Mira Ballantyne
5th Grade - Stone
Tritt Elementary School

COGNITIVE WATER:
DOES DRINKING MORE WATER HELP YOU THINK?

Question

Does drinking more water improve cognition and mood?

Background Research

Most people don't drink enough water. Liquid intake for men should be at least 3.7 liters daily, and for women should be at least 2.7 liters daily. About 75% of Americans are chronically dehydrated. A CDC study showed:

- 43% of adults drink <4 cups of water daily
- 35% of adults drink 4 to 7 cups daily
- 22% of adults drink 8 or more cups daily

Does being chronically dehydrated impact mood and cognition? Scientists have studied this question by dehydrating people. These studies showed that dehydration worsens the following measures of mood:

- Fatigue
- Sadness
- Sleepiness
- Alertness
- Depression
- Contentedness
- Positive Emotion
- Vigor
- Energy
- Anxiety
- Anger
- Calmness
- Confusion

In addition, dehydration worsens the following measures of cognition:

- Vigilance
- Reaction Time
- Memory
- Working Memory
- Reasoning
- Psychomotor
- Visuomotor Tracking
- Arithmetic
- Processing
- Associative Learning

Rather than dehydrating people and seeing that mood and cognition worsen, I want to know if the opposite will happen by increasing hydration.

Hypothesis

I think that drinking more water will improve mood and some areas of cognition.

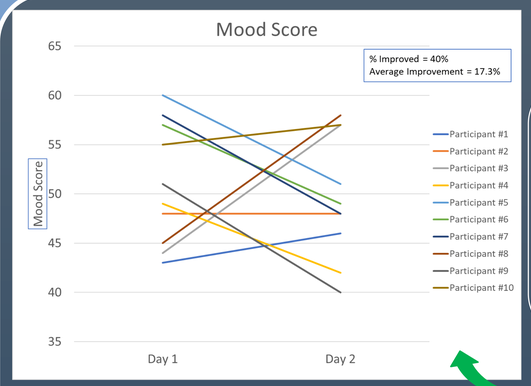
Procedures

Ten adult volunteers completed my study.

On Day One, I asked volunteers to drink the same amount of water and other liquids as they normally do and measure how much they drink. When measuring their fluid intake, ALL liquids counted, including water, tea, coffee, milk, juice, soda, broth, energy drinks, beer, wine, etc. At the end of the day before going to bed, the volunteers completed a mood survey and four cognitive tests, and submitted their data via two Microsoft Forms that I created.

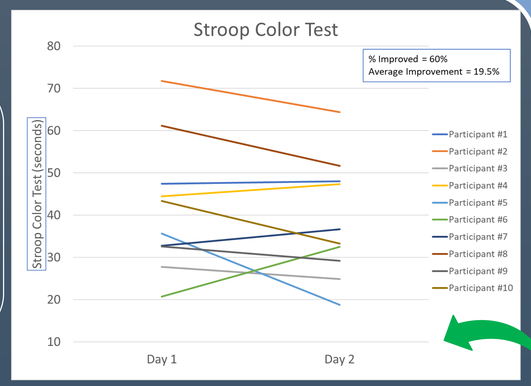
On Day Two, I asked volunteers to drink 50% more liquids than they did on Day One, with the extra coming mainly from water. At the end of the day, the volunteers repeated the same mood survey and cognitive tests, again submitting their data via Microsoft Forms. Volunteers were asked to keep as many other things as possible the same between Day One and Day Two, including exercise, salt intake, sugar intake, caffeine intake, bedtime, workday or weekend, and alcohol intake. The days did not need to be consecutive, since for some people, it's easier to keep other variables consistent if their test days were on the same day of the week.

Results



Mood Score: Volunteers filled out a standard survey used in scientific studies, called the Brief Mood Introspection Scale (BMIS). For each of 16 emotions, eight positive and eight negative, volunteers had to choose "Feel strongly", "Somewhat feel", "Somewhat don't feel" or "Definitely don't feel". The mood score was calculated by assigning a value 1 to 4 for negative emotions, and 4 to 1 for positive emotions, and totaling the values for each emotion.

Only 4 out of 10 volunteers had an improved mood after increasing hydration. Those who were in a better mood had an average increase in mood score of 17.3%.



