Motivations for Botanical Use by Socioeconomically Diverse, Urban Adults: Does Evidence Support Motivation?

Grace F. Duffy, BS, Emily Stave Shupe, MS, Marie Fanelli Kuczmarski, PhD, RD, Alan B. Zonderman, PhD, and Michele K. Evans, MD

Abstract

Objective: The study objectives were to characterize botanical dietary supplement (BDS) use and to compare the motivations for botanical supplement (BS) use to the efficacy of the botanical in a socioeconomically and racially diverse urban adult population.

Methods: Subjects were from the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study, a 20-year prospective health disparities study with African American and white adults from Baltimore, Maryland. All study participants completed two dietary recalls and a dietary supplement (DS) questionnaire in Wave 3 (n = 2140). Diet quality was evaluated by the Healthy Eating Index-2010 and the Mean Adequacy Ratio for 17 micronutrients. A comparison of reported motivations to efficacy reported in the literature of single BS was conducted.

Results: Approximately 50% (1062/2140) of participants took DS. Of these, 8% (n = 178) reported taking either BS or BDS. It was found that BDS users had better diet quality than DS users as well as nonusers of DS. The top three motivations for BDS users were to improve overall health, to maintain health, and to supplement the diet. There is limited evidence for the efficacy of most BS. Review of the efficacy of the 15 BS reported by 5% of the study population revealed beneficial health roles for only fiber, gingko biloba extract EGb 761, and hawthorn berry.

Conclusion: To the authors’ knowledge, this study is the first to report a better quality diet with BDS use for a racially diverse urban population. Yet, improvement in diet is needed because overall quality did not achieve current recommendations. To improve overall health, it may be beneficial for this population to focus on dietary modifications to reduce the risks associated with chronic diseases. In general, the reported motivations for BS use were not supported by clinical evidence.

Keywords: botanical, dietary supplements, motivation, treatment efficacy

Introduction

The most commonly used complementary health approach in the United States since 2002 is the use of nonvitamin, nonmineral (NVNM) dietary supplements (DS). Complementary health approaches are often employed to improve health and well-being and, in the United States, to complement conventional care. Globally, the DS market is growing. This growth has been associated with an increase in the aging population, life-style diseases, and healthcare cost. Data from the 2015 Council for Responsible Nutrition Consumer Survey on Dietary Supplements documented an increase in U.S. adult usage of herbs and botanicals by 5%, from 26% to 31% between 2014 and 2015. Botanical supplements (BS) are projected to be the largest market for DS in 2020.

A botanical is a plant or plant component utilized for its medicinal qualities or other remedial purposes. It can be

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classified as a DS if it meets all the criteria, as defined by the Dietary Supplement Health and Education Act of 1994. In the literature, botanicals are categorized as single or multiple botanical ingredient(s) (BS), NVNM DS with botanicals, or vitamin/mineral DS that contain botanical ingredients (botanical dietary supplements [BDS]).

Few studies have exclusively examined BDS use. Data from a nationally representative sample examined in the National Health and Nutrition Examination Survey (NHANES), 2003–2006 (n = 18,758), documented about 20% of U.S. adults used a DS containing one or more botanical ingredients. Schaffer et al. reported that 28.3% of a population (n = 15,985) enrolled in a health maintenance organization used botanicals, while van Breezen et al. reported that 79% of women aged 40–60 years (n = 500) from the University of Illinois at Chicago health clinics used BS. This high prevalence rate may be attributed to the fact that these individuals were already visiting health clinics and therefore may have been more motivated to take a supplement for their health.

Botanicals possess known active ingredients, as well as unknown ingredients, which can pose a challenge to nutritionists and other health professionals. They have been found to have protective effects against inflammation, cardiovascular disease, cognitive decline, and other age-related diseases in humans and rodents. The interaction of botanicals with macronutrients may modulate life-span, promoting healthy aging. However, botanicals can also interact with nutrients and/or prescription drugs, potentially resulting in adverse health effects. The lack of ingredient labels on botanical products, the quality of the extracts used, potential contamination, dosages, and toxicities raise concerns about the safety and potential risks of BDS. Additionally, botanical use is underreported to healthcare providers. This high prevalence rate may be attributed to the fact that these individuals were already visiting health clinics and therefore may have been more motivated to take a supplement for their health.

