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Evaluation of the Health Benefits of a Multivitamin, Multimineral, Herbal, Essential Oil–Infused Supplement: A Pilot Trial

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ABSTRACT

This study was designed to quantitatively evaluate the health benefits of a multivitamin, multimineral, herbal, essential oil–infused supplement using serum biomarkers. We also qualitatively evaluated the health effects of this supplement using a survey. Sixteen participants were recruited to take the supplement as directed for two months. The levels of the following serum components were measured in the participants: total cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, triglycerides, lipoprotein(a), LDL/HDL cholesterol ratio, total/HDL cholesterol ratio, ferritin, fibrinogen, C-reactive protein, insulin, testosterone, sex hormone binding globulin, free androgen index, red blood cell magnesium, homocysteine, coenzyme Q10, lipid peroxides, alpha-tocopherol, gamma-tocopherol, cardiovascular index, eicosapentaenoic acid (EPA), arachidonic acid (AA), and the AA/EPA ratio. The following markers were significantly improved ($p < .05$) after two months of supplementation: HDL cholesterol, LDL/HDL cholesterol ratio, fasting insulin, homocysteine, serum vitamin E, EPA, and the AA/EPA ratio. These findings demonstrate that the supplementation had significant positive effects on biochemical indicators of cardiovascular health, antioxidant status, inflammation, and blood glucose regulation. All of the outcomes in the 16-item qualitative survey were improved after two months of supplementation. Twelve of these outcomes were significantly improved. The participants reported more mental clarity, energy, motivation, control, balance, and happiness, while reporting less back pain, muscle pain, cold and flu incidence, anxiety, frustration, and irritation at the end of the two-month supplementation period. Although definite clinical efficacy remains elusive, these results suggest that the supplement may provide a broad range of health benefits for users in a short period.

KEYWORDS

anti-inflammation; blood glucose; cardiovascular health; energy; HDL cholesterol; immunity; LDL cholesterol; mental health

Introduction

There are many multivitamin, multimineral supplements available on the market. One such supplement, Lifelong Vitality Pack (LLV), is a comprehensive multivitamin, multimineral, herbal omega-3 supplement infused with essential oils. Its users (primarily middle-aged men and women) have reported increased energy levels, decreased pain, stronger immunity, and improved mental focus. These benefits are thought to be the results of the many active ingredients found in the product.

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The ingredients found in LLV include omega-3 fatty acids, boswellic acids, vitamins and minerals, and L-carnitine. Omega-3 fatty acids are generally considered anti-inflammatory. Fish oil supplements have been reported to have cardiovascular benefits (Minihane, 2013) and have been studied as treatments for depression and mood disorders as they support brain development and function (Song, 2013). This suggests that fish oil supplements may decrease pain and improve mental focus. Boswellic acids are specific, nonreducing inhibitors of 5-lipoxygenase and thus inhibit leukotriene synthesis (Safayhi et al., 1992). These compounds are thought to decrease inflammatory markers and the numbers of white blood cells at sites of trauma, which leads to faster healing (Kimmattkar et al., 2003). These findings suggest that boswellic acids may have potential effects on pain and immunity. Vitamins and minerals help maintain an appropriate nutritional state, which is an important factor for a healthy immune system. Vitamins and minerals are thus important for immune function (Maggini et al., 2007). L-carnitine, which is an amino acid derivative, functions as a shuttle between the cytoplasm and mitochondria for long-chain fatty acids and allows beta-oxidation to take place in the mitochondria. This process produces energy and controls fatty acid accumulation (Liu, Lin, & Chang, 2013). Thus, L-carnitine may contribute to the reported increases in energy levels.

The current study was designed to quantitatively and qualitatively explore the mechanisms underlying these reported benefits using blood markers and a survey. The objective was to determine how LLV affects both serum biomarkers and lifestyle factors over two months in individuals who had not previously taken the supplement. It was hypothesized that several serum biomarkers would be significantly improved in association with benefits reported by the users of the product. Likewise, it was hypothesized that the qualitative survey would indicate significant improvements in participants taking the supplement and provide us with insight regarding how these improvements were manifested according to the participants' perspectives.

