How Does Nicotine Affect the Burrowing Time of Redworms?

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Feburary 18, 2022
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Abstract

Nicotine is a stimulant drug that can damage the brain permenantly and disrupt thinking. If someone is considering using Nicotine, they should consider the risks. It could ruin their body, mentally and physically. We know this because of scientific experiments performed on worms.

Scientists looked at the effects of nicotine on worms to decide if it might be bad for humans too. They discovered many bad affects of nicotine. The scientists created an exposure chamber by taking a cup, putting a piece of filter paper over the top of it, putting 2 mL of Nicotine on it, adding 3 worms in, placing another filter paper piece over the worms, and placing another cup over the top. They exposed the worms to Nicotine for different amounts of time to see how long it takes for the worms to fully burrow themselves. This was repeated multiple times **with different worms** on different dilutions until all dilutions of all exposure times were measured. The reason that it is very important for the scientists to use new worms for each test instead of the same ones, is because the worms who were originally exposed to nicotine could still be affected by the Nicotine while being tested again. Reusing worms that were already exposed may make the data not valid because the worms were already being affected by the Nicotine that was already in their system.

The scientists found out that Nicotine exposure did actually negatively affect the earthworm's burrowing time by making it slower.

Introduction

Nicotine is a stimulant drug that can change a person's mood, awareness, and stress level. It can lessen stress at first but then increase stress over time if used enough. Nicotine is meant to smoke or vape. It is used by a lot of people, especially ones that are addicted to Nicotine. This is because Nicotine is an extremely addictive drug.

Nicotine is partially made of tobacco leafs, and it is not good for the human body. Nicotine is produced by taking the tobacco and other materials from a bunch of plants, and turning it into what is commonly called Nicotine.

Some effects of nicotine are well known and some not very well known. Some effects that are well known publicly about Nicotine are withdrawal symptoms: fatigue, constapation[1], headaches, dizziness, cough, anger[2]. Some not well known symptoms about Nicotine cravings are that they start about 30 minutes after the last cigarette and increased appetite starts about a day after the last cigarette[3]. Some instant Nicotine symptoms are increased anxiety and tension[4], increase of blood pressure, declined extroversion, oppenness, and agreableness[5], better mood, decreased' 3 appetite, nausea, diarrhea, better memory, decreased alertness[6], narrow arteries[7], poor development of the

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[1] "Common and Rare Side Effects for nicotine (polacrilex) buccal." https://www.webmd.com/drugs/2/drug-75256-746/nicotine-polacrilex-buccal/nicotine-lozenge-buccal/details/list-sideeffects. Accessed 22 Feb. 2022.

[2] "Does smoking make you angry? - Quora." 19 Feb. 2018, https://www.quora.com/Does-smoking-make-you-angry. Accessed 22 Feb. 2022.

[3] "Nicotine Withdrawals: Symptoms, Side-Effects, and Duration - WebMD." 6 Mar. 2021, https://www.webmd.com/smoking-cessation/understanding-nicotine-withdrawal-symptoms. Accessed 22 Feb. 2022.

[4] "Smoking and mental health." 9 Mar. 2021, https://www.mentalhealth.org.uk/a-to-z/s/smoking-and-mental-health. Accessed 22 Feb. 2022.

[5] "Smoking cigarettes linked to negative personality changes." 30 Jun. 2019, https://neurosciencenews.com/smoking-personality-changes-14383/. Accessed 22 Feb. 2022.

[6] "Does Vaping Make You Tired?." 6 Aug. 2020, https://www.flawlessvapeshop.co.uk/blogs/news/does-vaping-make-you-tired. Accessed 22 Feb. 2022.

[7] "How Smoking and Nicotine Damage Your Body - American Heart ...." 17 Feb. 2015, https://www.heart.org/en/healthy-living/healthy-lifestyle/quit-smoking-tobacco/how-smoking-and-nicotine-damage-your-body. Accessed 22 Feb. 2022.

brain, seizures[8], faster metabolism[9], and disruption of sleep[10]. Some non instant, and long-term effects of nicotine are: lung disease, negative affect on personality[11], increase of depression[12], addiction, interferance with brain development which causes permanent brain damage[13], hardening of the arterial walls, leading to a possible heart attack, and it can increase anxiety and tension.