NHANES 2007–2010 data revealed that the most common motivations for use of DS (including vitamins, minerals, botanicals, and NVNM supplements) were to improve overall health and to maintain health. Use of supplements by these NHANES participants was associated with lower body mass index (BMI), abstinence from smoking, more exercise, moderate alcohol use, and “very good” to “excellent” reported health compared with nonusers. The motivations for use of BS have not been extensively studied in socioeconomically diverse, urban African American and white populations, namely the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study participants. Unlike NHANES participants, HANDLS study respondents, who consume a diet that scored lower on the Healthy Eating Index (HEI)-2010 than the national average derived from NHANES data, tend to be overweight or obese and smoke. The primary objective of this study was to characterize BS use in a socioeconomically and racially diverse urban adult population. The secondary objective was to compare the motivations for BS use to the efficacy of the botanical.

Methods

HANDLS study sample

The HANDLS study was designed to explore the roles of race and socioeconomic status (SES) on health disparities with respect to cardiovascular and cerebrovascular diseases and cognitive function. The study design and aims of the HANDLS study, a 20-year prospective study, have been described in detail elsewhere. Participants were drawn from 32,959 households in 13 predetermined Baltimore neighborhoods, yielding representative distributions of individuals between 30 and 64 years old who were African American (AA) and white (W), male and female, and with a range of SES (operationalized by household incomes below or above the 2004 125% of the Federal poverty guidelines). In the baseline HANDLS study, 3720 AA and W participants were enrolled and examined between August 2004 and March 2009. Of these participants, 2468 were reexamined in Wave 3 between June 2009 and July 2013. This study’s sample included only Wave 3 participants who completed both dietary recalls and the DS questionnaire (n = 2140). In this sample, 61.5% (n = 1316) were AA and 38.5% (n = 824) were W.

Wave 3 of the HANDLS study consisted of two phases. The first phase was done on the Mobile Research Vehicles (MRV). This phase consisted of the first dietary recall, a physical examination, cognitive evaluation, a variety of physiological assessments, muscle strength and bone density, and laboratory measurements. The second phase included the second dietary recall and DS questionnaire, completed by phone 4–10 days later. The protocol and a complete listing of the examinations can be found on the HANDLS study website (http://handls.nih.gov/). The study protocol was approved by Institutional Review Boards at the National Institute of Environmental Health and University of Delaware. All HANDLS participants provided written informed consent and were compensated monetarily.

Socio-demographic variables

Socio-demographic variables included age, sex, race, SES, self-reported health, education, and literacy. In the baseline HANDLS study, general literacy was assessed by trained examiners on the MRV, using the reading subtest of the Wide Range Achievement Test—3rd Edition (WRAT-3), a widely validated and used measurement of literacy. The Rapid Estimate of Adult Literacy in Medicine (REALM)—a word recognition test focusing on medical words and pronunciation from simple to more complex, multisyllabic words—was performed during Wave 3 to assess health literacy. The WRAT-3 was found to be highly correlated with REALM.

BMI (kg/m²) was calculated from measured weight and height. Weight was obtained using a calibrated Med-weigh, model 2500 digital scale, and height was measured with the participant’s heels and back against a height meter supplied by Novel Products, Inc.

Diet and DS variables

Two dietary recalls were conducted by trained interviewers using the USDA Automated Multiple Pass Method (AMPM). Dietary recalls were coded using Survey Net, matching foods consumed with eight-digit codes in the Food and Nutrient Database for Dietary Studies. After the second recall, the DS questionnaire was administered. Detailed information was collected about over-the-counter BS, BDS, vitamin and/or mineral supplements without botanicals (DS), antacids, and prescription supplements. Information collected included supplement use over the past 24 h, past month, and total length of time taken. The HANDLS study DS database was developed and is maintained by trained nutritionists and registered dietitians based on supplements reported. The
questionnaire and detailed descriptions about the collection and processing of DS data are published elsewhere (https://handls.nih.gov/06Coll-w03DietSupplements.htm).

