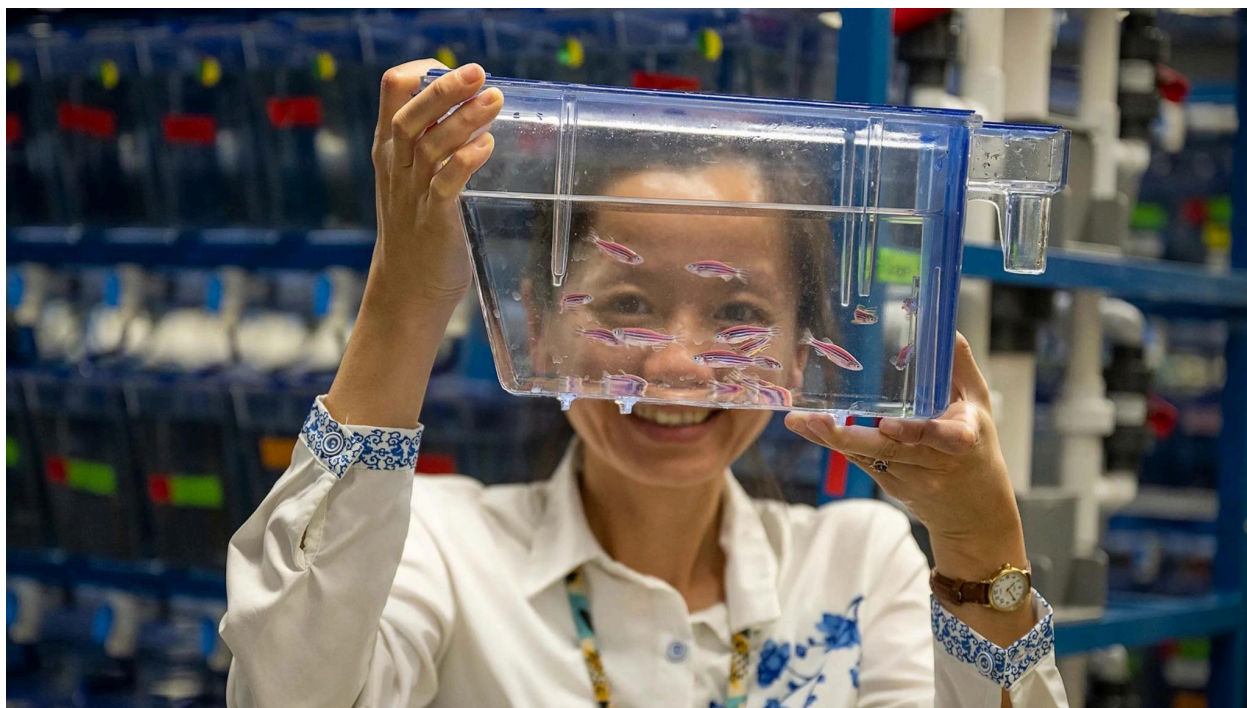


Investigating the Effects of Artificial Sweeteners & Dyes on the Memory of Humans

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Summary

Artificial food dyes and sweeteners are found in countless American consumer-goods. Studies fail to investigate the effects of a combination of these two ingredients on memory in humans, although they appear in popular American goods in combination with one another. Memory impairment disorders are common in U.S. citizens, with apparently no prominent cause.



Zebrafish in a laboratory

Zebrafish have been noted to be valuable test subjects for investigating neurological disorders within humans in terms of cognition, memory, etc. because of their similar brain structures to humans. The negative effects of artificial sweeteners & artificial food additives on memory could be further explored through research conducted on zebrafish, and potentially transferred over for human investigation.

Background Research

The American diet is composed of countless amounts of artificial dyes and sweeteners. Approximately 7.2 million Americans over the age of 65 live with Alzheimer's disease— an irreversible brain disorder that impairs one's cognitive function and memory over time. With no correlation at first glance, one may assume Alzheimer's disease results due to genetics or by mere chance. Albeit, it's important to note that Americans consistently happen to be the unhealthiest group of people around the world. Americans consume common dyes such as Red 40, Yellow 5, and Yellow 6 often in combination with sweeteners such as Aspartame, Sucralose, and Saccharin. They are found in common foods of American diets: brand-name yogurts, cereals, chips, gum, etc. -



What is Red Dye 40?

Dye in popular food items

Surprisingly, all of these artificial dyes and sweeteners were approved by the U.S. Food and Drug Administration. Many well-known food and drink brands rely on these artificial dyes & sweeteners to make their products for the consumer market. However, many scientists are concerned with the effects of these dyes and sweeteners on American consumers in terms of ADHD and other neurological disorders. The FDA has begun to take action in terms of recalling these previously approved dyes and sweeteners because of these concerns for American health.