Because of the negative effects of Nicotine, scientists decided to test Nicotine on earthworms to prove a correlation between nicotine and problems thinking. The scientists used earthworms because their muscular system is similar to humans. This investigation is important for society to know because Nicotine could end up killing or hurting a lot of people.

If the scientists' hypothesis is correct, Nicotine exposure will have a significant effect on the earthworm's burrowing time because it will effect the earthworm's brain and disrupt its thinking and behavior.

Materials and Methods

How The Scientists Created and Used the Exposure Chamber

Description of set-up of experiment:

Step one:

take one 16 oz plastic cup, and put one cut - out piece of filter paper in the cup.

Step two:

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[8] "Nicotine: Effects, Risks, and How to Get Help - Verywell Mind." 30 Dec. 2021, https://www.verywellmind.com/nicotine-addiction-101-2825018. Accessed 22 Feb. 2022.
[9] "Weight gain after quitting smoking: What to do - MedlinePlus." 17 Aug. 2020, https://medlineplus.gov/ency/patientinstructions/000811.htm. Accessed 22 Feb. 2022.
[10] "The Link Between Sleep And Nicotine | Henry Ford LiveWell." 28 Mar. 2018, https://www.henryford.com/blog/2018/03/connection-between-sleep-nicotine. Accessed 22 Feb. 2022.
[11] "Smoking cigarettes linked to negative personality changes." 30 Jun. 2019, https://neurosciencenews.com/smoking-personality-changes-14383/. Accessed 22 Feb. 2022.
[12] "Smoking and Depression - Everyday Health." 6 Jul. 2012, https://www.everydayhealth.com/depression/smoking-and-depression.aspx. Accessed 22 Feb. 2022.
[13] "Nicotine | Brain and Body Effects, Addiction, How It Affects Health." https://www.drugwatch.com/e-cigarettes/nicotine/. Accessed 22 Feb. 2022.

pour 2 mL of the concentration of Nicotine onto the filter paper, place the 3 worms on the filter paper.

Step 3:

put another piece of filter paper on top of the worm and put another 16 oz plastic cup on top.

Step 4:

the scientists would start the timer for either 2.5 min, 5 min, or 10 min, depending on where the scientists were in the concentration.

Step 5:

After the timer goes off, the gloved scientist will take the cup off, pull out the filter paper and take the worms out.

Step 6:

Another scientist that is not gloved will prepare a stopwatch and then the scientist with the worms will put the worm into a cup of moist dirt while at the same time, the non gloved scientist will start the stopwatch.

Step 7:

Wait until a worm burrows, then record the time. Do this 2 more times with the same stopwatch.

Step 8:

Repeat steps 1-7 with a different dilution/ exposure time.

If some scientists decide to expose redworms to nicotine, then, the worm's burrowing time will be negatively affected because it will stop their brains from working properly.

The scientists found that the earthworm's burrowing time, was, in fact, negatively affected by the nicotine.

The concentrations were not made by the scientists, they were pre-made by 8th graders.

Materials

- Two 50 mL beakers
- 8 16 oz plastic cups
- Coffee filters
- Scissors
- 0.01 ppm, 0.05 ppm, 0.1 ppm Nicotine
- One 2 mL pipette
- 27 Adult redworms from the school garden
- Gloves
- Spray bottle
- Two 16 oz cups of moist dirt (the dirt was from the school garden)
- Two stopwatches
- One chromebook
- One 100 mL beaker
- 2 styrofoam trays, one for the worms, the other for pouring the dirt onto to find the worms

Saftey:

Safety is one of the most important parts of this experiment. What the scientists did was they wore goggles the whole time, and, if the scientists were handling the Nicotine, they would wear plastic gloves. If any Nicotine spilled on the table or on anything, the scientists would immediately clean it up with paper towels.