Nutrient-based diet quality was calculated from reported food and beverage intake with and without nutrients from supplements over the past 24 h. The proportion of 17 micronutrients—namely calcium, magnesium, selenium, phosphorus, vitamin A, vitamin C, vitamin D, vitamin E, vitamins B6 and B12, folate, iron, thiamin, riboflavin, niacin, copper, and zinc—was compared to the Recommended Dietary Allowance (RDA). The following formula was used to determine the nutrient adequacy ratio (NAR): Subject’s daily intake of nutrient/RDA of nutrient. An adjustment of an additional 35 mg of vitamin C was applied to the RDA for participants who were current smokers. The NAR of each nutrient was then converted to a percentage, and percentages >100 were truncated to 100. The mean adequacy ratio (MAR), a measure of total quality of the diet, was calculated using the following formula: MAR = Sum of all 17 nutrient NARs/17. Two MAR scores were used in analysis: a Diet MAR score was calculated using only NAR scores based on both dietary recalls, and a Diet + Supplement MAR score was calculated using nutrients from both dietary recalls plus nutrients from supplements.

Food-based diet quality was evaluated with the HEI-2010. The National Cancer Institute’s Applied Research Web site provided the basic steps for calculating the HEI-2010 component and total scores and statistical code for 24 h recalls (http://appliedresearch.cancer.gov/tools/hei/tools.html). A detailed description of the procedure used for this study is available on the HANDLS website (http://handls.nih.gov/06Coll-dataDoc.htm). Component and total HEI-2010 scores were calculated for each recall day and were averaged to obtain the mean for both days combined.

For each supplement reported, an open-ended question about motivations for use was asked by interviewer. Participants could provide more than one reason. The interviewer recorded the response and assigned it a categorical value. For this study, antacid and prescription supplements were excluded in analyses.

**Literature search strategy**

Prior to the literature review, a listing of all the single botanicals reported was created. There were 251 single botanicals reported, which were categorized into 39 groups, ranging in use from <5% to 21%. The decision was made to compare the motivation to efficacy for only BS reported by ≥5% of the study population, resulting in a total of 15 single botanicals. As shown in Table 1, the most commonly reported BS were garlic (*Allium sativum*), flaxseed (*Linum usitatissimum*), and gingko biloba (*Gingko biloba*). The remaining 12 botanicals with their percent usage are reported in Table 1. It should be noted that rose hips was consumed by 16% of the sample but since this botanical was in combination with vitamin C it was not included in the single botanical listing. The primary motivation for taking rose hips was to prevent colds and boost the immune system. It should also be noted that there were no relevant clinical trials found for milk thistle relating to overall health, nails, hair, cleanse, appetite, or weight. Therefore, only reviews concerning the liver were included.

### Table 1. Usage of Botanical Supplements by HANDLS Study Participants

<table>
<thead>
<tr>
<th>Botanical</th>
<th>%</th>
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<tbody>
<tr>
<td>Garlic (<em>Allium sativum</em>)</td>
<td>21</td>
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<tr>
<td>Flaxseed (<em>Linum usitatissimum</em>)</td>
<td>16</td>
</tr>
<tr>
<td>Gingko (<em>Gingko biloba</em>)</td>
<td>16</td>
</tr>
<tr>
<td>Glucoamine chondroitin</td>
<td>11</td>
</tr>
<tr>
<td>Milk thistle (<em>Silybum marianum</em>)</td>
<td>11</td>
</tr>
<tr>
<td>Cinnamon (<em>Cinnamomum cassia</em>)</td>
<td>11</td>
</tr>
<tr>
<td>Echinacea (<em>Echinacea purpurea</em>)</td>
<td>9</td>
</tr>
<tr>
<td>Evening primrose (<em>Oenothera biennis</em>)</td>
<td>9</td>
</tr>
<tr>
<td>Black cohosh (<em>Cimicifuga racemose</em> and <em>Actaea racemose</em>)</td>
<td>7</td>
</tr>
<tr>
<td>Ginseng (<em>Panax ginseng</em>)</td>
<td>7</td>
</tr>
<tr>
<td>Turmeric (<em>Curcuma domestica</em>)</td>
<td>7</td>
</tr>
<tr>
<td>Bilberry (<em>Vaccinium myrtillus</em>)</td>
<td>5</td>
</tr>
<tr>
<td>Fiber</td>
<td>5</td>
</tr>
<tr>
<td>Hawthorn berry (<em>Crataegus species</em>)</td>
<td>5</td>
</tr>
<tr>
<td>Saw palmetto (<em>Sabal serrulatum</em>)</td>
<td>5</td>
</tr>
</tbody>
</table>

Only single botanicals used by ≥5% of the study population are reported.

