

Semester Project: Parts One and Two

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Part One

Read the article by Gold, P.E. Cahill, L. and Wenk, G. L. (2002) and answer the following questions.

Analysis Questions:

1. What are the authors' general conclusions (summarized) on the effectiveness of *Ginkgo biloba* as a cognitive enhancer?

Gold et al. (2002) conclude that, overall, there is not enough information at present to tell if *Ginkgo biloba* improves or worsens cognitive function. This may be due to the lack of experimentation and the variance in the quality of the current experimentation. Most of the current investigations into ginkgo have been tested on smaller sample sizes that lack adequate diversity in subjects.

From the current amount of information, there was a small amount of evidence found that supports the view that ginkgo improves cognition. It may, due to antioxidant and stress-relieving properties, slow cognitive decline in dementia patients and generally improve memory. However, the importance of this evidence was lessened by the fact that acetylcholinesterase inhibitors, epinephrine hormones, and even just glucose have been shown to produce similar or higher levels of cognitive enhancement.

2. Briefly summarize the findings regarding ginkgo's cognitive effects in humans. (pp. 3-5)

In studies involving patients with a form of cognitive impairment (such as Alzheimer's disease), Gold et al. (2002) found that *Ginkgo biloba* produced "mild, but statistically significant increases in performance on various standardized tests of cognitive function

after chronic treatment with ginkgo compared with placebo” (p. 3). These tests assessed attention, short-term memory, and choice reaction time. Despite these positive results, it is unclear whether ginkgo actually improves cognitive ability or slows the deterioration of cognitive ability.

In studies involving non-impaired, healthy subjects, ginkgo showed signs of improving attention in younger individuals. In middle-aged subjects, a combination of ginkgo and ginseng showed a significant effect on memory. There is not enough evidence, however, to make any definitive conclusions about the effects of ginkgo on healthier individuals.

3. Briefly summarize the findings regarding ginkgo’s cognitive effects in animal models. (pp. 5-7)

Animal experimentation involving rats and mice has shown that *Ginkgo biloba* may reduce stress and enhance learning and memory. For example, Gold et al. (2002) references a study where mice treated with ginkgo over 4 to 8 weeks learned how to complete a task slightly faster than the control mice. In another study, both chronic (over a long period) and acute (over a short period) administration of ginkgo in rats enhanced the rats’ ability (in the short term) to sense new versus familiar odors.

4. Briefly summarize the findings regarding the biological actions associated with ginkgo. (pp. 7-9).

Ginkgo biloba has been shown to have some effects on biological processes. Ginkgo can trigger vasodilation (the dilatation of blood vessels) which increases blood flow and lowers blood pressure. Though these cardiovascular effects can be positive, they can also cause occlusive or hemorrhagic strokes. There is also evidence to support that ginkgo can

reduce the production of free radicals - unstable atoms that can damage cells - with its antioxidant properties. According to Gold et al. (2002), “these antioxidant substances can scavenge free radicals that might injure neurons and thereby retard age-related changes in brain and other functions” (p. 7). These antioxidant benefits are not unique to ginkgo, however, and can also be seen in substances like red wine and chocolate.

In relation to cognitive function, ginkgo can increase glucose utilization and neural activity in certain areas of the brain. This, in turn, could enhance how humans process sensory information, plan complex actions, control movement, and experience pleasure. Ginkgo, as mentioned in the previous section on animal models, has also been shown to reduce stress and anxiety. Higher levels of stress in the long-term can elevate glucocorticoids (a type of steroid hormone) in the blood. This may lead to a deterioration in the brain’s ability to learn.

5. Critique Question: Having read the article, elaborate on your opinions about the effectiveness of ginkgo. Would you choose to use it? Why or why not?

I would consider using Ginkgo biloba. Although the quantity of scientific research and experimentation is low, there is evidence to support that Ginkgo biloba has positive effects on both cognitive and bodily functions. These can include everything from memory and learning enhancement to decreased age-related cell deterioration. I also consider the use of ginkgo to be relatively low risk. At present, there are very few mild or severe negative side effects associated with the usage of ginkgo.

Read the article by McDaniel, M. A., Maier S. F., and Einstein, G. O. (2002), and answer the following questions.