Materials and methods

Study materials

The study product, LLV (dōTERRA; Pleasant Grove, UT, USA), comprised three bottled supplements: Alpha CRS+, xEO Mega, and Microplex VMz. Users were instructed to take the product twice daily as a comprehensive dietary supplement foundation. LLV contains many well-studied vitamins, minerals, herbal extracts, omega-3 fatty acids, and essential oils (dōTERRA, 2016). The main ingredients are as follows.

Alpha CRS+ contains boswellic acids, silymarin, curcumin, ginkgo, bromelain enzyme, carotenoids, and polyphenols, such as resveratrol, ellagic acid, baicalin, and proanthocyanidins from grape seed.

A single daily dose of xEO Mega provides 1,000 milligrams of marine lipids with 340 mg EPA, 240 mg docosahexaenoic acid, and a blend of plant-sourced essential fatty acids. xEO Mega also includes 800 IU of vitamin D, 60 IU of vitamin E, and 1 mg of astaxanthin (an antioxidant carotenoid harvested from microalgae), as well as other carotenoids.

Microplex VMz includes a balanced blend of the essential antioxidant vitamins A, C, and E and a complex of B vitamins. It also contains all essential minerals, including calcium, magnesium, and zinc, as well as trace minerals. In addition, Microplex VMz contains a blend of nine essential oils, including oils from peppermint, ginger, and caraway.

Study procedure

Eighteen participants were recruited to take LLV as directed for two months. Participants were screened using a medical history questionnaire to determine eligibility. The participants were not eligible for the study if they had previously taken LLV and were asked to stop the use of all other supplements before and during the study; they were encouraged to continue with their normal lifestyles. Participants were required to be in self-judged good health with no diagnostic disease present and not obese (body mass index [BMI] < 30 kg/m²). Pregnant or lactating women were excluded from the study. A blood sample was collected and surveys were taken both before and after the two-month period. The study protocol was reviewed and approved by an Institutional Review Board before the study began.

Blood samples were drawn by a certified phlebotomist, prepared, and then analyzed by an independent laboratory. The following components were measured in sera from the participants: total cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, triglycerides, lipoprotein(a), LDL/HDL cholesterol ratio, total/HDL cholesterol ratio, ferritin, fibrinogen, C-reactive protein, insulin, testosterone, sex hormone binding globulin, free androgen index, red blood cell (RBC) magnesium, homocysteine, coenzyme Q10, lipid peroxides, alpha-tocopherol, gamma-tocopherol, cardiovascular index, eicosapentaenoic acid (EPA), arachidonic acid (AA), and AA/EPA ratio. These biomarkers are generally thought to provide a good assessment of cardiovascular health, antioxidant status, inflammation, and blood glucose regulation.

A 16-item 9-point hedonic scale survey was administered to evaluate the qualitative effects of LLV that could not be measured using serum analysis. The 16 items on the survey were back pain, joint pain, muscle pain, headaches, other pain, cloudy thinking/lack of clarity, tiredness or lack of energy, lack of motivation, a cold or flu, other illness, anxiety, frustration or lack of control, irritation, felt in control, balanced, and happy.

Data analysis

The data were analyzed using the Statistics Analysis Software system (SAS Institute Inc.; Cary, NC, USA). Analysis of the data determined that there were no significant interactions among the variables. All results were analyzed using two-tailed paired *t* tests. Differences were considered significant if *p* values were < .05.

Results

Two participants were unable to complete the study, so results are based on the 16 participants (12 women and 4 men) who completed the study. The participants had an average age of 42 years and an average BMI of 26.4 kg/m².

Quantitative serum analysis

The results of the serum analysis before and after two months of LLV supplementation are summarized in [Table 1](#). HDL cholesterol levels were significantly increased from 56.4 to 63.2 mg/dL. LDL cholesterol levels were also slightly increased, although this increase was not considered statistically significant. Due to the increases in HDL and LDL levels, total cholesterol levels were also significantly increased, although this increase was primarily due to the increase in HDL levels. Lipoprotein(a) levels had a small but statistically significant increase.

Table 1. Summary of serum biochemical measures of the participants before and after 2 months of Lifelong Vitality (LLV) supplementation.

