The main categories of child abuse are neglect, physical abuse, emotional abuse, and sexual abuse. Neglect is a failure by a child's caregiver to meet a child's basic needs, like adequate shelter, safety, health care, supervision, or nutritional requirements. In physical abuse, the child is injured by hitting, punching, kicking, shaking, burning, stabbing, or choking. The emotional abusers ignore, isolate, terrorize, and reject their victims. Child sexual abuse refers to any sexual activity with a child, including sexual intercourse, attempted intercourse, touching of genitals directly or through clothing, exhibitionism, exposure to adult sexual activity or pornography, and using the child for prostitution or pornography. Neuroimaging studies have shown that childhood abuse and maltreatment are associated with structural brain changes. In this study, the researchers from Turkey utilized brain magnetic resonance imaging (MRI) scans to investigate the effects of sexual abuse on the limbic and prefrontal cortex structures in adolescent brains. Based on previous research, the authors hypothesized that the volumes of the amygdala and hippocampus, as well as the cortical thickness of the prefrontal cortex, would be altered in sexually abused adolescents compared to non-abused individuals.

The human brain is still developing during childhood through processes of synaptic remodeling, which affects both gray and white matter organization. Child abuse is a serious stressor with the potential to disrupt neurodevelopmental processes due to physiological, neurochemical, and hormonal changes. Brain regions most frequently affected by childhood abuse include the prefrontal cortex, anterior cingulate cortex, hippocampus, amygdala, corpus callosum, and cerebellum, suggesting that fronto-limbic circuits may be most affected.

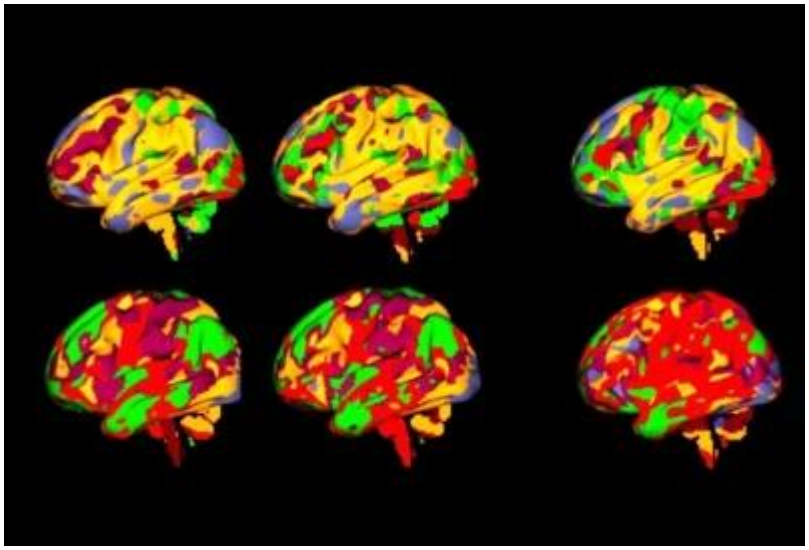
Early adversities have detrimental effects on the mental health of the child. Internalizing behavioral problems include limited stress tolerance, anxiety, affective instability, depression, suicidality, post-traumatic stress disorder (PTSD), dissociative disturbances, and hallucinatory phenomena. Externalizing behavioral symptoms include poor impulse control, episodic aggression, substance abuse, attention deficit hyperactivity disorder, and conduct disorder. Abuse usually leads to PTSD, with incidence ranging from 36% to 63%. A significant concern in interpreting the neuroimaging findings in individuals who had experienced childhood abuse is that the majority of studies investigate subjects with associated psychiatric conditions. More pronounced structural brain changes in survivors of childhood abuse with PTSD than in survivors without PTSD make it difficult to determine the cause of these changes.

About the study

The study included 57 adolescents who had been sexually abused and 33 non-abused controls (mean age: 16.5± 0.2). All participants were females. The exclusion criteria for both study groups were as follows: a score of 70 or less on the intelligence quotient, a history of perinatal complications, a history of head injury with transient loss of consciousness lasting more than three minutes, a neurological or developmental disorders, and a personal or family history of psychotic or bipolar disorders. Participants treated with antidepressants within four weeks before the study were also excluded.

The psychiatric evaluation included the Kiddie schedule for affective disorders and Schizophrenia present and lifetime, the Beck depression inventory, the State-trait anxiety inventory, the Childhood trauma questionnaire, the Wechsler Intelligence Scale for children aged 9-16 and the Wechsler Adult Intelligence Scale for participants above the age of 16 years.

All participants underwent brain MRI scans to explore whether and how sexual abuse impacts their brain structures.



Results

The MRI findings of the sexually abused participants showed significantly larger volumes of the right and left hippocampus and the right amygdala and reduced cortical thickness in the inferior frontal gyrus compared to non-abused controls. Despite the larger volume of the left amygdala in the sexually abused individuals, this difference did not reach a statistically significant level.

The hippocampus is a part of the limbic system and plays an important role in learning and memory. Previous studies revealed that hippocampal volume is particularly sensitive to sexual abuse that occurs between 3 and 5 years and between 11 and 13 years. Some studies have found that changes in the hippocampal volume correlate with the onset or duration of childhood abuse.

The amygdala plays a key role in emotional processing, assessing threatening information, controlling behavior, and memorizing emotional events. Memory and emotion processing are of extreme importance in threatening situations, and therefore, child abuse may be associated with structural changes in the amygdala. Increased volume of the amygdala has been found in postinstitutional adolescents who were exposed to severe early deprivation. The increase in the amygdala volume correlated with the time spent in the institution.

The prefrontal cortex plays a major role in all functions that characterize mature adult behavior, including higher-level motor control, attention, working memory, personality expression, emotion, and motivation regulation. The prolonged development of the prefrontal cortex makes it an important target for abnormal development in children

exposed to severe environmental stressors, such as abuse. Numerous studies have found a thinner lateral prefrontal cortex, particularly the inferior frontal gyrus, in children with adverse childhood experiences. An MRI study demonstrated a reduced gray matter volume in the whole frontal cortex, the left dorsolateral prefrontal cortex, and the right medial prefrontal cortex in women who had been sexually abused in childhood.

Importantly, the prefrontal cortex has regulatory and inhibitory functions on the limbic cortex, which could be maladaptive in children exposed to hazardous experiences.

Scores on the Childhood trauma questionnaire did not correlate with observed changes in the brain structures.

Conclusion

This MRI study has shown that volumes of the amygdala and hippocampus, as well as the cortical thickness of the prefrontal cortex, were altered in sexually abused adolescents compared to non-abused adolescents. The authors suggested that greater volumes of the amygdala and hippocampus, combined with reduced cortical thickness in the inferior frontal gyrus, may represent a maladaptive response to dangerous experiences.

They concluded that these results provide evidence of the structural brain changes in adolescents who had experienced childhood sexual abuse.

This article was published in the Scandinavian Journal of Child and Adolescent Psychiatry and Psychology.

Journal References

Bulut Demir MH et al. The effects of sexual abuse on female adolescent brain structures. Scandinavian Journal of Child and Adolescent Psychiatry and Psychology 2023; Vol. 11: 87-94. (Open Access). https://doi.org/10.2478/sjcapp-2023-0009

Hart H and Rubia K. Neuroimaging of child abuse: a critical review. Frontiers in Human Neuroscience March 2012; Volume 6, Article 52. (Open Access). https://www.frontiersin.org/articles/10.3389/fnhum.2012.00052/full


UNLIMITED DOWNLOADS
VectorStock
ROYALTY FREE VECTOR GRAPHICS