Stroop Color Test: This test measures processing and selective attention. Volunteers are given a series of color words that don't match the color of the letters themselves. They have to say the color of the letters and not read the color word. It's harder than it sounds! Try naming the color of these words aloud:

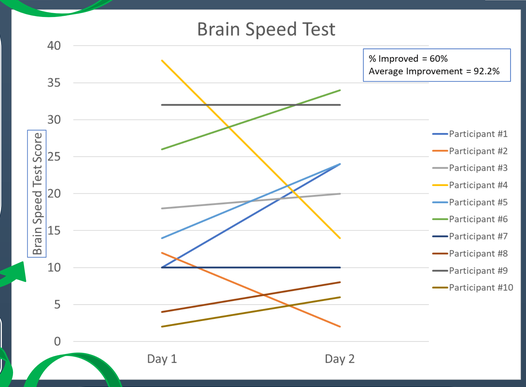
RED, BLUE, YELLOW, GREEN, PURPLE, ORANGE

Their score is the time it takes to read all of the words. Volunteers were asked to do the Stroop Color Test on this website: https://www.math.unt.edu/~tam/SelfTests/StroopEffects.html

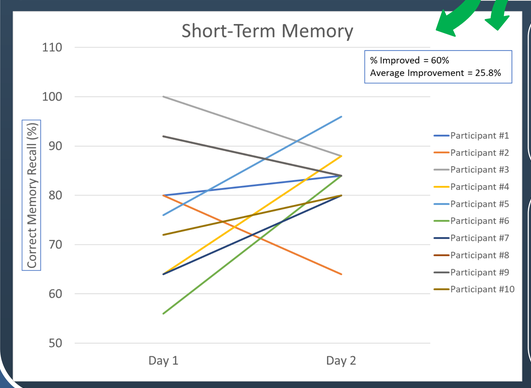
6 out of 10 volunteers had a faster Stroop Color Test time after increasing hydration. Those who did improve had 19.5% faster times on average.

Brain Processing Speed: This test measures working memory, spatial memory, and attention. Volunteers are shown a string of numbers or images in a grid. Then they have to repeat the numbers or image position in forward or reverse order. Volunteers were asked to do the expert mode Brain Processing Speed test on this website: https://www.memorylosstest.com/brain-processing-speed-test/

6 out of 10 volunteers had a higher Brain Processing Speed score when they were more hydrated. The average improvement for these volunteers was almost double, at 92.2% improvement.



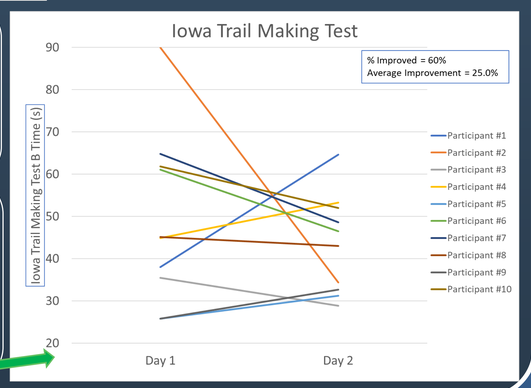
6 out of 10 volunteers had higher accuracy on the Short-Term Memory Test when they were more hydrated. The average improvement for these volunteers was 25.8%.



Short-Term Memory Test: This test measures short term memory and recognition memory. Volunteers are shown a series of pictures, some repeated and some new, and have to identify whether they've seen a picture before. They are scored on accuracy. Volunteers were asked to take the Short-Term Memory Test on this website: https://www.memorylosstest.com/free-short-term-memory-tests-online/

Iowa Trail Making Test: This test measures visual attention, task switching, visual search speed, scanning, speed of processing, mental flexibility, and executive functioning. Volunteers had to tap out a trail from number to letter (1-A, 2-B, 3-C, etc.) using a free smartphone app (Trail Making Test on Google, TMT Lite on Apple), which recorded their time.

6 out of 10 participants had faster times when hydrated, and those that got faster improved on average by 25%.



Conclusions

My experiment showed that, for most people, drinking more water helps improve cognition, with specific improvements in: selective attention, short-term memory, recognition memory, visual attention, task switching, visual search speed, scanning, speed of processing, mental flexibility, executive functioning, working memory, spatial memory, and attention. All participants showed improvement in some measures of cognition and worsened in other areas, but on average they showed more improved cognition scores than worsened ones. There wasn't a big impact on mood, since only 40% improved with increased hydration; but those who did see improvement got more cheerful by a fair amount. Some participants said that having to go to the bathroom a lot made them grumpy. My hypothesis was incorrect because mood didn't see much improvement, and all my cognition tests showed a lot of improvement.

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