**HANDLS, Healthy Aging in Neighborhoods of Diversity across the Life Span.**

Electronic searches were performed using PubMed/MEDLINE, The Cochrane Library, the National Center for Complementary and Integrative Health’s “Herbs at a Glance,” the National Institutes of Health’s Office of Dietary Supplements, and the University of Maryland Medical Center Complementary and Alternative Medicine Guide. Keywords included the scientific and common botanical name and keywords related to motivations listed in Table 1 and Supplementary Table S1 (Supplementary Data are available online at www.liebertpub.com/acm). The initial review included articles from January 2010 to March 2016, focusing on systematic reviews and systematic reviews with meta-analyses. If no relevant articles or trials were found, then review articles or single randomized control trials that pertained to the primary motivation were sought. For single clinical trials, a Jadad score was calculated independently by three researchers, and only studies with a score of ≥4 were included. Lastly, if no relevant articles or trials that pertained to the primary motivation existed within the time frame of January 2010 to March 2016, the search was extended from January 2005 to March 2016. The only articles cited for efficacy of a claim were published between 2007 and 2016.

**Statistical analyses**

Means and standard errors for continuous variables and proportion of participants for relevant categorical variables were calculated. Analysis of variance (ANOVA) was used to compare socio-demographic and life-style factors across DS categories, and *p*-values were adjusted for multiple comparisons of continuous variables using the Bonferroni test. The first set of analyses compared persons taking only BS with persons taking BDS. Since there were no differences in demographic or life-style characteristics between persons using BS and participants using BDS, these two groups were aggregated. The second set of ANOVAs compared users of BDS to nonusers of DS (NDS) and to users of DS. NDS and users of DS were also compared. Chi square analyses were performed to compare motivations.
between users of BDS and DS. All analyses were performed with IBM SPSS Statistics for Windows v23. For all statistical analyses, \( p < 0.05 \) was considered significant.

**Results**

There were 1062 users of DS of the 2140 Wave 3 HANDLS study sample. Among DS users, 56 people took BS, 122 consumed BDS, and 884 reported using DS. HANDLS study participants who reported using only botanicals tended to be women (36/56), W (34/56), non-smokers (13/56), and had a high SES (45/56). Their health literacy score was 61.7 ± 1.2, and their general literacy was 43.3 ± 10.9, equivalent to a 12th grade reading level. On average, these people completed 14 years of education.

As shown in Table 2, compared with nonusers of supplements, people taking supplements with botanicals or solely botanicals were older and had more years of education, higher overall literacy and health literacy scores, and better diet quality, measured by the Diet MAR score and the Diet + Supplement MAR score, as well as the HEI-2010. The BDS group was composed of more women and fewer AAs. There were no differences in self-reported health, energy intake, or BMI.

More Ws compared with AAs composed the BDS group. In contrast, more AAs compared with Ws comprised the DS group (Table 2). The only differences found between DS and BDS users were education, SES, and diet quality. Again, users of BDS had more years of education, more education, SES, and diet quality. As shown in Table 2, compared with nonusers of supplements without botanicals, BDS users had more years of education, more education, SES, and diet quality. BDS users had more years of education, more education, SES, and diet quality.

The results indicated that BDS users had better quality diet with BDS usage. While botanicals themselves do not have any innate nutritional value, users of supplements with botanicals had higher HEI-2010 scores than nonusers or users of supplements without botanicals, indicating a higher food-based diet quality. However, this finding must be interpreted with caution, since the overall HEI-2010 scores indicated <50% compliance with the Dietary Guidelines for Americans, suggesting different food choices are needed. Additionally, nutrient diet quality was also higher, as evidenced by the higher MAR score. Not only did BDS users have higher Diet + Supplement MAR scores, which would be expected due to the vitamin and mineral nutrient content in botanicals and nutrient content in DS.

**Discussion**

To the authors’ knowledge, this study is the first to report a better quality diet with BDS usage. While botanicals themselves do not have any innate nutritional value, users of supplements with botanicals had higher HEI-2010 scores than nonusers or users of supplements without botanicals, indicating a higher food-based diet quality. However, this finding must be interpreted with caution, since the overall HEI-2010 scores indicated <50% compliance with the Dietary Guidelines for Americans, suggesting different food choices are needed. Additionally, nutrient diet quality was also higher, as evidenced by the higher MAR score. Not only did BDS users have higher Diet + Supplement MAR scores, which would be expected due to the vitamin and mineral nutrient content in botanicals and nutrient content in DS.

