Coffee and Brain Functional Connectivity

Study Shows Daily Coffee Consumption Relates to Different Pattern in Brain Functionalities

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March 12, 2022

(Pixabay, RoomZ-nl)

Ah, coffee, the drink of energy and life.

Many people find the first sip of warm coffee helps them to start the day; I as well see coffee as encouragement for waking up in the morning. The Statista is astonishing, recognizing coffee drinking as a "worldwide trend." Coffee nowadays is considered one of the most widely consumed beverages in the world; in the years 2020 and 2021, around 166.63 million 60 kilogram bags of coffee (approximately 17 million cups of coffee) are consumed worldwide.

At times I could not help but wonder: despite its ability to help us concentrate and be energetic, what else coffee might do to our bodies or, most importantly, to our brains?

Coffee and Brain Connectivity

In a recent study, researchers found that people who consume coffee regularly (at least one cup of coffee per week) were found to have a decreased functional connectivity of the somatosensory and limbic networks by fMRI scanning. The decrease is related to the frequency of coffee intake.

Sematosensory network

"a more efficient and beneficial pattern of connections with respect to motor control and alertness."

Limbic network

"by modulating memory and motivation, determine emotional, autonomic, motor, and cognitive responses."

Interestingly, such changes also appeared in non-frequent coffee drinkers after they were instructed to consume caffeine in the study.

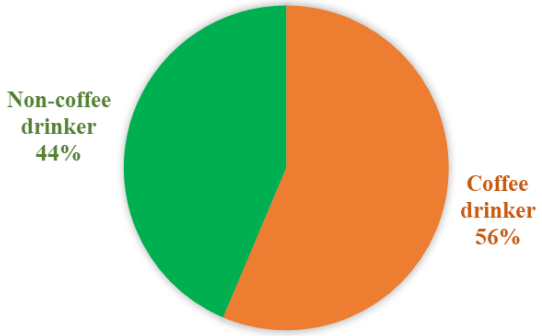
The researchers hypothesize that decreasing connectivity would result in better efficiency in motor control and alertness; however, this could also be a double-edged sword, since that decrease in too much connectivity might also lead to other problems. It is all about the balance!

The take-home message here is that people have to consider whether they will take the risk of reduced brain connectivity to prompt their attention and concentration.

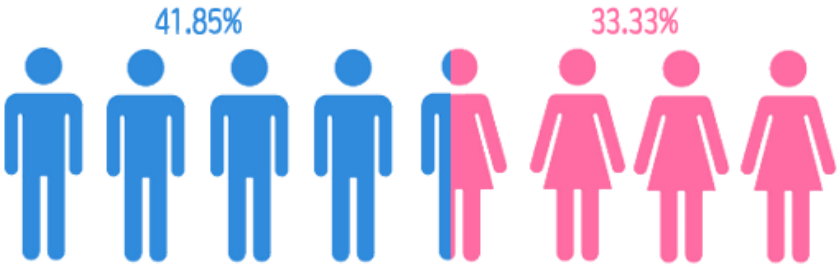
This imaging study was published in *Molecular Psychiatry* (April 20, 2021).

“Footprints” from the Caffeine

Participants in the study are recruited from the Portugal population through different ways of advertisements; 31 coffee drinkers and 24 non-coffee drinkers were recruited. Participants who drink at least one cup of coffee a week (≥1) were categorized as coffee drinkers, whereas participants who drink coffee less (<1) were considered as non-coffee drinkers.



The two groups do not differ significantly in age, years of formal education and sex distribution (slightly more men than women) in the study.



During the study, participants were each interviewed by a certified psychologist to collect their demographic and mental health-related information; after the interview, an fMRI scan (non-invasive procedure to take pictures of the brain) was done on their resting state. For non-coffee drinkers, in addition to the first scan, they were instructed to drink coffee and go through another fMRI scanning after ~30 mins.

But What About…!

The study had also dug in towards the relationships between brains and neuropsychological factors: coffee drinkers were scored not only higher on alertness and arousal but were also found to score higher on anxiety as well.

Luckily, researchers discussed that causality between coffee and anxiety cannot be inferred from the study design – “Our results are open to two interpretations: higher coffee/caffeine

consumption leads to increased stress and anxiety; or, alternatively, higher stress and anxiety induce higher coffee/caffeine consumption."
The effect of coffee on enhancing concentration and alertness is the "only result that survived correction for multiple comparisons," they mention. Thus, coffee does not necessarily cause an elevation in anxiety.

Other Health Issues?

Another large meta-analysis study shows that a moderate amount of coffee (3~4 cups) is "more likely to benefit the health rather than harm." Drinking coffee seems generally safe in this case.

Maybe there is an optimal amount of coffee that can benefit one's health rather than harm; it depends on whether you would like to take the risk to reduce your brain's functional connectivity or not.

(Pixabay, qimono)

The Pros and Cons

Again, you may want to really consider whether you want to take the risk of reducing connectivity between the parts of the brain to boost concentration and prompt response.
Other possible effects resulting from reduced functional connectivity of the brain is not elaborated in the study; however, it might cause more harm than good if you consume too much caffeine.

The researchers are insightful as they know that the difficulties with the study do not only come from the diversity and representative problems of the participants. Many other confounding factors are not yet found and need more studies and analyses to find out in the future.
Nevertheless, the study still provides a meaningful direction for future researchers so that they can find out more about our precious, precious coffee.

Time to have my daily caffeine intake now!

Read until the end? Enjoy this joke!

(119 Funny Coffee Puns to Get You Through the Day, Nathan)

Journal References:

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Other Additional Items for Marking:

Effect size Check (for the article study): "From the dynamic FC analysis, one functional subsystem (Fig. 3A, PL state 4) was found to last significantly longer in CD (Fig. 3B, 17.95 ±

18.32 s) compared to pre-coffee NCD (8.95 ± 6.13 s) surviving correction for multiple comparisons with a corrected $p = 0.038$ and a medium effect size with Hedge's $g = 0.62$." (page 4 - 6)

Effect size Check (For the other relevant study): "Large effect sizes of >2 or <0.5 can permit observational evidence to be upgraded in GRADE, and only the association between high versus low coffee consumption and both liver cancer43 and chronic liver disease43 reached this magnitude. In fact, associations between coffee consumption and liver outcomes consistently had larger effect sizes than other outcomes across exposure categories. Our reanalysis did not change our GRADE classification for any outcome." (in the article section: "Strengths and weaknesses and in relation to other studies")