Biochemical parameter	Before (mean $\pm$ SD)	After (mean $\pm$ SD)	<i>p</i> value
Total cholesterol (mg/dL)	178.5 $\pm$ 31.7	198.8 $\pm$ 47.8	.001*
HDL cholesterol (mg/dL)	56.4 $\pm$ 11.9	63.2 $\pm$ 11.3	.003*
LDL Cholesterol (mg/dL)	119.6 $\pm$ 27.7	126.7 $\pm$ 41.8	.113
Triglycerides (mg/dL)	116.1 $\pm$ 39.1	122.6 $\pm$ 55.5	.262
Lipoprotein(a) (mg/dL)	14.6 $\pm$ 17.7	16.6 $\pm$ 19.2	.026*
LDL/HDL cholesterol ratio	2.2 $\pm$ 0.6	2.0 $\pm$ 0.6	.038*
Total/HDL cholesterol ratio	3.3 $\pm$ 0.7	3.2 $\pm$ 0.6	.226
Ferritin (ng/dL)	60.8 $\pm$ 40.5	69.4 $\pm$ 50.3	.078
Fibrinogen (mg/dL)	223.3 $\pm$ 55.9	235.7 $\pm$ 53.7	.244
C-Reactive Protein (mg/L)	2.3 $\pm$ 3.3	2.4 $\pm$ 2.8	.414
Insulin (μ U/mL)	5.9 $\pm$ 2.7	5.3 $\pm$ 2.9	.018*
Testosterone $\blacklozenge$ (ng/dL)	201.0 $\pm$ 96.1	250.3 $\pm$ 53.7	.488
Sex hormone-binding globulin (nmol/L)	56.2 $\pm$ 37.1	52.8 $\pm$ 31.9	.262
Free androgen index $\blacklozenge$	42.7 $\pm$ 14.6	48.8 $\pm$ 11.1	.547
RBC magnesium (ppm)	45.5 $\pm$ 6.1	47.3 $\pm$ 6.3	.103
Homocysteine (nmol/mL)	9.3 $\pm$ 2.13	8.2 $\pm$ 1.5	.001*
Coenzyme Q10 (mg/L)	1.0 $\pm$ 0.28	1.0 $\pm$ 0.4	.424
Lipid peroxides (nmol/mL)	1.3 $\pm$ 0.4	1.3 $\pm$ 0.3	.437
Alpha-tocopherol (mg/L)	11.2 $\pm$ 2.6	15.5 $\pm$ 5.0	<.001*
Gamma-tocopherol (mg/L)	1.3 $\pm$ 0.6	0.6 $\pm$ 0.3	<.001*
Cardiovascular index	3.3 $\pm$ 0.9	3.1 $\pm$ 0.7	.128
EPA (μ mol/L)	18.9 $\pm$ 4.3	46.4 $\pm$ 16.2	<.001*
AA (μ mol/L)	272.0 $\pm$ 61.5	259.3 $\pm$ 52.7	.128
AA/EPA ratio	15.3 $\pm$ 4.7	6.1 $\pm$ 2.1	<.001*

SD = standard deviation; HDL = high-density lipoprotein; LDL = low-density lipoprotein; RBC = red blood cell; EPA = eicosapentaenoic acid; AA = arachidonic acid.

$\blacklozenge$ Reported for male participants only.

*Difference was considered statistically significant ($p < .05$).

The LDL/HDL ratio was significantly decreased from 2.2 to 2.0, mainly due to the increase in HDL levels. Insulin levels were also significantly reduced from 5.9 to 5.3 μ U/mL. Homocysteine levels were significantly decreased from 9.3 to 8.2 nmol/mL. Alpha-tocopherol levels were significantly increased from 11.2 to 15.5 mg/L, while gamma-tocopherol levels were significantly decreased from 1.3 to 0.6 mg/L. EPA levels had a 2.5-fold increase from 18.9 to 46.4 μ mol/L, while AA levels were relatively unchanged. As a result, the AA/EPA ratio significantly decreased from 15.3 to 6.1.

All other biomarkers—triglycerides, total/HDL cholesterol ratio, ferritin, fibrinogen, C-reactive protein, testosterone (men only), sex hormone binding globulin, free androgen index (men only), RBC magnesium, coenzyme Q10, lipid peroxides, cardiovascular index, and AA—were statistically unchanged after the two-month supplementation.

Qualitative survey

The results of the survey before and after the two-month supplementation period are summarized in Table 2. After two months of LLV supplementation, the qualitative responses to the 16 items were improved. Twelve of the items had statistically significant improvements. The participants reported significantly less back pain and muscle pain. They also reported significant improvements in mental clarity, energy, motivation, anxiety, and irritation. Furthermore, the participants reported significantly better feelings of control, balance, and happiness overall. The incidences of cold and flu were also decreased.