**Table 2. Characteristics of HANDLS Study Participants (n = 2140) Categorized by Dietary Supplement Use**

<table>
<thead>
<tr>
<th>Socio-demographic and lifestyle factors</th>
<th>Nonusers (n = 1078)</th>
<th>Comparison of nonusers to users of BDSb (n = 178)</th>
<th>Comparison of nonusers to users of DSb (n = 884)</th>
<th>p-Value for BDS to DS user comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, baseline, years</td>
<td>46.5 ± 0.3</td>
<td>49.6 ± 0.6***</td>
<td>49.4 ± 0.3***</td>
<td>0.969</td>
</tr>
<tr>
<td>Agec, Wave 3, years</td>
<td>51.7 ± 0.3</td>
<td>54.7 ± 0.6***</td>
<td>54.6 ± 0.3***</td>
<td>0.999</td>
</tr>
<tr>
<td>African American</td>
<td>709 (65.7%)</td>
<td>83 (46.6%)***</td>
<td>524 (59.3%)**</td>
<td>0.003</td>
</tr>
<tr>
<td>Female</td>
<td>585 (54.2%)</td>
<td>119 (66.9%)***</td>
<td>556 (62.9%)***</td>
<td>0.317</td>
</tr>
<tr>
<td>Literacyd</td>
<td>40.5 ± 0.4</td>
<td>44.1 ± 0.8***</td>
<td>42.4 ± 0.4***</td>
<td>0.203</td>
</tr>
<tr>
<td>Health literacye</td>
<td>57.6 ± 0.4</td>
<td>61.8 ± 0.6***</td>
<td>59.9 ± 0.4**</td>
<td>0.147</td>
</tr>
<tr>
<td>Education, years</td>
<td>12.1 ± 0.1</td>
<td>13.9 ± 0.2***</td>
<td>12.7 ± 0.1**</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>SESf</td>
<td>480 (44.5%)</td>
<td>40 (22.5%)***</td>
<td>331 (37.4%)**</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Self-reported healthg</td>
<td>229 (29.2%)</td>
<td>47 (34.1%)***</td>
<td>178 (27.9%)</td>
<td>0.314</td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
<td>30.1 ± 0.2</td>
<td>31.2 ± 0.6</td>
<td>31.2 ± 0.3**</td>
<td>0.998</td>
</tr>
<tr>
<td>Energy, kcal</td>
<td>2043 ± 26</td>
<td>2044 ± 68</td>
<td>1995 ± 28</td>
<td>0.768</td>
</tr>
<tr>
<td>Diet MARb Score</td>
<td>72.6 ± 0.4</td>
<td>78.0 ± 1.0***</td>
<td>74.8 ± 0.5**</td>
<td>0.016</td>
</tr>
<tr>
<td>Diet + Supplement MARb</td>
<td>72.7 ± 0.4</td>
<td>90.1 ± 0.8</td>
<td>85.2 ± 0.4**</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HEI-2010c Score</td>
<td>41.0 ± 0.4</td>
<td>48.8 ± 1.4</td>
<td>44.2 ± 0.5**</td>
<td>&lt;0.001</td>
</tr>
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</table>

Values for continuous variables expressed as mean ± standard error; categorical variables expressed as N (%).

Levels for nonuser to BDS user comparison: \( p < 0.05 \); \( **p < 0.01 \); \( ***p < 0.001 \).

\( a \)Age range was 32–70 years.

\( b \)Measured with WRAT—3rd edition.\(^{21}\)

\( c \)SES, categorized as <125% of 2004 Federal poverty guidelines.

\( d \)Rated health as very good or excellent.

\( e \)MAR based on the diets of 17 micronutrients. Maximum score = 100.

\( f \)HEI-2010, maximum score of 100 means optimal compliance to Dietary Guidelines for Americans.

BDS, botanical dietary supplement; DS, dietary supplement without botanicals; WRAT, Wide Range Achievement Test; REALM, Rapid Estimate of Adult Literacy in Medicine; SES, socioeconomic status; MAR, mean adequacy ratio; HEI-2010, Healthy Eating Index.
Evidence for the beneficial health roles only currently exists was also one of the three most common motivations for participants was “to improve overall health.” Among Ws, which was not true for the HANDLS study. Breeman found the use of BDS was greater among AAs than

