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Effect of Alcohol use on the Adolescent Brain and Behavior

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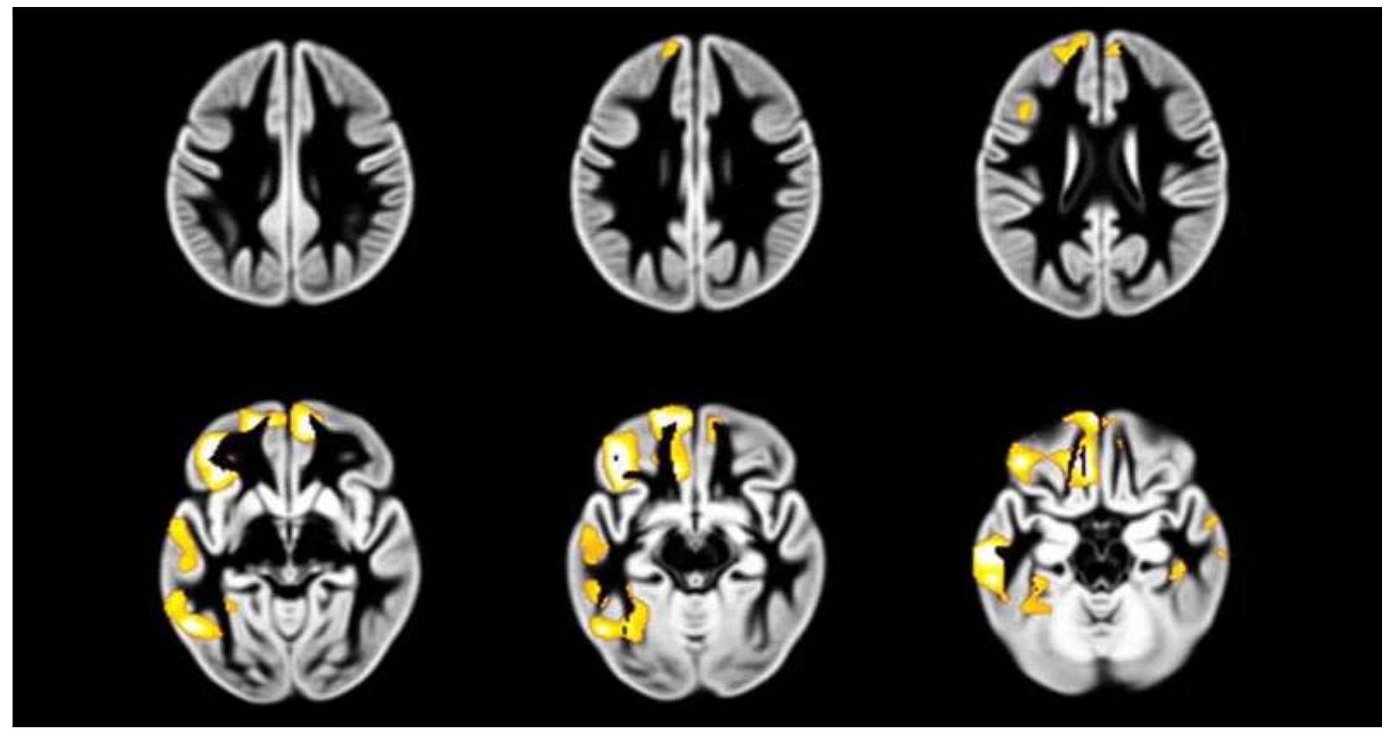
INTRODUCTION

Adolescence is a period of considerable physical, cognitive, emotional, social, and behavioral changes. Adolescence is marked by increased reward sensitivity, sensation seeking, and impulsive conduct, as well as a loss of self-control in controlling emotions and behaviors.

This contributes to the high prevalence of dangerous behavior, such as the beginning and progression of alcohol consumption.