Results:

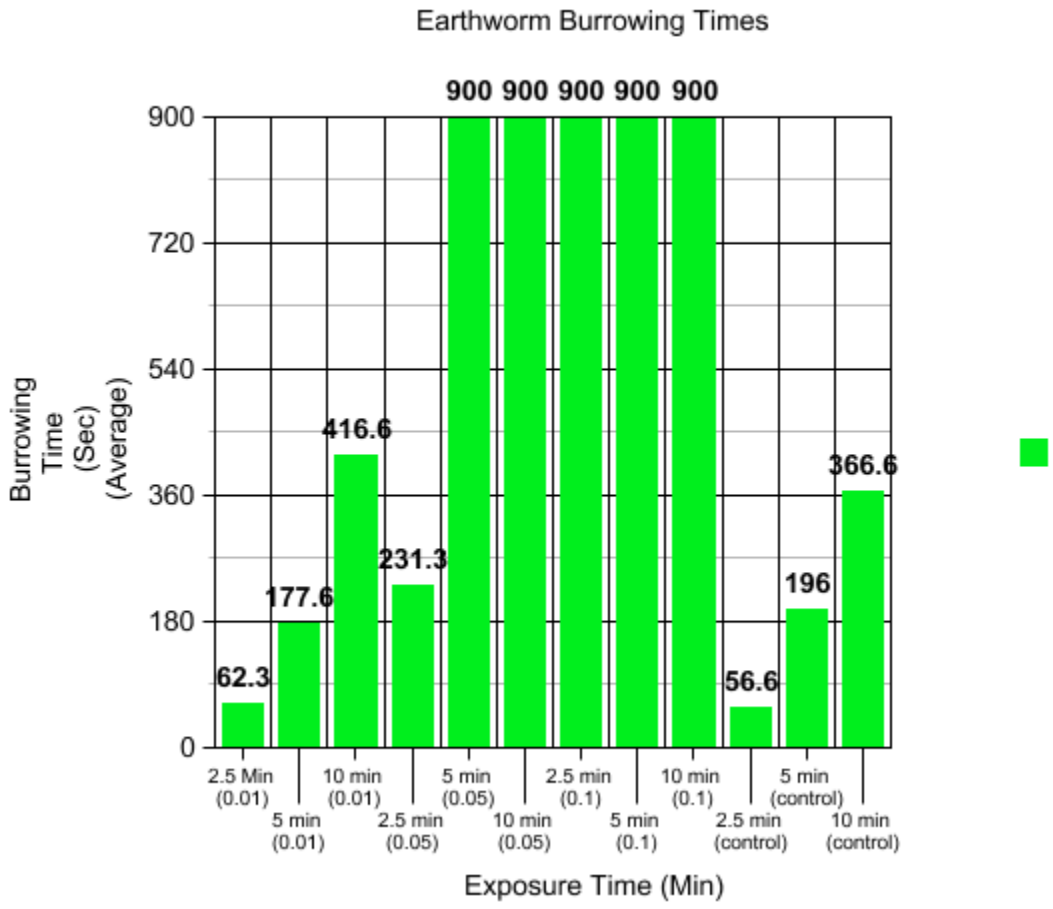
Nicotine is a stimulant drug that can change your mood, awareness, and affect other things like heart rate. Nicotine is bad because it is highly addictive and can eventually lead to permanent, bad, consequences that can end up ruining your life. Some symptoms of using Nicotine is lung disease, negative affect on personality, increase of depression, addiction, interferance with brain development which causes permanent brain damage, hardening of the arterial walls, leading to a possible heart attack, and it can increase anxiety and tension.

Because 14% of adults aged 18+ use nicotine in the U.S[14], some scientists decided to do an experiment on how different dilutions of Nicotine would affect earthwom's burrowing time. If the scientists exposed the earthworms to Nicotine, then, it will have a negative effect on the earthworm's burrowing time because it will effect the earthworm's brain and disrupt its thinking and behavior.

