little something extra to lose the weight	5
Rationale for use	Do not work	Supplements do not work as intended/claimed/could tell no difference	41
Rationale for use	Doctor rec	Doctor recommended taking supplement	15
Rationale for use	energy	Supplements help you have more energy/stay awake/focus	46
Rationale for use	Expensive	Supplement costs too much money/benefit not great enough for the price/expensive to buy vitamins separately/it is expensive, but still take them/waste of money	12
Rationale for use	Eyes	Eyes/sight	1
Rationale for use	Flush system	Supplements flush out your system	1
Rationale for use	For athletes	Supplements aid for athletes	3
Rationale for use	Gain weight	Taking supplements to gain weight	12
Rationale for use	Good idea	Thought it would be a good idea to take a supplement/great thing	8
Rationale for use	Guys	Think guys use supplements more than girls, or think there is a double standard on females using supplements	9
Rationale for use	HairSkinNails	Improve hair, skin, and/or nails (make healthy)	14
Rationale for use	healing	Use for healing a sore, etc.	1
Rationale for use	Healthy	Take supplements to be healthy or enhance healthy lifestyle/necessary	20

Final Codebook continued			
Category	**Code**	**Description**	**Count**
Rationale for use	Heart health	Helps support your heart/keep heart healthy	1
Rationale for use	Illness	Take supplement to treat illness (anemia, etc.), deficiency, medical reason/absolute need to take supplements	30
Rationale for use	Look a certain way	Use supplements to look a certain way	5
Rationale for use	Lose Fat	Supplement taken to help lose fat/fat burner/lose weight	22
Rationale for use	Meal replacement	Take supplement as meal replacement	1
Rationale for use	memory	Supplements to improve/help with memory	1
Rationale for use	Metabolism	Supplements help with metabolism	2
Rationale for use	MoodEnhancer	Act as a mood enhancer	1
Rationale for use	More and Longer	Have to take more herbals for a longer time to see a result	1
Rationale for use	muscle	Use supplements to build muscle/mass	42
Rationale for use	Natural	Herbals more natural than medication	1
Rationale for use	No Doctor	Never seen/heard of a doctor/trainer/coach rec the supplement	4
Rationale for use	Not sports approved	Supplements not approved when involved in sports teams in high school/college	1
Rationale for use	Nutrients	Need to take a vitamin because they aren't getting enough nutrients in their normal diet	
Rationale for use	Pain Reliever	Use supplements to help relieve pain	2
Rationale for use	Performance	Supplements enhance performance/training/achieve max. potential	16
Rationale for use	Personal Choice	Personal choice to take supplements	7
Rationale for use	Prevention	Take supplements to prevent illness/boosts immune system/antioxidant properties	32
Rationale for use	QuickResults	Want quick results/are lazy/quicker than making a meal	10
Rationale for use	Recovery	Use to help with recovery from workout	4
Rationale for use	Specific target	Trying to target a specific area or work on something specific/specific need	5
Rationale for use	Stress resistance	Supplement increases resistance to stress	2
Rationale for use	Tell a difference	Take supplements and can tell a difference when taking them, feel better, worked well or state that they think they will work	70
Rationale for use	Trainer rec	Supplement recommended by personal trainer	5
Sources of information[8]	Consult Doc	Should consult doctor before taking supplements	28
Sources of information	FamAdvice	Family member has encouraged student to take supplements	18
Sources of information	Family	Mention family member uses dietary supplement	33
Sources of information	Friend	Mention friend taking supplement	47

Final Codebook continued			
Category	**Code**	**Description**	**Count**
Sources of information	FriendAdvice	Friend giving advice to student	4
Sources of information	internet	Website/internet	3
Sources of information	OtherAdvice	Someone other than family, friend, or doc give student advice on supplements	7
Sources of information	Self	Advice from self, personal knowledge	2
Sources of information	StudentAdvice	Student giving advice to student	47
Sources of information	TVmedia	Mention commercials/TV as source of information/the media	14
Sources of information	WrittenResearch	Information from studies on the supplement/other written material/research	12

1 The main categories of student discussion in the blog, under which the individual codes are sorted; may contain a subcategory
2 The code developed for each new idea the students mentioned in the blog
3 The definition of the code
4 The frequency the code was used in the blog
5 Individual dietary supplements students mentioned in the blog
6 The students' overall perceptions as well as perceptions of the safety of dietary supplements
7 The students' rationale for use or nonuse of dietary supplements
8 The sources of information on dietary supplements students mentioned in the blog

Appendix 3: Inter-coder Agreements

Inter-coder Agreements

Coded Blogging Files*	Agree Absent	Agree Present	Disagree	Percent	Scott's Pi
Section10GroupA **Initial Code Totals**	122	64	111	62.7%	0.225
Section10GroupA Section10GroupB Section11GroupA **Final Code Totals**	58205	376	299	99.5%	0.713

* 3 of the 14 blogging files (32.3% of blog posts) analyzed in this study were used in the calculation of inter-coder agreement

References: Appendix

1. Babbie E. *The Practice of Social Research.* 11th ed. Belmont, CA: Thomson Wadsworth. 2007.

2. Denzin NK, Lincoln YS. *Handbook of Qualitative Research.* 2nd ed. Thousand Oaks, CA: Sage Publications, Inc. 2000:785.

Vita

Beth (Rohling) Brown was born in December 1985 in the great city of Chattanooga, TN. Beth was raised in Chattanooga and graduated from Notre Dame High School in 2004. She attended Tennessee Tech University in Cookeville, TN, where she joined her father and sister as proud Tech alum, earning her Bachelor's degree there in 2008. She majored in Human Ecology, with a concentration in Food, Nutrition, and Dietetics.

Beth was accepted into the Dietetic Internship program at The University of Tennessee, Knoxville, which she completed in August 2010. She is currently pursuing her Master of Science degree in Nutrition with a concentration in Public Health Nutrition at The University of Tennessee. She plans to complete her degree in December 2010.