Table 2. Summary of self-assessments reported by the participants before and after 2 months of Lifelong Vitality (LLV) supplementation.

9-point hedonic scale survey item	Before (mean $\pm$ SD)	After (mean $\pm$ SD)	<i>p</i> value
Back pain	4.8 $\pm$ 3.0	3.4 $\pm$ 2.9	.008*
Joint pain	5.1 $\pm$ 2.9	3.8 $\pm$ 2.8	.126
Muscle pain	4.3 $\pm$ 2.4	2.6 $\pm$ 1.8	.006*
Headaches	3.8 $\pm$ 2.3	2.9 $\pm$ 1.9	.182
Other pain	2.0 $\pm$ 2.2	1.8 $\pm$ 2.0	.363
Cloudy thinking/lack of clarity	5.2 $\pm$ 2.2	2.8 $\pm$ 1.8	.007*
Tiredness or lack of energy	7.4 $\pm$ 1.2	4.3 $\pm$ 2.8	.001*
Lack of motivation	6.7 $\pm$ 1.5	3.4 $\pm$ 2.5	< .001*
Cold or flu	1.8 $\pm$ 0.9	1.1 $\pm$ 0.3	.020*
Other illness	2.6 $\pm$ 2.8	1.8 $\pm$ 1.9	.356
Anxiety	4.1 $\pm$ 2.5	2.1 $\pm$ 1.4	.025*
Frustration or lack of control	5.1 $\pm$ 2.5	2.8 $\pm$ 1.9	.006*
Irritation	6.0 $\pm$ 2.1	3.3 $\pm$ 2.0	< .001*
Felt in control	6.1 $\pm$ 2.0	7.8 $\pm$ 1.3	.011*
Balanced	5.5 $\pm$ 1.8	7.4 $\pm$ 1.5	.002*
Happy	7.0 $\pm$ 1.7	7.9 $\pm$ 1.4	.011*

SD = standard deviation.

*Difference was considered statistically significant ($p < .05$).

Users did not report significant improvements for four of the 16 items after two months of supplementation with LLV. These items were joint pain, headaches, other pain, and other illness.

Discussion

Our results indicate that LLV had significant positive effects on outcomes associated with cardiovascular health, antioxidant status, inflammation, and blood glucose regulation over a two-month period. Improvements in these four areas may explain the improvements in energy, pain, immunity, and mood reported by LLV users.

HDL and LDL cholesterol levels are well-known biochemical indicators of heart health. High HDL (typically > 60 mg/dL) has been shown to be optimal for protection against cardiovascular disease (Rye & Barter, 2014). Accordingly, the significant increase in HDL cholesterol levels from 56.4 to 63.2 mg/dL indicates that LLV may have a strong protective effect on heart health. Unexpectedly, LDL cholesterol levels were also slightly increased, although this increase was not statistically significant. As a result, there was a significant increase in total cholesterol levels. Lipoprotein(a) levels were also slightly, but significantly, increased. The small increases in total cholesterol and lipoprotein(a) levels appear to be due to nonsignificant increases in LDL cholesterol and triglyceride levels coupled with the significant increase in HDL cholesterol levels. The LDL/HDL ratio had a significant decrease, which suggests that the effects of LLV are protective overall.

Vitamin E family members are powerful antioxidants, and alpha-tocopherol delivers the highest vitamin E activity in the human body due to its physiological selection by the liver (United States Department of Agriculture, 2016). The levels of gamma-tocopherol were less than one-tenth those of alpha-tocopherol in our participants. We observed significant increases in the levels of serum alpha-tocopherol, which suggests that LLV improved antioxidant status in our participants. It is unclear why gamma-tocopherol levels were decreased, although this decrease may have been a compensatory mechanism in response to the

significant increase in serum alpha-tocopherol levels. Although both alpha- and gamma-tocopherol are strong antioxidants (Mathur et al., 2015), gamma-tocopherol levels have been shown to be inversely associated with lung function in a longitudinal aging study (Hanson et al., 2016). This suggests that there may be a potential protective role for decreased serum gamma-tocopherol levels.