You will want to take 2 cups, and place one on the table. You will now want to place a piece of cut out filter paper inside the cup and pour the dilution of Nicotine on it. Exactly 2 mL. Once you do that,

[14] "Current Cigarette Smoking Among Adults in the United States | CDC." https://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm. Accessed 25 Feb. 2022.

quickly place your 3 worms into the cup and put another filter paper on top of it, right away after that, put another cup on top of the other one and start your timer. When the timer stops, you will put the 3 earthworms in a cup of moist dirt and start a stopwatch. You will want to watch closly so that you can read the time when an earthworm burrows completely. When you see that an earthworm burrows, do not stop the time, just read what time it is at and record that. When all 3 worms burrow, then stop the timer and dig out the worms. Repeat this until you are done with all experimenting.



(The burrowing time was averaged because I could not figure out how to put multiple sets of data in each bar…)

Statistics:

Dilution	Exposure Time	Mean	T - Score	Statistically Significant?
0.01	2.5 min	62.33	0.2390	Not Statistically Significant
0.01	5 min	177.67	2.5630	Statistically Significant
0.01	10 min	416.67	1.4865	Statistically Significant
0.05	2.5 min	231.33	1.5508	Statistically Significant
0.05	5 min	900.00	53.2543	Statistically Significant
0.05	10 min	900.00	53.2543	Statistically Significant
0.1	2.5 min	900.00	53.2543	Statistically Significant
0.1	5 min	900.00	53.2543	Statistically Significant
0.1	10 min	900.00	53.2543	Statistically Significant

The scientists' statistics suggests that most of the data did, in fact, support the scientists initial hypothesis, that nicotine will negatively affect the earthworm's burrowing time. There is a trend. The scientists noticed that there was a trend of the greater the dilution/exposure time is, the greater the average/t score is. The results did provide the scientists with enough information that was needed.

The scientists noticed that there were some outliers on the 10 min exposure times. An example is about 2 min, 2.5 min, and 15 min. There may have been a couple of problems that could have changed the results for the scientists. One example is that the dirt may have been more wet in some experiments

which would either make it easier for the worms to burrow. This may have changed the results. Some limitations in the experiment for the scientists may have been the time they had, and the tools. Another limitation is the dilutions that were already made. One final limitation for the scientists might have been that they could've had more worms experimented on to get a better result.

Discussion:

A trend that the scientists noticed was that the higher the dilution/exposure time was, the longer and longer it took for the earthworms to burrow. The scientists results showed that their hypotheses was correct, saying that the worm's burrowing time would be negatively affected by nicotine exposure. Most of the data was statistically significant, making the hypothesis correct. Only one of the results were not statistically significant, so, for the most part, the hypothesis was correct.

Some limitations for the scientists was that they had a limited amount of time, not the greatest tools, and, they might want to get more worms tested to get a more accurate mean, t-score, time, and the whole experiment would be even better and more accurate.

The earthworms behaved the way they did because when the nicotine got into their systems, it started to make their brains not work in the correct way, making them confused, and their brains made them not burrow faster because they were very confused. Basically, the reason that the worms slowed in their burrowing after being exposed to Nicotine is because it slowed their brain, making the worms confused and, therefore, making their burrowing slower.

This experiment will help society because it shows just how bad Nicotine might be for people's brains along with a worm's. This means that if people ingest Nicotine, their brains might slow and it could permanently damage their brain. Why this is important for society is to show that Nicotine is

extremely bad for your brain, and it can possibly damage your mental health and brain. The more you use Nicotine, the worst it might get.

A couple ways that the scientists could go even further for the experiment would be testing different dilutions on different worms, different ages of worms, lengths of worms, size overall, and, they could also test different counterparts of Nicotine. They could also use different stimulant drugs simmilar to Nicotine with different dilutions and worm types, sizes, and ages. The scientists could use this to go even further in their experiment and get better results