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File: ■ Spirulina (*Arthrospira platensis*, Oscillatoriaceae)
■ HIV
■ Antioxidant

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RE: Spirulina as Nutritional Support in Potentially Undernourished African Women with HIV

Winter FS, Emakam F, Kfutwah A, Hermann J, Azabji-Kenfack M, Krawinkel MB. The effect of *Arthrospira platensis* capsules on CD4 T-cells and antioxidative capacity in a randomized pilot study of adult women infected with human immunodeficiency virus not under HAART in Yaoundé, Cameroon. *Nutrients*. July 23, 2014;6(7):2973-2986.

Human immunodeficiency virus (HIV), the virus causing acquired immunodeficiency syndrome (AIDS), infects people around the world; this disease is especially devastating in Sub-Saharan Africa. Although highly active antiretroviral therapy (HAART) extends life expectancy to those living with HIV, these drugs may not be accessible to poorer populations, and limited access to nutrition also confounds health prognoses. Dietary supplements may potentially help those with HIV through the modulation of antioxidant defenses, viral load, or CD4 (white blood cells) cell count, a diagnostic criterion of AIDS progression. Spirulina (*Arthrospira platensis*, Oscillatoriaceae) has been shown in vitro and/or in vivo to be antioxidant and antiretroviral, and to stimulate the immune system. This randomized, double-blind, placebo-controlled study in Cameroon investigated the impact of spirulina supplementation on women infected with HIV.

This study enrolled HIV-positive women in Yaoundé, Cameroon who were not receiving HAART. Patients had a body mass index < 26 kg/m^2, CD4 cell count < 600 $cells/mm^3$, and were not pregnant or breast feeding. Treatment consisted of powdered spirulina, procured from Earthrise Nutritionals; Irvine, California. Placebo consisted of pea (*Pisum sativum*, Fabaceae) protein (Pisane® F9) together with Dextran (EMDEX™), procured from Herbamed GmbH; Euskirchen, Germany. Tablets of treatment and placebo contained 500 mg, and 10 tablets were taken daily for 3 months, resulting in a daily dosage of 5 g. The treatment and placebo tablets shared equal protein (62%) and equivalent energy content. Patients met with physicians once per month for the assessment of adverse side effects (ASEs) and showed leftover tablets to gauge dosage. Blood was collected at baseline and endpoint of the study to measure CD4 cell count, antioxidant capacity, and viral load measurements. Patient BMI was also assessed.

In total, 73 patients were randomly assigned to either spirulina (37) or placebo (36) groups from 513 patients initially screened. Those that finished the study totaled 28 in the spirulina group and 30 in the placebo group; there were 5 patients and 1 patient in the spirulina and placebo groups, respectively, that dropped the study due to ASEs, and 8 patients stopped due to "unset response." Compliance was 78%, and HAART was begun by 12 patients 2 weeks after the study. Malaria was contracted by 30% of patients in both groups. The average age of those that completed the study was 32 years old, and the average CD4 cell count was 441 cells/mm^3; average BMI was 22 kg/m^2, and no changes were observed in patient diet.

No differences in CD4 cell count were seen between groups at the end of the study; however, CD4 cells significantly decreased from baseline to the end of the study for both groups ($P<0.001$ for both). Also, the viral load of HIV type 1 was not different between groups. CD38 expression, a marker of the immune activation, also was not different between groups. Total antioxidant status was measured in blood serum using the Trolox Equivalent Antioxidant Capacity (TEAC) assay. TEAC measurements were significantly increased in the spirulina group ($P=0.007$, indicating higher antioxidant capacity), but decreased in the placebo group ($P=0.008$). Additionally, 21 of 30 patients in the placebo group acquired opportunistic infections, diarrhea, headaches, fatigue, or respiratory or gastrointestinal problems over the course of the study; in the spirulina group, 12 of 28 patients experienced these similar health problems.

Those in the placebo group gained a significant amount of weight at the end of the study as compared to baseline ($P=0.005$), but there was no significant difference between body weight of groups at the end of the study. Also, serum albumin decreased significantly in both groups at the end of the study ($P=0.026$, spirulina group, and $P=0.034$, placebo group), but no differences were observed between groups. At the end of the study, serum creatinine significantly increased in the spirulina group ($P=0.002$), but not in the placebo group; the difference between the groups at the end of study was statistically significant ($P=0.008$).

In summary, this study did not observe any effect of spirulina supplementation on viral load or CD4 cell count in women with HIV; however, serum antioxidant capacity and serum creatinine concentrations were elevated in women consuming spirulina, suggesting subtle benefits of the treatment on endogenous antioxidant defenses. Also, less concomitant health problems were observed in those taking spirulina; this may point to a correlation of antioxidant status and progression of infection in HIV-positive populations. Authors mention that lack of effect on the primary endpoint could be due to the short duration of the study or inadequate powering of patient number. Also, dosage may be too small and HIV infection not progressed far enough for dramatic changes to occur. Despite this, spirulina may be potentially helpful in supporting the overall health of women living with HIV by improving their antioxidant status.

—Amy C. Keller, PhD

Referenced article can be accessed at http://www.mdpi.com/2072-6643/6/7/2973.