Several studies have investigated the effects of sweeteners on the memory of humans, many which have shown negative effects. In a research study that focused on identifying the effects of several artificial sweeteners on memory, participants under the age of 60 who consumed large amounts of sweetener(s) over the course of eight years demonstrated 62% faster declines in memory when compared to participants in the same age group that consumed small amounts of sweetener(s) (Salamon, 2025). Food dyes, on the other hand, have also been investigated separately. Several animal studies evidence that artificial food dyes alter brain structure and impair memory & learning (Delson, 2021). But, limited studies investigate the effects of artificial dyes and sweeteners

together on memory in humans, which could prove significant as these two ingredients are often found together in countless food items.

Noted in a scientific conference at a public high school in New York City, zebrafish have been acknowledged to be extremely useful for research involving cognitive studies affecting humans due to the similarity in brain structure to that of humans. Zebrafish are valuable in studying certain neurological conditions such as Alzheimer's, making them valuable test subjects for investigation of how food coloring and artificial sweeteners impact the human brain. In addition their incredibly small and low effort care promotes their usage in terms of experimental purposes further motivating the cause behind researching sweeteners & food coloring on such fish.



Sweeteners in popular food and drinks

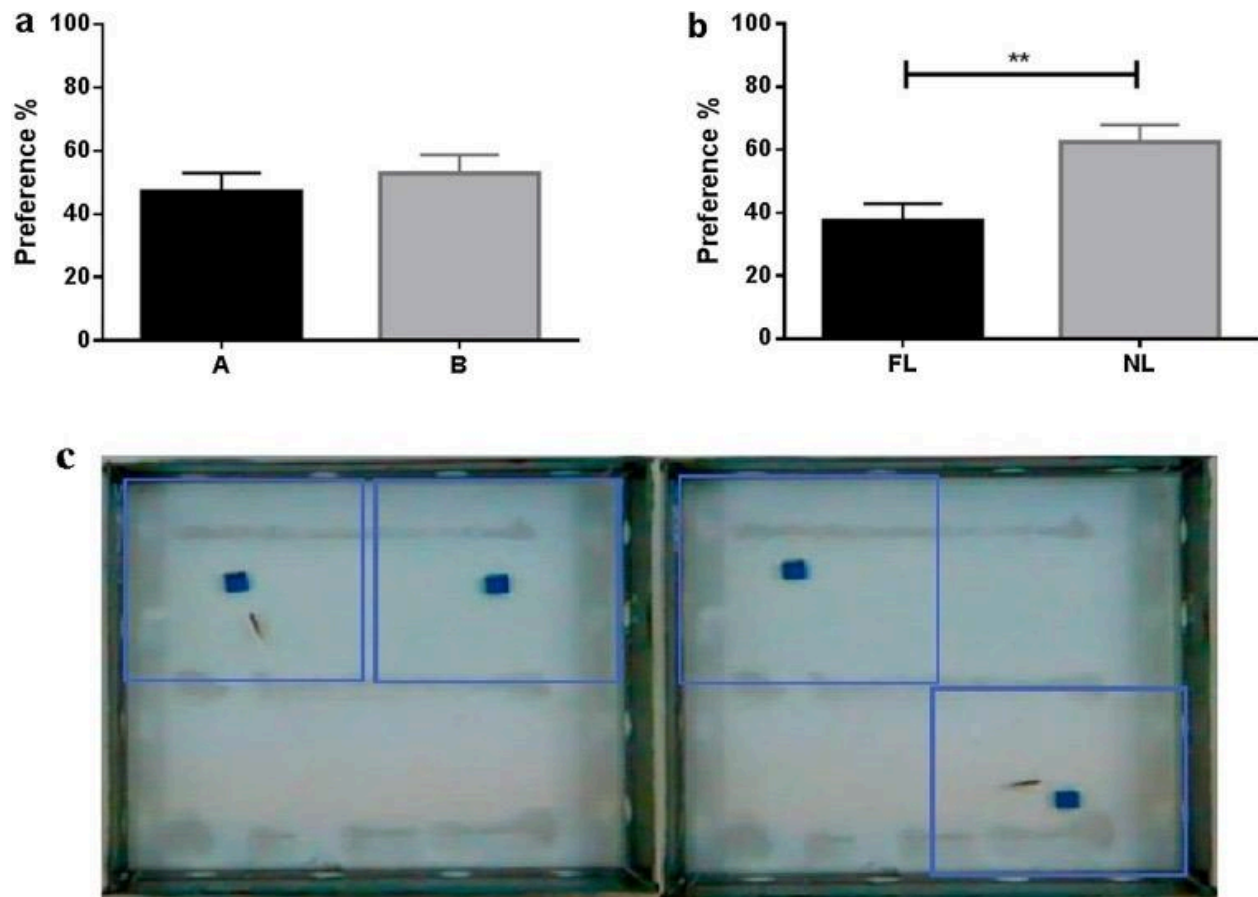
Field Research Plan

Our objective in this study is to evaluate the influence that the extremely common combination of the artificial food enhancers Red 40 and aspartame have on cognitive function and health. By taking advantage of similarities between the zebrafish cognitive system and that of humans, we will conduct experiments exposing the fish to a combination Red 40 and aspartame to help us better understand how detrimental these ingredients can be to the memory and risks of serious neurodegenerative diseases of humans not only independently but in tandem with each other. Our hypothesis is that the combination will contribute to more damage to cognitive health than when zebrafish are exposed to each of the ingredients alone.

As we would be handling vertebrate animals, it would be crucial to ensure the safest techniques in our research so that we can isolate the results for the most accurate analysis and application. Once we acclimate the zebrafish in their tanks, we can get a veterinarian who works at our school to approve the setup as well as providing guidelines for non-deadly amounts of each chemical so that we can attain viable results. In order to isolate each

variable, the zebrafish will be split amongst four different tanks: control, Red 40 solution, aspartame solution, and Red 40 with aspartame. This way, we can assess which ingredients the fish are more reactive to and if combining them makes a significant difference in their cognition. Throughout our experimental process we will continue to consult our veterinarian to ensure that we are adhering to protocol.

The main experimental model we will use is the Novel Object Recognition (NOR) test, which has the potential to better our understanding of Alzheimer's Disease. This test is optimal for our means because it allows us to determine changes in the memory of our zebrafish and is reasonable for a classroom laboratory environment because of the relatively small amount of materials needed. For this diagnostic we will need to obtain two sets of identical objects, which will be placed in the tanks in a set order. To begin, we will place one pair of identical objects in the tanks, then for a set amount of time that will be