Researchers have been trying to figure out the direction of this association for the past decade. Human research is limited to natural observational studies since it would be immoral to randomly assign youth to different alcohol-using groups.. By assessing youth before they have ever used alcohol or other drugs and continuing to assess them over time as a portion of the participant population naturally transitions into substance use, prospective, longitudinal designs have been used to help delineate between pre-existing alterations and post-alcohol effects on brain development. This methodology allows researchers to compare the brain maturation of adolescents who have never used alcohol or drugs throughout adolescence to youth who have transitioned from adolescence to adulthood.

In a recent analysis, potential pre-existing neurobiological markers of alcohol use in humans were summarized. While prior investigations have looked into the neurological effects of alcohol consumption, there are certain limitations. Previous reviews reviewed studies that looked at the influence of one adolescent drinking habit or one study type (i.e. neuropsychological studies, neuroimaging studies).



(Fig.1) [2] *Brain regions where a decrease in grey matter between the ages of 14 and 19 years is associated with an increase in drunkenness frequency between 14 and 19 years*

Discussion

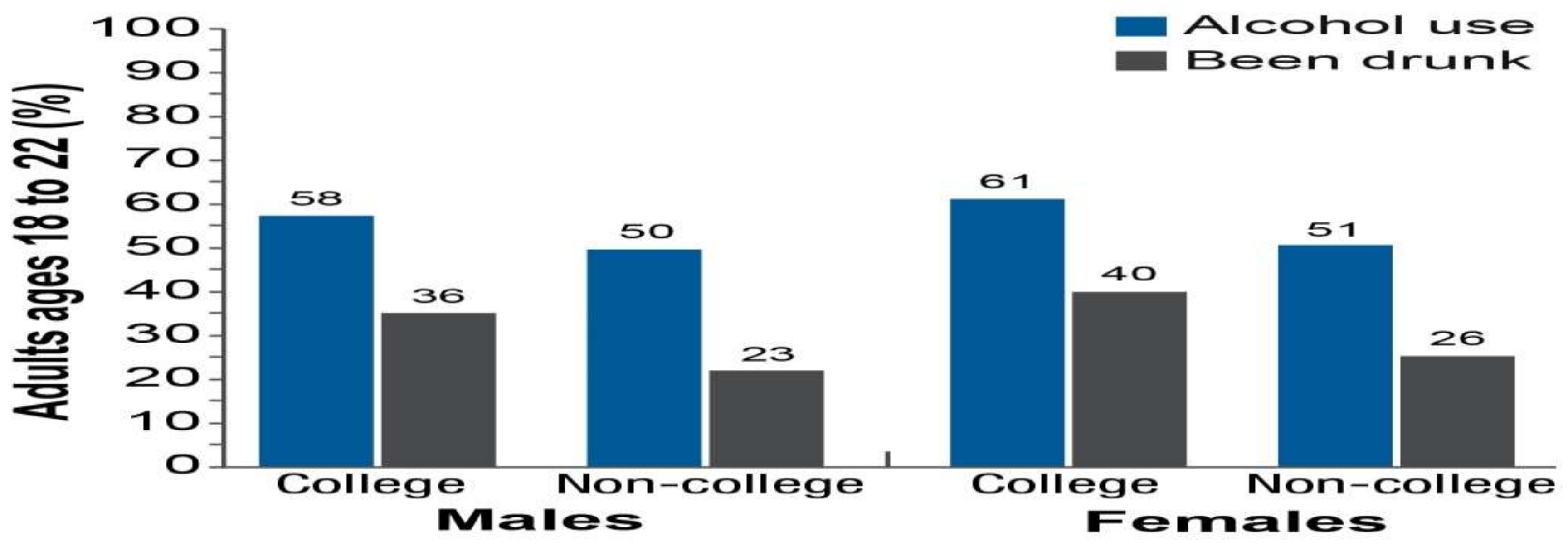
During adolescence, the brain undergoes major neurodevelopment, with maturation lasting until roughly the age of 25. During normal teenage brain growth, brain gray matter, which mostly consists of nerve cell bodies and dendrites, tends to diminish due to the elimination of weak synaptic connections and changes in the extracellular matrix. With ongoing myelination of axons, white matter volume and white matter integrity grow with time, allowing for more efficient communication across brain areas. Some study implies that this process increases dispersed connectivity and circuitry between distant brain regions, compared to more local connectivity; nevertheless, this conclusion is controversial.

