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File: ■ Ginger (*Zingiber officinale*)
■ Cognitive Function

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RE: Ginger Improves Cognitive Function in Middle-aged Women

Saenghong N, Wattanathorn J, Muchimapura S, et al. *Zingiber officinale* improves cognitive function of the middle-aged healthy women. *Evid Based Complement Alternat Med*. 2012;2012:383062. doi:10.1155/2012/383062.

Previous research has shown that women in middle age commonly suffer from cognitive decline; this affects attention, memory recall, and is also thought to correlate with age-related oxidative stress. Ginger (*Zingiber officinale*) rhizome has been used extensively in traditional medicine worldwide.[1] Past in vivo animal studies by this team have shown that ginger may prevent brain damage and aid in memory,[2] and others have shown that ginger has antioxidant activity. In this double-blind, placebo-controlled, randomized trial, ginger rhizome extract was assessed for the improvement of cognition in middle-aged women.

Subjects included Thai women between 50 and 60 years old (average age was 53.40 ± 3.57 years) who were determined healthy by a physician. Subjects were excluded if they had histories of cardiovascular diseases, head injuries, diabetes, cancer, alcohol abuse, or smoked more than 10 cigarettes daily. Those taking any drugs or nutraceutical agents acting on the nervous system were excluded.

An extraction of dried ginger rhizome was prepared using 95% ethanol and was standardized to contain 7.33% w/w of the phenolic constituent 6-gingerol and 1.34% w/w of the phenolic constituent 6-shogaol. This material was manufactured by the Thailand Institute of Scientific and Technological Research; Pathum Thani, Thailand. Subjects were randomized to receive a capsule of either 400 mg of ginger extract, 800 mg of ginger extract, or matched placebo daily for 2 months. At baseline, all subjects were tested for cognitive functioning using standard progressive matrices (SPMs) and measured for cognitive ability after 1 month and 2 months of treatment. Compliance was assessed by interviewing subjects and counting leftover capsules. Subjects were also monitored for adverse side effects throughout the study.

Cognitive functioning was assessed by measuring event-related potentials (ERPs). The amplitude and latency of the event potentials called N100 (thought to correspond to memory function, short-term memory, and attention) and P300 (representing recognition

and processing of stimuli, among other cognitive functions) were measured with an electroencephalogram (EEG) as subjects were listening to and counting a series of tones. A standard tone occurred with an 80% frequency and a target tone played at 20% frequency. Subjects also completed cognitive tests including word presentation, picture presentation, simple reaction time, digit vigilance task, choice reaction time, spatial working memory, numeric working memory, delayed word recognition, and delayed picture recognition. These measured memory recall, reaction times, and short-term memory.

There were no significant differences between baseline characteristics of any of the groups in the study. There were also no significant differences in the baseline ERP measurements of any of the groups; however, after 1 month of the study, the 800 mg group had a significantly greater N100 amplitude as compared to the placebo group (7.05 ± 1.19 vs. 5.65 ± 1.08, respectively, $P<0.01$). Following 2 months of treatment, significant increases were seen in the P300 amplitude as compared to the placebo group for both the 400 mg group (8.10 ± 1.16 vs. 7.20 ± 1.05, respectively, $P<0.01$) and the 800 mg group (8.40 ± 1.35 vs. 7.20 ± 1.05, respectively, $P<0.01$). Also, as compared to the placebo group, the 800 mg group showed a significant increase in N100 amplitude (6.90 ± 0.96 vs. 5.70 ± 1.07, respectively, $P<0.001$) and a significant decrease in P300 latency (321.35 ± 9.77 vs. 332.35 ± 8.99, respectively, $P<0.001$).

Baseline measurements for the memory tests were not different between groups. After 1 month of treatment, those in the 800 mg group had a significant increase in accuracy as compared with the placebo group in both the choice reaction time (89.95 ± 8.26% accuracy vs. 81.70 ± 6.68% accuracy, respectively, $P<0.01$) and numeric working memory (82.40 ± 9.63% accuracy vs. 75.00 ± 10.43% accuracy, respectively, $P<0.05$) tests. In addition, after 2 months of treatment, there was a significant decrease in reaction time as compared to placebo in the word recognition test for both the 400 mg (1,120.67 ± 111.2 msec vs. 1,245.06 ± 165.89 msec, respectively, $P<0.05$) and 800 mg groups (1,099.67 ± 185.22 msec vs. 1,245.06 ± 165.89 msec, respectively, $P<0.01$).

Those in the 800 mg group were also significantly improved as compared to the placebo group after 2 months of treatment in the delayed word recognition (84.89 ± 8.03% accuracy vs. 75.33 ± 8.94% accuracy, respectively, $P<0.01$), digit vigilance (48.40 ± 5.40% accuracy vs. 42.45 ± 8.744% accuracy, respectively, $P<0.05$), and choice reaction time (90.00 ± 7.82% accuracy vs. 80.55 ± 7.47% accuracy, respectively, $P<0.001$) tests. In addition, significant improvements were also seen for the 800 mg group as compared to the placebo group in the numeric working memory (85.00 ± 8.72% accuracy vs. 74.70 ± 10.54% accuracy, respectively, $P<0.01$), spatial working memory (71.77 ± 4.12% accuracy vs. 66.29 ± 4.59% accuracy, respectively, $P<0.01$), and choice reaction time (874.65 ± 50.59 msec vs. 961.30 ± 135.76 msec, respectively, $P<0.05$) tests. No adverse side effects were reported.

These results suggest that ginger rhizome extract improves both attention and cognitive functioning in middle-aged women. In particular, the 800 mg dosage significantly improved both N100 and P300 amplitude as well as scores in the applied tests for attention and attention accuracy, and memory speed and quality. Possible mechanisms of action include potential effects of the extract or certain phenolic constituents in it on neurotransmitters such as serotonin and acetylcholine; this is described in prior studies. Also discussed is that the antioxidant activity of ginger may improve brain function.

Although it is stated that the placebo was similar in "color, texture, size, and odor" to the ginger extract capsules, no mention was made of the contents. This is important to include as ginger has a distinct taste and odor that may be difficult to imitate or mask. Despite this, the positive results reported herein justify further investigation as to the biological mechanisms behind the improvement in cognitive function as a result of ginger extract supplementation.

—Amy C. Keller, PhD

References

[1]Blumenthal M, Goldberg A, Brinckmann J, eds. *Herbal Medicine: Expanded Commission E Monographs*. Austin, TX: American Botanical Council; Newton, MA: Integrative Medicine Communications; 2000.

[2]Wattanathorn J, Jittiwat J, Tongun T, Muchimapura S, Ingkaninan K. *Zingiber officinale* mitigates brain damage and improves memory impairment in focal cerebral ischemic rat. *Evid Based Complement Alternat Med*. 2011;2011:429505. doi: 10.1155/2011/429505.

Referenced article can be accessed at
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3253463/pdf/ECAM2012-383062.pdf.