Analysis Questions:

6. What are the authors' conclusions about the effectiveness of each of the following:

- phosphatidylserine (pp. 16-23)
 - Phosphatidylserine (PS) has been theorized to maintain the neuron membrane, increase the number of receptors, promote dendritic branching, and stimulate the release of neurotransmitters. In other words, if PS can increase physical efficiency in the brain, it can increase cognitive efficiency as well. After looking at multiple research studies, McDaniel et al. found that PS might enhance cognition in older adults with age-related memory impairment, but that there is not strong enough evidence to conclude that PS produces positive memory effects generally.
- choline (pp. 23-24)
 - Choline can be found in the compounds phosphatidylcholine (PC) and citicoline. Choline is used to produce a neurotransmitter called ACh. Declines in memory seem to be associated with declines in ACh. Therefore, if Choline can produce more ACh, it can block cognitive decline. McDaniel et al. found little evidence to support memory benefits from choline compounds. Of the two compounds, citicoline has shown more promising results (but only in memory-impaired older adults).
- piracetam (pp. 24-26)
 - Piracetam was the first compound to be labeled a “nootropic”. It is thought to protect, maintain, and facilitate neuron activity. McDaniel and coauthors are

skeptical about its cognitive benefits. Studies with Alzheimer patients and older adults with age-related memory loss did not show significant mnemonic benefits from piracetam. One study involving epileptic patients did show some cognitive enhancement.

- vinpocetine (pp. 26-28)
 - Vinpocetine is a vinca alkaloid used to treat patients with cerebral oxygen deficits resulting from a lack of blood flow in the brain. McDaniel et al. found that patients with cerebrovascular disorders taking vinpocetine showed significant improvements on general cognitive assessments. However, too little research has been done relating vinpocetine to memory to make concrete conclusions about it in that regard.
- acetyl-l-carnitine (pp. 28-30)
 - Acetyl-l-carnitine (ALC) is an amino acid thought to maintain and protect neurons and increase neural energy production. McDaniel and coauthors found that using ALC daily for a year might slow behavioral deterioration in Alzheimer's patients. With the exception of word-list memory tests, significant results have not been found for memory enhancement due to ALC.
- antioxidants (pp. 30-32)
 - Antioxidants help to decrease free radicals. These free radicals, oxygen molecules lacking electrons, can damage different cell components by taking electrons from other molecules. Free radicals increase with age, so it is theorized that neutralizing free radicals will slow age-related cognitive decline. McDaniel et al. found that studies involving healthy college students or patients with Alzheimer's

or Parkinson's reported no benefit to memory or attention from antioxidants. There is, however, some evidence to support a positive relationship between antioxidants and memory when testing healthy older adults with age-related memory decline.

7. How would you describe the authors' general conclusions about the effectiveness of non-prescription compounds that are claimed to be memory enhancers?

McDaniel and coauthors (2002) concluded that "the current data do not allow strong scientifically based recommendations for any of these memory nutrients" (p. 35). They also stated, however, that there were enough positive results to warrant further study in the field of nootropics. In other words, there is not enough information to make concrete conclusions about the subject matter at this time. The authors suggest that further research should focus more on healthy older adults rather than those with more severe cognitive damage (like Alzheimer's). They also suggest that certain nootropics may only benefit certain areas of memory like storage processing or deep processing. Therefore, research should focus more on these specific areas when studying a single nutrient and combine nutrients when studying overall memory function.

Critique Questions:

8. Having read the article, what are your conclusions about non-prescription compounds that are claimed to be memory enhancers? Would you choose to take them? Why or why not?

Overall, my conclusions about these memory enhancers are similar to those I had about ginkgo - I would consider taking them. All the nutrients listed, in normal doses, were deemed to have little to no severe or mild side effects. Therefore, there does not seem to

be a risk in taking individual nootropics and they could have possible cognitive benefits. It is suggested by the authors that the cognitive benefits could be enhanced by mixing nutrients, but I would be more hesitant to take these nutrients in combination with one another until further research is completed about their side effects when mixed.

9. How does the quality of the research in this article compare to that of the Gold et al. Article (Part 1)? (compare/contrast) Which article did you find more convincing? Please explain your answer.

Due to the fact that the Gold et al. article focused solely on Ginkgo biloba, it was able to discuss the research methods and studies in more detail. This extra detail, however, did not convince me that the Gold et al. article was of a higher quality than the McDaniel et al. analysis. Seeing as though both articles came to similar conclusions - that these nutrients might have positive effects but that more research was needed for definitive answers - I don't know that the extra depth about specific studies was necessary.

Overall, I preferred the McDaniel article. By covering multiple nutrients (as opposed to just one), why they were believed to have memory-enhancing properties, and what early studies were showing, this article better convinced me that more research into nootropics would be valuable. It also convinced me that most of the common compounds used in memory supplements are safe in normal quantities.

Part Two

Do a journal article search (on the UALR Ottenheimer Library search site) to find 1 journal article related to the topic of *Ginkgo biloba* or another herbal memory enhancer (of your choice).

Choose just 1 journal article that you think is interesting. This journal article must be a primary source describing original research. Secondary sources, such as magazine articles, newspaper articles, or internet sites do not count. The article you choose must have been published within the past 5 years.

11) Briefly describe the journal article. Include in your description 1) the hypotheses being investigated by the researchers, 2) the type of research participants (subjects) used, 3) the research method employed by the researchers, 4) the most important result of the study, and 5) the final conclusion drawn by the researchers.