Lower order sensorimotor regions mature earliest, followed by limbic regions critical for reward processing, and frontal regions linked with higher order cognitive functioning mature later in adolescence and young adulthood. The development of adolescent brains differs by gender, with female brains growing one to two years earlier than male brains. Cortical gray matter thickness peaks in the parietal lobes at ages 10 (female) and 12 (male), and in the frontal lobes at ages 11 (female) and 12 (male), respectively (male). Although the temporal lobes, which attain maximum thickness at the ages of 16 (male) and 17 (female), the trend is inverted (female).

In adolescence, neurotransmitter systems, which carry chemical signals across synapses, also alter significantly. During adolescence, dopamine projections to the limbic and frontal areas are generally at their highest. When compared to adulthood, this is connected with increased brain sensitivity in response to incentives. Inhibitory control is lower in adolescence than in adulthood, owing to more excitatory synapses and fewer GABAergic inhibitory neurotransmitters in higher-order frontal areas, with the ratio reversing later in adolescence and into adulthood.. Even minor changes in neurodevelopmental trajectories can affect a range of cognitive, emotional, and social functioning. Neurotoxin exposure, particularly alcohol use, during adolescence can affect healthy brain development, with even minor changes in neurodevelopmental trajectories affecting a range of cognitive, emotional, and social functioning. Adolescent alcohol consumption may thus set the scene for cognitive difficulties in adulthood, with long-term functional repercussions.

Prospective longitudinal neuropsychological, neuroimaging, and neurophysiological research have found cognitive and neurological repercussions that are directly linked to teenage alcohol consumption beginning . Overall, teenage alcohol consumption has been shown to have a deleterious impact on cognition, brain structure, and function; however, the extent to which alcohol consumption and distinct drinking patterns affect male and female brain functioning has been contested.

Even after controlling for confounding characteristics like sex and externalizing behavior, alcohol use patterns around the ages of 12 to 14 predict inferior educational success in subsequent years. Adolescent binge drinking was linked to an overall cognitive deficit as well as particular impairments in decision-making and inhibition, according to a new meta-analysis of cross-sectional research. We provide findings from longitudinal research that show that adolescent binge drinking and heavy alcohol consumption can have deleterious consequences on memory, learning, visuospatial function, executive function, reading ability, and impulsivity.



(Fig2) [3] Past-month alcohol use and drunkenness among emerging adults (ages 18 to 22) based on college status. Both measures are declining more for emerging adult males than for emerging adult females, leading to disappearing gender gaps.

Material and methods

In this study, two groups of adolescents between the ages of 12-19 were used. They were classified into a group addicted to drinking alcohol and the other group does not drink alcohol. From this experiment, the difference in behavioral and moral development, as well as the development in brain functions, was used.

RESULTS

Drunkenness is defined as behaviors that suggest a high level of drunkenness, such as stumbling when walking, being unable to talk clearly, vomiting, or forgetting what happened. Adolescents were asked how often they had been intoxicated in the previous year.

The link between greater drinking in females and changes in grey matter in the brain over time was particularly robust. The researchers also looked at the impact of impulsivity and discovered that only males showed an association between impulsivity and higher alcoholism, implying that boys and girls may have separate developmental pathways leading to drunkenness.

brain changes in the frontal and temporal lobes might happen even before the onset of alcohol use. As a result, assertions that underage drinking would harm your brain are oversimplified and do not reflect the complexity of brain development and environment connections. Structure changes in the brain in adolescents who do not drink heavily could be a predictor of alcohol use, and additional research is needed to uncover relevant risk variables that could assist characterize such individuals

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