However, there is increased risk of bleeding when gingko and hawthorn berry are taken with blood-thinning drugs. For prostate health, menopausal symptoms, notably hot flashes, night sweats, and mood swings. Women in the HANDLS study reported the reason for use of black cohosh and evening primrose oil was hot flashes. Unfortunately, the evidence on efficacy of these botanicals is mixed. Sharing findings of clinical studies with consumers is important, as is the importance for health professionals to be knowledgeable about the clinical evidence related to efficacy and safety of botanicals. Despite better diet quality with botanical usage, the mean BMI of the study population indicated overweight/obesity, a risk factor for many chronic conditions. Given the motivation to improve overall health, it may be more beneficial for this population to limit their BDS use and focus on improving the quality of their diet through other methods. Perhaps health professionals should develop interventions that assist individuals to develop the skills to modify food choices and preparation methods within their budgets. Dietary changes can improve nutritional status, thereby improving health and reducing risks associated with chronic conditions.

This study has several strengths. First, it focused on a unique, understudied, relatively large AA and W urban population who are at higher risk of health disparities and who are vulnerable to unhealthy eating practices. Second, the measures of diet quality were based on dietary data collected from two 24h recalls, which likely represents typical intakes. The method used to collect the recalls has been shown to provide valid intakes for normal and overweight individuals and better energy estimations compared with intakes based on food frequencies. As with any research, there are limitations. First, although DS questionnaire and dietary recall interviews were administered, there is still potential for biased data due to underreporting. Energy intake collected by the AMPM has been reported to be underreported by normal weight individuals by 3% and by overweight individuals by 16% when compared with the doubly labeled water technique. Second, results describe an urban population that resided in Baltimore, Maryland. Although the findings cannot be generalized to a national population, independent demographic analyses found this population representative of populations from 14 U.S. cities with similar population densities and racial distribution. Last, no information on botanical use as adjunctive therapy was gathered by the DS questionnaire.

In conclusion, maintenance of health is the top motivator for use of supplements that contain botanicals or single BS. This finding differs from the top motivation of users of supplements that do not contain botanicals, namely doctor recommended. As anticipated, the Diet + Supplement MAR scores of DS users were significantly higher than those for non-users. Diet quality of users of BDS was significantly higher than for users of DS. These groups were similar with respect to literacy and health literacy, energy intake, self-reported health, and BMI. Perhaps the higher SES and education levels of the users of BDS contributed to healthier food choices. However, the HEI-2010 scores revealed that this urban population was only 50% compliant with current dietary recommendations.

**Acknowledgments**

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Author Disclosure Statement

No potential conflict of interest was reported by the authors.

