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Protocol For Study Of Brain Derived Neurotrphic Factor And Cognition In Mobile Addicts: An Observational Study

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Abstract

Mobile phone overuse has emerged as a growing concern, particularly among young individuals, with potential negative effects on brain health and cognitive performance. Brain-Derived Neurotrophic Factor (BDNF), a key neurotrophin involved in synaptic plasticity, learning, and memory, may be affected by excessive mobile usage. This observational study aims to investigate the relationship between BDNF levels and cognitive performance in individuals identified as mobile addicts. The study will include participants aged 18–40 years who meet established criteria for mobile addiction, assessed using Short version of Smartphone Addiction scale. Baseline blood samples will be collected to measure serum BDNF levels using ELISA, and cognitive functions will be evaluated using CogniFit app. The findings may offer valuable insights into the neurobiological consequences of mobile addiction and underscore the need for early interventions.

Key words: Mobile addiction, brain derived neurotrophic factor, cognition

Introduction

Neuroplasticity is described as the property of the Central Nervous System to reorganize its connections, structures, and functions in response to any intrinsic and extrinsic stimuli.[1] The process of neuroplasticity includes synaptogenesis, neurogenesis, and neuroprotection.[2] Previous literature suggests that neuroplasticity is an ongoing process in the brain throughout life and the process of neuroplasticity alters from healthy individuals to individuals suffering from any mental or neurological disorders.[3] According to previous studies, the methods of measurement of neuroplasticity are Structural MRI, Task-based functional MRI, and Serum BDNF levels.[4,5]According to a study by Yvonne Naegelin et. al. the levels of BDNF can be readily measured in human serum. Measurement of BDNF levels in human serum is reliable and is correlated to brain neuroplasticity.[6] Brain Derived Neurotrophic Factor belongs to the neurotrophin family which is present widely in the Central Nervous System (CNS) highly concentrated in the hippocampus and cortex of the brain.[7] It plays an important role in neuronal growth, differentiation, and repair.[8] BDNF plays role in neuroplasticity by promoting changes in cortical thickness and synaptic density in response to external stimuli or experiences.[9]

Cognition is one of the important functions of the brain and the process of neuroplasticity and the levels of BDNF alters with the changes of cognition. Cognition is the mental process of knowing and applying information. It includes many complex neural processes, including arousal, attention, concentration, memory, learning, and executive functions. Executive functions can be categorized into following main areas: planning, cognitive flexibility, initiation and self-generation, response inhibition and serial ordering and sequencing.[10]

Among all of electronic devices, smartphones are the most popular and most used devices by most of the young population.[11] Smartphones are the advanced devices which has many functions like calling, gaming, use of internet and social media, etc. The features of smartphone like portability and real time availability of internet anytime and anywhere are the reasons of higher usage of smartphones.[12] According to recent studies, prevalence of smartphone addiction is 30% in medical students.[13] Addiction is considered by WHO (WHO Expert Committee - 1964) as dependence, as the continuous use of something for the sake of relief, comfort, or stimulation, which often causes cravings when it is absent.[13] Many researchers conducted on smartphone use provide the evidence that its excessive and uncontrolled use can be associated with various problems.[14] Excessive use of smartphones is an issue raising health related problems.[15] Smartphone addiction is positively correlated with mental distress such as depression, anxiety, loneliness, stress, boredom linked to poor sleep quality, impaired learning and acquisition and premature cognitive decline.[16] The levels of BDNF and their significance has been studied in neurological conditions like Dementia, Alzheimer's disease, Parkinson disease and Stroke, etc.[7] but it has never been studied in Mobile Addicts. Previous studies provide evidence for the correlation of Mobile Addiction and Cognitive decline.[1] Therefore, it is important to study the levels of BDNF and cognition in Mobile Addicts and to compare it with age and gender-matched Non-Mobile Addicts.

STUDY AIM AND OBJECTIVES

AIM: To study the Bain Derived Neurotrophic Factor (BDNF) and cognition in mobile addicts.
OBJECTIVE: To understand the impact of Mobile addiction on neuroplasticity and cognition by studying the levels of serum BDNF.
To compare the levels of Brain Derived Neurotrophic Factor in Mobile and Non-Mobile Addicts.

RESEACH METHODOLOGY

Study Design: This will be prospective observational study of brain derived neurotrophic factor and cognition in mobile addicts.

Population and Sample: Mobile addicts and Non mobile addicts aged between 18-40 years of both genders diagnosed using Short Version of Smartphone Addiction Scale willing to participate in the Study. Individual with preexisting neurological condition, known case of type 1or 2 diabetes and hypertension, chronic alcoholism and cigarette smoking will be excluded from study.

Sampling Strategy: Non-probability convenience sampling method will be used for the recruitment of the participants. The sample size is 48. The calculation is done using the technique of estimating sample size for the Paired "t" test.

Participant selection and recruitment: Individuals from the population will be evaluated using the Short Version of Smartphone Addiction Scale and 36 individuals will be recruited in a group of mobile addicts. Other group will be formed with age and gender matched 36 non-mobile addicts evaluated using the same scale. Participant will be briefed about the study. Demographic data and written informed consent will be obtained from participants of both the groups.

Data collection: Initially, blood samples will be collected from antecubital vein of each of participant at KLE Hospital. Then, all the participants from each group will be assessed for cognition using CogniFit app which is a game based cognitive test. The scores of each participants will be obtained. The samples collected will be tested for BDNF levels using BDNF GENLISA ELISA kit at Basic Science Research Centre in JNMC campus. The data of test results of each group will be collected. The results of BDNF levels and Cognition scores will be compared in Mobile and Non-Mobile Addicts. The data collected from blood test and cognition test will be statistically analyzed.

Statistical analysis: Data will be collected and analyzed using version 23 of SPSS software. Demographic characteristics will be described using Descriptive Statistics. A normality check will be done for all the variables using the Shapiro-Wilk Test. The cognitive scores of group A and group B will be compared using the

Independent sample "t" test. BDNF levels of group A and group B will be compared using the Mann-Whitney "U" test. The significance level for all variables was p-value < 0.05.

Ethical consideration: This study is approved by the Research and Ethical Committee, KLEU Institute of Physiotherapy, Belagavi. The study emphasises voluntary participation, and participants can drop out of the study at any point in time without any penalty. The study observes that no risk is involved in the participation. The information provided by the participants will be confidential and safely secured.

RESULTS AND DISCUSSION

The current study is designed to explore the association between Brain-Derived Neurotrophic Factor (BDNF) levels and cognitive performance in individuals with mobile phone addiction. Given the rising prevalence of smartphone overuse, especially among the youth, there is a growing concern about its impact on brain health and cognitive functions. Previous studies have established that BDNF plays a vital role in neuroplasticity, influencing neuronal growth, synaptic transmission, and overall cognitive performance. However, limited research has focused on how behavioral addictions such as mobile phone overuse affect BDNF levels and cognition.

This study hypothesizes that mobile phone addiction may negatively influence serum BDNF levels and cognitive domains such as attention, working memory, and executive functions. The use of validated neuropsychological tests and serum BDNF assays will allow for an objective correlation between these two parameters. If a significant association is found, it could provide biological evidence supporting the cognitive risks associated with excessive mobile use.

Furthermore, comparing the results with non-addicted, age- and gender-matched individuals will help determine whether mobile addiction has a measurable impact on neurobiological and cognitive markers. These findings could lay the groundwork for future interventions, such as cognitive training or physical activity, to enhance BDNF levels and mitigate cognitive decline in affected individuals.

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