

Cognitive Deficit in Depressed People and its Development

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Abstract. Depression is one of the most common mental disorder that could negatively affects individuals' feeling, cognition and behaviour. From the cognitive modal of depression, people who have a negatively biased thinking mode tend to produce negative feeling about self, world, and their future (Beck, Aaron T, 2008). Compared to the normality, the 'abnormal' people tend to have a different way of interpreting things. This results from the abnormal brain functions which in turn causes cognitive deficits in depressed people. This literature review will focus on how those cognition deficits developed in children and how it causes a 'depressed brain'. It points out people with depression usually have impairment in executive function, memory, and attention and these cognition impairments are related to the dysfunction of locus control and prefrontal cortex.

Keywords: Cognition Deficit; Cognitive Development; Depression; Cognition Mechanism.

1. Introduction

Cognition is a mental ability of people to perceive, understand, and respond to the outside environment (Medalia & Revheim, 2002). Cognitive ability refers to the ability of the human brain to process, store and extract information, including perception, memory, attention, thinking, and imagination. The formation and development of cognitive abilities are based on the integrated function of the brain, which begins during the fetal period. Cognitive development is affected by nature and nurture elements including family genes and environment of surrounding. Only when the integration function is effective the cognitive ability can be improved. According to the diagnosis criteria in DSM 5, depression is a mental illness that causes people excessive stress and depression. It is mainly manifested as low mood, loss of interest, pessimism, slow thinking, lack of initiative, self-blame, poor diet, poor sleep, loss of joy, and a negative view of surroundings (DSM-5, 2013). Severe cases may have suicidal thoughts and behaviors. Much previous research has shown the strong correlation between cognition development and depression. Rock (2014) in his meta-analysis conveys that cognitive impairment is a core element resulting in depression. Among the depression patients that he researched, approximately 94% of them are experiencing some level of cognitive deficits and most of them are associated with memory and learning.

2. Cognitive Impairment that Related to Depression

2.1 Executive Function

Cognition is a mental ability of people to perceive, understand, and respond to the outside environment (Medalia & Revheim, 2002). Cognitive A meta-analysis (Levin, R.L, 2007) gives a more concrete explanation of this executive function of brain. It introduces that the anterior region is the spot for brain to organize executive functions including planning, thinking, metacognition, verbal fluency, inhibition, and conducting goal-directed behavior. Rogers (2004) in his research shows these cognitive impairments through the test done by depressed people. The 'Tower of London test' measures the planning efficiency by asking participants to move colored disks in order to change from an initial state to a goal pattern. The time participants take to finish the task reflects the problem-solving and planning efficiency (Philips, 1999). The test result turns out that people with depression take a longer time and achieve a lower accuracy, indicating that depressed people tend to have lower planning ability compared to normal people (Fu, L, 2018).

2.2 Memory

Another research suggests that executive function impairments largely result from the memory deficit (Heller and Nitschke 1997). They explain this correlation as an ineffective cognitive function that can prevent individual from processing and remembering information. A meta-analysis that discussed the memory deficit in depressed people conveys that rather than implicit memory, it is the deficit in explicit memory that forms the association with depression. Also, strong evidence shows that people with depression tend to remember more negative scenarios than positive ones (Levin, R.L, 2007). They find it difficult to initiate cognitive strategies that help them to process positive memory. People suffering from depression are shown to have impaired control over information recall (Levin, R.L, 2007). This deficit is not caused by the insufficiency of attention being put to the task but by the motivation of initiating the positive memory in an effortful way.

2.3 Attention

Another core element that has been used to diagnose depression is the decrease in concentration that results from the attention deficit (Levin, R.L, 2007). Previous research on attention impairment in depressed people shows that they took longer reaction time in simple choice questions and behave badly in sustained attention tasks (Mialet et al., 1996). It demonstrates the failure of task performance is due to the poor cognitive efficiency and affects the information processing. The research also shows that people with depression are less capable of suppressing the distractors. It would largely influence the accuracy of resource allocation, therefore affecting individuals' decision-making. The intensity of attention is the factor that interrupts the individual's information processing and causes deficits in depressed people (Mialet et al., 1996). This deficit is related to the dysfunction of the frontal-subcortical axis which works for behavior motivation, information organization, and interpretation (Bonell, 2007).

3. Mechanism

3.1 Locus of Control

Those cognitive impairments including executive function, memory, and attention deficits can result in an emotional drop-down and significantly affects individual's daily function. Levin (2007) mentioned in his article that those cognitive impairments could be associated with some negative affective experiences. Research done by Barahal (1981) investigated abused children and their cognitive development after experiencing the battered events. He discussed that the locus of control is the core element that leads to the negative style of information processing. Locus of control is a cognitive process that enables individuals to perceive if they hold primary control over their lives and other external circumstance. Abused children learned to have low confidence to influence and shape their experience and this would develop into helplessness in later adulthood. This learned helplessness is recognized as an important element that could contribute to the development of depression.