kept constant for every round and for every tank, we will measure the number of interactions the zebrafish have with the objects. Then, the next trial will involve swapping one of the identical items out for one from the other set. At this point, zebrafish with intact memories should exhibit different interactions with the objects, a higher amount of time spent exploring the new object exemplifying learning, and less amount of time spent interacting with the familiar object showing memory retention. The last trial will involve replacing the remaining original object with the identical of the second object. This process will be repeated for every tank and can be recorded via camera so that we can study the behavior of the fish even after the trials are over and compare their behavior across tanks. Finally, to quantitatively measure the changes in memory, we will use the Discrimination Index formula.



Novel object recognition and object location tasks in zebrafish: Influence of habituation and NMDA receptor antagonism.

Recommendation

At the end of our study, we hope to provide strong, conclusive evidence to bolster suspicions many scientists and health specialists have regarding the dangers of artificial ingredients such as Red 40 and aspartame. Ideally, giving a greater voice to this issue will catch the attention of a range of Americans, whether they be parents concerned for their children's health at snacktime, elders at risk of developing Alzheimer's or similar cognitive diseases, or leaders of large food companies. There is existing FDA regulation on Red 40 as it is being increasingly understood to be unhealthy thanks to existing scientific research, but we are dedicated to this project so that we can draw even more attention to the damage it can do. Aspartame on the other hand is regulated by the FDA but does not have much restriction and there is currently no legislative effort to phase out its use in commercial food products, so if our research confirms our hypothesis we recommend that the FDA more aggressively raises these imminent issues to Congress so that stricter legislation can be passed in regulation and possible restriction of these artificial additives. It is crucial that the government takes charge in ensuring the safety of American foods as in our capitalist society, it is easy for large corporations to deceive consumers, and Americans should have the right to healthier food options.

Conclusion

Evidently enough, artificial sweeteners and food dyes impose a negative impact on the human brain, especially in terms of cognitive memory. Although it is difficult to investigate these substances on real human beings due to cost, safety hazards, and varying digestive systems, zebrafish pose as valuable test subjects in part because of their similar brain structure to that of a human as well as their small size & behavioral aspects. Investigating the impact of artificial sweeteners and food dyes on the human mind can prove to individuals that consumption of these additives is harmful to our cognitive minds. This can also help be a part of movements that are seeking to exterminate such additives in the food industry, imperatively in the United States. Many communities can discover that even through short-term consumption of sugary foods/drinks, these additives harm the human brain, which is why it is so important to investigate the effects of what we are consuming on every organ in the human body.

References

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- 2) Delson, Sam. "Report Links Synthetic Food Dyes to Hyperactivity and Other Neurobehavioral Effects in Children." *OEHHA*, 16 Apr. 2021, oehha.ca.gov/risk-assessment/press-release/report-links-synthetic-food-dyes-hyperactivity-and-other-neuro-behavioral-effects-children.
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