ATTENTION-DEFICIT/HYPERACTIVITY DISORDER AND EXECUTIVE FUNCTION – A REVIEW OF LITERATURE

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ABSTRACT

Attention Deficit Hyperactivity Disorder (ADHD) is a common childhood neurodevelopmental disorder. ADHD is associated with impairment in executive functions. This study is to understand the theory of ADHD, executive functioning, impact of executive dysfunction, effect of intervention and the studies supporting the theory in both western and Indian context. This study includes the research on three subtypes of ADHD with samples like children, adolescents, and adults with ADHD. The executive function is responsible for planning, organizing, and cognitive functions. This study concludes that children with ADHD have executive dysfunction. Impairments in executive functioning may have a direct impact on grade retention, lower academic performance, working memory, self-regulation and set-shifting. There are various effective training that enhances working memory, an executive function that also helps in reducing problematic behavior and enhance short-term memory and academic performance.

Keywords
ADHD, Attention-deficit/hyperactivity disorder, executive functioning, children, attention.

I. INTRODUCTION

ADHD is a “common childhood neurodevelopmental disorder and is characterised by symptoms of inattention, hyperactivity, and impulsivity” (APA, 1994).

The three main symptoms of ADHD are “inattention, hyperactivity and impulsivity”. Since ADHD is a childhood disorder, the symptoms should present before the age of 12 and it should persist for six months of duration in two or more places (like home, friends place, school, play area) and the symptoms should be a hindrance to daily functioning of a person in a social and work setting for a clinical diagnosis setting (American Psychiatric Association, 2013). ADHD majorly affects about 4%-5% of children (APA, 2000). It is found that boys are more prevalent of ADHD than girls. Barkley and Murphy (1998) found that it is an early onset that may continue in adolescence and adulthood.

According to DSM-5, “ADHD is further classified in to three subtypes; they are predominantly in attentive presentation (ADHD-PI), Predominantly Hyperactive-Impulsive Presentation (ADHD-PHI) and Combined Presentation (Inattentive & Hyperactive-Impulsive) (ADHD-C)” (APA 2013).

India is the second largest country in the world in terms of population. As per the census report published by the government (2020) the child population in India between the age group 5 to 14 is approximately 253 million. The studies conducted on ADHD in India are very minimal and the results are inconsistent (Singhi P, Malhi P, 1998). Bhatia MS (1991) states the fewer studies that are available estimates that ADHD prevalence rate in the Indian children range between 10% to 20%. These studies also reveal that prevalence of ADHD is high in males than in females.

When compared to western world, the study in India on ADHD is limited. This is an alarming issue which needs to be addressed with immediate effect. As reported above, the child population alone in India is over 250 million
which is much larger when compared to the whole population of many other nations. So it is the duty of the researchers to focus more on the study of ADHD in the Indian children and be at par with the western world.

Theory of ADHD

Barkley Theory on ADHD (1997)

Globally, people have the preconceived notion that attention impairments are the core problem of ADHD. However Barkley deep dived to look beyond attention impairment in his study on ADHD. He conveys that individuals with ADHD may not be inattentive all the time. He says the prime impairment of ADHD is Response Inhibition which is due to abnormalities in the prefrontal cortex part of the brain and impairments in neurotransmitter.

Response Inhibition: Response Inhibition is the process of inhibiting the initial response to an event, interrupting an on-going response, permitting a stagnant in the decision making to respond or continue responding.

Working Memory: Baddeley and Hitch (1974), defined Working memory as a “multicomponent system to store temporarily information as it is processed”. Thus, it is clear that working memory plays an essential role in storing short term information which helps to effectively combat with day-to-day situations. Also Barkley in his study concludes the working memory is low in ADHD individuals. Kofler.M.J (2009) found that ADHD children have impairment in central executive processing and rehearsal capacity.

Self-Regulation: Fonagy and Target (2002) in their publication “Early intervention and the development of self-regulation” says “Self-Regulation refers to Children’s ability to control the reaction to stress, their capacity to maintain focused attention and the capacity to interpret mental states in themselves and others”. So, Self-Regulation can be understood as the ability to monitor and manage one’s emotion, thought process and action. Barkley in his theory states that the inability to monitor and manage one’s emotion, thought process and action is a key symptom linked to ADHD.

Internalization of Speech: Flavell, Beach, & Chinsky (1966) define Private speech or Internalization of Speech as “speech that is not explicitly addressed to another person and thus serves no apparent interpersonal communicative function”. As the definition clearly says one’s internally generated speech is not addressed to another person, it should be assumed that Internalization of Speech is the ability to use the generated speech to guide self’s actions and behavior. Barkley states in his theory that ADHD individual does not have the capacity to generate internal speech to guide their actions and behaviour.