3.2 Prefrontal Cortex

Despite this, Sullivan RM and Brake WG (2003) in the meta-analysis explained that prefrontal cortex (PFC) is where executive functions, working memory, attention control, and emotional regulation take place. The early-stage adverse events could also negatively influence mature of PFC particularly in the right hemisphere by the deficit in dopamine. Also, Sullivan proposed that the impairment in executive function, memory, and attention is associated with the childhood parenting style including caregiving or interaction between parent and children. A review of the influence that postpartum depressed parents could bring on infants emphasizes the importance of parenting and early interaction (Tiffany Field, 2010). This article conveys that parents with postpartum depression tend to show irritability and hostility toward infants in their first three months. Between the 3rd to 6th month when infants start to learn communication skills and develop their cognition through smiling

or talking, there are few interactions between postpartum parents and infants. This lack of positive interaction contributes to the later impairments in infants' social, emotional, and cognitive functioning.

4. Conclusion

In conclusion, depression largely depends on cognitive processes in individuals. Early negative events can build up more on the production of cognitive deficits including executive function, memory, attention, and negative information processing style. It is essential to raise attention and attach importance to those early stage development and conduct treatment as early as possible. This article summarizes that the impairment in cognition development is highly related to the presence of depression in patients. However, the direction of the interaction between cognition impairment and depression development has yet to be identified. Future research could investigate whether cognition impairment causes depression or whether depression is a consequence of cognition impairment.

References

- [1] Barahal, R. M., Waterman, J., & Martin, H. P. (1981). The social cognitive development of abused children. *Journal of Consulting and Clinical Psychology*, 49(4), 508–516. <https://doi.org/10.1037/0022-006X.49.4.508>.
- [2] Beck, Aaron T. (2008), The Evolution of the Cognitive Model of Depression and Its Neurobiological Correlates, *American Journal of Psychiatry*, 10.1176, Doi: 10.1176/appi.ajp.2008.08050721.
- [3] Bonelli, R. M., & Cummings, J. L. (2007). Frontal-subcortical circuitry and behavior. *Dialogues in clinical neuroscience*, 9(2), 141–151. <https://doi.org/10.31887/DCNS.2007.9.2/rbonelli>.
- [4] Diagnostic and statistical manual of mental disorders: DSM-5. (Fifth edition.). (2013). American Psychiatric Publishing.
- [5] Fu, L., Xiang, D., (2018). Reduced prefrontal activation during the Tower of London and verbal fluency task in patients with bipolar depression: A multi-channel NIRS study. *Frontiers in Psychiatry*, 9, 214. <https://doi.org/10.3389/fpsy.2018.00214>.
- [6] Heller, W., Nitschke, J. B., Etienne, M. A., & Miller, G. A. (1997). Patterns of regional brain activity differentiate types of anxiety. *Journal of Abnormal Psychology*, 106, 376–385.
- [7] Levin, R.L., Heller, W., Mohanty, A. et al. Cognitive Deficits in Depression and Functional Specificity of Regional Brain Activity, (2007), *Cogn Ther Res* 31, 211–233. <https://doi.org/10.1007/s10608-007-9128-z>.
- [8] Medalia, A., & Revheim, N. (2002). Dealing with cognitive dysfunction associated with psychiatric disabilities: A handbook for families and friends of individuals with psychiatric disorders. New York State Office of Mental Health. DOI:10.5014/ajot.63.6.797.
- [9] Mialet, J.-P., Pope, H. G., & Yurgelun-Todd, D. (1996). Impaired attention in depressive states: A nonspecific deficit? *Psychological Medicine*, 26, 1009–1020.
- [10] Phillips, L.H. (1999) The Role of Memory in the Tower of London Task, *Memory*, 7:2, 209-231, DOI: 10.1080/741944066.
- [11] Rock, P., Roiser, J., Riedel, W., & Blackwell, A. (2014). Cognitive impairment in depression: A systematic review and meta-analysis. *Psychological Medicine*, 44(10), 2029-2040. DOI:10. 1016/ j. euroneuro.2014.12.004.
- [12] Rogers, M. A., Kasai, K., Koji, M, Fukuda, R., Iwanami, A., Nakagome, K., Fukuda, M., & Kato, N. (2004). Executive and prefrontal dysfunction in unipolar depression: a review of neuropsychological and imaging evidence. *Neuroscience Research*, 50, 1–11.
- [13] Sullivan RM, Brake WG. (2003), What the rodent prefrontal cortex can teach us about attention-deficit/hyperactivity disorder: the critical role of early developmental events on prefrontal function. *Behav Brain Res*. 146(1-2), doi: 10.1016/j.bbr.2003.09.015. PMID: 14643458.
- [14] Tiffany Field, (2010), Postpartum depression effects on early interactions, parenting, and safety practices: A review, *Infant Behavior and Development*, 33, 1-6, <https://doi.org/10.1016/j.infbeh.2009.10.005>.