Homocysteine, EPA, AA, and the AA/EPA ratio have all been shown to be important inflammatory markers (Simopoulos, 2002; Blom & Smulders, 2011). High homocysteine levels can lead to blood vessel inflammation and may predispose individuals to arteriosclerosis (Blom & Smulders, 2011). EPA has been shown to be anti-inflammatory, while AA is inflammatory and causes predisposition to obesity (Simopoulos, 2002). Here we found a large increase in EPA levels (2.5-fold), while AA levels had a slight nonsignificant increase. Both homocysteine levels and the AA/EPA ratio were significantly decreased, suggesting that LLV supplementation leads to improvements in inflammatory markers. The sharp increase in EPA levels was expected, as LLV contains high concentrations of EPA.

The level of insulin is probably the most important indicator of blood glucose regulation (Röder et al., 2016), and higher insulin levels and lower insulin sensitivity are risk factors for diabetes. LLV supplementation significantly reduced insulin levels in the participants. This suggests that LLV may have beneficial effects on insulin sensitivity and thus blood glucose regulation.

The participants reported feeling more energy, less pain, improved immunity, and better mental clarity. There were also significant improvements in global items, such as balance and happiness, suggesting that LLV may positively affect a wide range of lifestyle factors. We observed some nonsignificant changes in the biomarkers studied and survey items. The exact reasons for these observations are unclear. The lack of significant improvement in these measures may be because the two-month study duration was not long enough to lead to significant changes. Alternatively, our observations may be a reflection of insufficient statistical power for these measures in our study.

A previous two-month intervention study (Hintze & Gunning, 2014) explored the effects of LLV supplementation specifically on mental health using several standard, well-validated scales, including the Hospital Anxiety and Depression Scale (Bjelland et al., 2002), the General Health Questionnaire (Campbell, Walker, & Farrell, 2003), the Center for Epidemiological Studies—Depression Scale (Kazarian, 2009), and the Perceived Stress Scale (Ezzati et al., 2014). Hintze and Gunning (2014) found that LLV supplementation significantly improved the participants' mental health and well-being globally. Taken together, these findings support the positive effects of LLV supplementation on both serum biomarkers and mental health.

In addition to containing the active ingredients discussed earlier, LLV is a comprehensive and balanced formula of dozens of well-studied vitamins, minerals, omega-3 fatty acids, herbal extracts, and essential oils. These ingredients may work additively or synergistically to provide the broad range of health benefits observed here.

The current study has several limitations. The study size was small. The two-month study duration was also relatively short, which may explain the absence of significant changes in some of the outcomes. The study can be further improved with the use of a randomized, double-blind, and placebo-controlled design. A follow-up study with better design, larger size, and longer duration is required to establish the definite clinical efficacy of LLV.

In conclusion, the current study shows that LLV supplementation has a significant positive effect on biochemical markers in four major categories: cardiovascular health, antioxidant

status, inflammation, and blood glucose regulation. These positive effects were correlated with improvements in four subjective self-reported categories: pain, energy, immunity, and mood. LLV appeared to provide a broad range of health benefits to the study participants in the relatively short two-month supplementation period.

Declaration of interest

The study was funded by dōTERRA (Pleasant Grove, UT, USA). X. H. and T. P. are employees of dōTERRA, where the studied product, LLV, is manufactured. D. E. is a consulting statistician for dōTERRA.

About the authors

Xuesheng Han holds a PhD in Biological Sciences from the University of Utah, and is an elected Fellow of the American College of Nutrition. Dr. Han's group primarily studies the health benefits of essential oils, nutritional supplements, functional foods, and skincare products. They work closely with research institutes, hospitals, and clinics to develop quality products with therapeutic benefits. Han has worked in biotech, biomedical, and nutraceutical industries.

Dennis L. Eggett received his BS and MS in Statistics from BYU and his PhD in Applied Statistics from North Carolina State University. He worked in the industry for ten years at Pacific Northwest National Laboratory. Since 1997, Dr. Eggett has been the director of the Center for Statistical Consultation and Collaborative Research in the Department of Statistics at Brigham Young University. His specialties include linear models and mixed model analysis.

Tory L. Parker holds a PhD in Nutritional Sciences from the University of Illinois at Urbana-Champaign, and has worked in both the consumer products industry and as an academic professor. He is currently the Senior Director of Research & Development for dōTERRA Intl.

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