References


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<th>Botanical and motivation</th>
<th>Study design</th>
<th>Evidence</th>
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<tbody>
<tr>
<td><strong>Bilberry</strong> <em>Vaccinium myrtillus</em>&lt;br&gt;For eye health, macular degeneration</td>
<td>Systematic review of RCTs and PC studies</td>
<td>Lack of efficacy of beneficial effect of bilberry in night vision in healthy persons from well-designed studies(^40)&lt;br&gt;Effectiveness of bilberry on glaucoma is methodologically flawed(^40)</td>
</tr>
<tr>
<td><strong>Black cohosh</strong> <em>Cimicifuga racemosa L.</em>&lt;br&gt;<em>Actaea racemosa</em> L.&lt;br&gt;Women’s health, breast cancer, cancer survivor, hot flashes</td>
<td>Systematic review article</td>
<td>Efficacious in reducing symptoms of menopause when compared to placebo, compared to other herbal regimes, or used in combination. Mixed evidence on reduced risk of developing breast cancer(^41).&lt;br&gt;Isopropanolic <em>Cimicifuga racemosa</em> extract and ethanolic extract (BNO 1055) efficacious in treatment of climacteric complaints(^42)&lt;br&gt;Insufficient evidence to support efficacy in controlling symptoms of menopause(^43)</td>
</tr>
<tr>
<td><strong>Cinnamon</strong> Diabetes</td>
<td>Review article</td>
<td>Lack of efficacy of therapeutic benefit on glycemic control&lt;br&gt;Potential benefit as adjunctive to conventional treatment for patients with mild diabetes and possibly for patients with high HBA1c&lt;br&gt;High coumarin content of <em>Cinnamomum cassia</em> has resulted in recommendation to supplement with <em>Cinnamomum zeylanicum</em>(^45)</td>
</tr>
<tr>
<td><strong>Echinacea</strong> To prevent colds, boost immune system</td>
<td>Systematic review and meta-analysis of 10 RCTs</td>
<td>No significant difference in glycosylated hemoglobin A1C (HbA1c) in patients with type 2 diabetes. Potential benefit on fasting blood glucose, LDL-cholesterol, HDL-cholesterol, and triglyceride levels in patients with type 2 diabetes(^46).&lt;br&gt;Risk for recurrent respiratory infections and complications (conjunctivitis, sinusitis, otitis media/externa, tonsillitis/pharyngitis, bronchitis, pneumonia) was reduced compared to placebo(^47).&lt;br&gt;No significant effects on cough symptoms but significantly improved cold-related symptoms and duration of illness in 4/8 trials(^48).&lt;br&gt;Weak evidence (2/6 RCT) for clinical treatment to shorten duration of colds. Post hoc pooling of data from 12 prevention trials suggests a relative risk reduction of catching a cold by 10–20%(^49)</td>
</tr>
<tr>
<td><strong>Evening primrose oil (EPO)</strong> <em>Oenothera biennis</em>&lt;br&gt;Women’s health, breast cancer, cancer survivor, hot flashes</td>
<td>Systematic review 1–40 center trial</td>
<td>Gamma linolenic acid, active ingredient of EPO, not effective in treatment of mastalgia (breast pain)(^50)&lt;br&gt;Lack of efficacy of beneficial effect of EPO on decreasing the frequency or duration of hot flashes. EPO significantly reduced intensity of hot flashes(^51)&lt;br&gt;No evidence of benefit of EPO for symptoms of premenstrual syndrome(^52)&lt;br&gt;EPO not effective in treatment of mastalgia (breast pain)(^53)</td>
</tr>
<tr>
<td><strong>Fiber</strong> For good bowel/colon health, GI, fiber supplements, prebiotics</td>
<td>Systematic review with meta-analysis of 8 RCTs</td>
<td>Soluble fiber but not bran supplementation found to be effective in treating irritable bowel syndrome (IBS)(^50)&lt;br&gt;Significant inverse association between higher fiber intake and Crohn’s disease risk(^31)</td>
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<th>Evidence</th>
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<tbody>
<tr>
<td>Flaxseed</td>
<td>Systematic review with meta-analysis of 14 RCTs</td>
<td>Evidence indicates consumption of whole flaxseed for 3–48 weeks may lower blood pressure. <strong>54</strong></td>
</tr>
<tr>
<td></td>
<td>Systematic review with meta-analysis of 28 RCTs</td>
<td>Mixed evidence on serum cholesterol—significant reduction of total and LDL-cholesterol and total cholesterol levels with whole flaxseed, but no substantial effect on HDL-cholesterol or triglycerides. No significant decrease in total and LDL-cholesterol with flaxseed oil. <strong>55</strong></td>
</tr>
<tr>
<td>Garlic</td>
<td>Review article of 2 DBRCTs and 12 meta-analysis of RCTs</td>
<td>Limited evidence on reduction of blood pressure (systolic and diastolic). Potential benefit as adjunctive therapy for reducing total cholesterol. <strong>56</strong></td>
</tr>
<tr>
<td></td>
<td>Cochrane systematic review of 1 RCT</td>
<td>Lack of efficacy in the treatment of peripheral arterial occlusive disease (12-week trial). <strong>57</strong></td>
</tr>
<tr>
<td></td>
<td>Cochrane systematic review of 2 RCTs</td>
<td>Insufficient evidence of significant risk reduction of mortality and cardiovascular morbidity in patients with hypertension compared to placebo. Possible impact on lowering blood pressure. <strong>58</strong></td>
</tr>
<tr>
<td></td>
<td>Cochrane systematic review of 1 RCT</td>