- **Hypothesis:** This article, like the articles given in Part One of the semester project, is a meta-analysis of multiple studies (these studies involve Gincosan, a combination of *Ginkgo biloba* and *Panax ginseng*). The authors do not directly state a hypothesis. They instead state the purpose of their research: “The aim of the current review were to systematically summarize and critically discuss the findings from research investigating the physiological and psychological effects of combining *Ginkgo biloba* and *Panax ginseng* into a single treatment [synergy], in humans” (Reay et al., 2018).
- **Participants:** The authors required that all studies have human participants.
 - Study 1: 10 volunteers suffering rheological abnormalities
 - Study 2: 85 volunteers (43–72 years) all presenting with at least one symptom of cerebrovascular disorder
 - Study 3: 64 adults (average age 54 years) suffering neurasthenic complaints
 - Study 4: 256 healthy middle-aged adults
 - Study 5: 20 healthy young adults (average age 20)

- Study 6: 20 healthy young adults (average age 21)
- Study 7: Healthy population
- Study 8: 70 healthy, older, postmenopausal women (ages 51-66)
- **Methods:** The authors reviewed literature discussing the physiological and psychological effects of combining *Ginkgo biloba* and *Panax ginseng* on humans. They “identified all studies meeting inclusion criteria: (a) written in English; (b) peer-reviewed; (c) conducted in humans; (d) including either a proprietary Panax ginseng/Ginkgo biloba treatment or a study preparation containing both; (e) placebo-controlled; (f) utilizing standardized extracts” (Reay et al., 2018). Finally, the authors analyzed each trial, calculated standardized effect sizes, and provided recommendations.
- **Results:** The authors found eight studies that met the criteria. Gincosan, a Ginkgo/Panax combination treatment, was investigated by all the chosen studies. According to Reay et al. (2018), benefits to the circulatory and cardiovascular system and improved secondary memory performance were seen in patient and healthy populations.
 - Study 1: Improvements in blood pressure, heart rate, spontaneous platelet aggregation, and cutaneous erythrocyte velocity in capillaries
 - Study 2:
 - Improved concentration and forgetfulness
 - Increased mean blood flow velocity in the middle cerebral artery
 - Study 3:
 - Increased memory performance
 - Lower heart rate
 - Study 4: Increased memory performance

- Study 5: Memory enhancement
 - Study 6:
 - Memory enhancement
 - Increased performance on tasks requiring higher levels of mental effort (i.e. arithmetic tasks)
 - Mood enhancement
 - Study 7: Increased performance on tasks requiring higher levels of mental effort (i.e. arithmetic tasks)
 - Study 8: No effect
- **Conclusions:** “A Panax ginseng and Ginkgo biloba combination treatment can improve aspects of physiological and cognitive function in humans; however, evidence for synergy requires further investigation and future research should directly investigate synergy following repeated dosing” (Reay et al., 2018).

12) How does the information in this journal article (that you found) provide new or different information than what was presented in the two journal articles that I provided for you to read (in Part 1)? Offer your own opinion on whether or not you believe the research in this article is valid.

This article focuses more on the research methods of the studies rather than the results.

The authors discuss the results and their conclusions about the findings, but a large part of the article focuses on analyzing how the studies were conducted and how they may be improved. The authors spend a little over half of the article summarizing each study and

making conclusions. The rest of the work focuses on calculating effect sizes and making recommendations for research models, research design, and proper data analysis.

I believe this research article is valid. It produces similar psychological and physiological findings to those seen in the Gold et al. article on *Ginkgo biloba* (memory enhancement and positive cardiovascular effects). As stated earlier, the extra emphasis on research methods was not needed for my purposes (finding conclusions about the effectiveness of herbal nootropics), but it did not detract from the validity and could be useful to those looking to format their own scientific study.

13) Think of an original research study that you would like to conduct to try to prove or disprove the effectiveness of one of the herbal memory enhancers (i.e, Ginko biloba). State the hypothesis of the research study you are proposing. Briefly describe how you would conduct (run) this study. Describe the type(s) of research participants you would include in your research study.

- **Hypothesis:** Acute dosing of *Ginkgo biloba* will produce stronger levels of memory enhancement in healthy, college-aged adults than will acute dosing of a placebo treatment.
- **Participants:** This study will include 30 female and 30 male college students with an average age of 21.
- **Methods:** The study will split the participants into three groups: a control (20 participants), a placebo (20), and a Ginkgo group (20). Each group will receive a high (but safe) dose of their specified substance (Ginkgo, placebo, nothing) and then they will complete a scientifically supported cognitive examination that tests multiple facets of

memory. The exam will be started within 30 minutes after the dosing. Results will be measured based on the average exam scores of each group.

References

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