<td>Insufficient clinical evidence to support for prevention or treatment of the common cold. <strong>59</strong></td>
</tr>
<tr>
<td>Gingko biloba</td>
<td>Systematic review and meta-analysis of 9 RCTs</td>
<td>Change in cognition, functional domain (activities of daily living), behavioral symptoms, and global assessment of patients with dementia and cognitive impairment was stabilized or slowed with EGB 761 (trials lasted 22–26 weeks with dose of 240 mg/day). <strong>33</strong></td>
</tr>
<tr>
<td></td>
<td>Systematic review and meta-analysis of 7 RCTs</td>
<td>Confirmed efficacy of EGB 761 (compared with placebo) for treatment of patients with dementia. Outcomes included improved cognitive domain, functional domain (activities of daily living), and global assessment. <strong>34</strong></td>
</tr>
<tr>
<td></td>
<td>Systematic review with meta-analysis of 10 RCTs</td>
<td>No significant enhancement of memory, executive function, or attention in healthy individuals with all effect sizes non-significant and effectively at zero. <strong>35</strong></td>
</tr>
<tr>
<td>Ginseng</td>
<td>Multisite RDBPCT with American ginseng</td>
<td>Panax quinquefolius efficacious in reducing cancer-related fatigue measured by Multidimensional Fatigue Symptom Inventory-Short form compared with placebo. <strong>60</strong></td>
</tr>
<tr>
<td></td>
<td>RDBPCT with Asian ginseng</td>
<td>No significant effects of 1 g of Panax ginseng on fatigue severity measured with a Visual Analog Scale in patients with idiopathic chronic fatigue compared with placebo. Significant reduction observed with 2 g of Panax ginseng. <strong>51</strong></td>
</tr>
<tr>
<td>Glucosamine, chondroitin</td>
<td>Cochrane systematic review of 43 RCTs</td>
<td>Patients with osteoarthritis treated with chondroitin alone or in combination with glucosamine scored significantly better on pain scales compared to placebo. Studies were &lt;6 months and judged to be low quality. Studies with larger sample sizes and higher methodological quality showed no significant difference between chondroitin and placebo. <strong>62</strong></td>
</tr>
<tr>
<td></td>
<td>Network meta-analysis of 10 RCTs</td>
<td>Glucosamine, chondroitin, or their combination did not yield a clinically relevant reduction of joint pain or affect joint space narrowing compared with placebo. <strong>63</strong></td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Botanical and motivation</th>
<th>Study design</th>
<th>Evidence</th>
</tr>
</thead>
</table>
| **Hawthorn berry** *Crataegus species*  
For heart health, circulation, blood pressure, elevated CRP, omega 3 | Review article  
Cochrane systematic review of meta-analysis of 14 DBRCTs (placebo controlled) | Effective in improvement of typical symptoms of chronic heart failure (2/3 RCT, 1 open prospective cohort study) and in congestive heart failure (4/4 RCT). Effective in lowering blood pressure (3/4 RCT). Significance benefit in symptom control (dyspnea [shortness of breath] and fatigue) and function of heart as an adjunctive treatment for adult patients with chronic heart failure. (Treatment ranged from 3 to 16 weeks, and longest follow-up was 26 weeks. Note: Hawthorn is slow-acting herb and should be used for at least 4–8 weeks for full benefit).  
Review article  
Cochrane systematic review of meta-analysis of 14 DBRCTs (placebo controlled) | Significant benefit in symptom control (dyspnea [shortness of breath] and fatigue) and function of heart as an adjunctive treatment for adult patients with chronic heart failure. (Treatment ranged from 3 to 16 weeks, and longest follow-up was 26 weeks. Note: Hawthorn is slow-acting herb and should be used for at least 4–8 weeks for full benefit). |
| **Milk thistle**  
*Silybum marianum* (L.) Gaertner  
To improve my overall health, nails, hair, cleanse, liver, improve appetite, increase weight | Review article  
Cochrane systematic review of 13 RCTs  
Systematic review with meta-analyses of 19 clinical trials | Evidence of mechanism of action: antioxidant free radical scavenging, especially hydroxyl radical, and inhibition of lipid peroxidation. Evidence for use as adjunctive therapy in hepatic cirrhosis. Insufficient evidence to support or refute intervention for patients with alcoholic and/or hepatitis B or C virus liver diseases. No significant beneficial effects on mortality. Available evidence supports use as supportive drug in therapy of liver cirrhosis. |
| **Saw Palmetto**  
*Sabal serrulatum*  
For prostate health | Cochrane systematic review of 32 RCTs (27 double-blinded)  
Systematic review with meta-analyses of 19 clinical trials | No significant decrease in nightly urination or prostate size from baseline. Peak urine flow not improved in men with benign prostatic hyperplasia. (Trial length ranged from 4–72 weeks). |
| **Turmeric**  
*Curcuma domestica*  
For healthy joints, arthritis | DBRCT | Curcumin extracts as effective as ibuprofen in decreasing symptoms associated with knee osteoarthritis with fewer gastrointestinal side effects. |

DBRCT, double-blinded randomized controlled trial; RDBPCT, randomized double-blinded placebo-controlled trial; PC, placebo-controlled; RCT, randomized controlled trial. Note: could be double-, single-, or unblinded.