Reconstitution: Reconstitution refers to the ability to create complex behaviour sequences in order to attain future goals.

Motor Control/Fluency/Syntax

Barkely (1997) analyzed that the above executive components are responsible to create a shift from external environment control to internal information control. The impairment of these executive components leads to inhibition of sensory input and motor behavior. This in turn leads to poor motor control, behavior control, adapt new information and goal directed behaviors.

II. METHODOLOGY

Different computerized databases were searched such as PsycINFO, Proquest, JSTOR Pubmed, Medline, Scopus database, Google scholar, published and unpublished research papers like dissertation and abstracts. The keywords used to look through the databases were discovered significant to ADHD, Executive Functioning, working memory, self-regulation and response inhibition. We utilized a sensitive, centred literature search technique. After casual survey of different titles, we limited analysis to 35 studies. After exterior review and exhortation, a further a few journals were added to widen the scope of the search. Journals representing education psychology, cognitive psychology, neuropsychology, child psychology and psychiatric were included. Studies with children, adolescents and adult were included in the study.
III. DISCUSSIONS

A comparative study among ADHD-P (Persistent), ADHD-R (Remittance) and ADHD-N (Non ADHD) children by evaluating executive functions, behaviour problems was conducted in different domains like family, school, social activities and risky activities. The researcher found that ADHD-P showed poor performance in all the executive functions when compared with ADHD-N (control group) whereas ADHD-R group showed poor performance only in planning and organizing skill when compared with ADHD-N group (Rosello et al 2020).

Kofler, Michael (2019) analyzed 83 studies that administered executive functioning measures with ADHD group (3734) and NON ADHD (2969) group. The result showed significant impairment in all the executive functioning with ADHD group. The author concluded that impairment in executive functioning is crucial factor of ADHD.

ADHD is a developmental disorder and Executive function develops hierarchically (with the growth of the children). A 4 year longitudinal study on executive function tasks was conducted with children with ADHD (age between 8 - 12 years) and again after 4 years when the same children were between 12 to 15 years and concluded the same (Tillman, Brocki, Sørensen, Lundervold 2015). Ferrer, Mateo and Begeny (2014) conducted study to check both the parents as well as teacher’s behavior rating measures of executive functions among 14 children with ADHD-PI (with inattentive), 16 combined ADHD (ADHD-CT) children and 13 control group using BRIEF Scale. The result in BRIEF Scale by both the parents showed impairment in executive function in both inattentive type and combined type than the children without ADHD. Children with ADHD of combined type showed more impairment then inattentive group. The result also showed that the impairment occurs in both home and school setting.
A study was conducted on ADHD with a sample size of 458 students, inclusive of ADHD students and control group. The researcher analysed the functional impairment and executive functioning problem prevail among the ADHD students. Students completed a questionnaire on ADHD related problems. The result showed that children with ADHD exhibit more functional impairment and executive functioning problem than the control group. Wood W.L (2013).

A study was conducted to analyse the difference in executive dysfunction with the ADHD-PI (Inattentive), ADHD-C (Combined) and the control group and it was found that there were significant variation between the two subtypes of ADHD and the control group in inhibition but there were no impact among ADHD-PI and ADHD-C (Walkowiak, Jenifer Lin 2008).

Pennington and Ozonoff (1996) in their review study found that ADHD children exhibited more weakness in Executive Functioning than the control groups.

The reason behind the inattention problem was explained by inhibition of executive function (Liza Berlin 2003). The researcher further found in her study that executive inhibition is highly associated with ADHD symptoms for boys in school and home context and only in school contexts for girls.

Impact of executive dysfunction

Gropper, Tannock (2009), conducted a pilot study to analyse the relationship of academic performance and the effective functioning with ADHD. A sample of 16 ADHD and 30 non ADHD groups were selected. Participants were requested to complete 2 visual and spatial working measures, 3 auditory and verbal working memory measures and 1 control executive functioning task. The students’ university grade points were also taken into consideration. The results showed the ADHD students were lagging in the visual tasks, auditory tasks and academic performance. The study concluded that the effect of ADHD in a student had direct impact in their academic performance and the working memory.

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The effective functioning impairment leads to poor academic performance which in turn mostly resulted in grade retention. This is an alarming issue as it affects the future of the child. (Biederman, Monuteaux, Doyle, Seidman, Wilens, Ferrero, F 2004). The researchers took a larger sample of children with ADHD and without ADHD and conducted a comparative study on the impacts of ADHD and executive dysfunction. The study revealed that the group with ADHD showed effective functioning impairment in a larger scale compared to the control group.

ADHD – Indian context

In the context of Indian school children, teachers generally have the preconceived notion that the learning disability in a child has a direct correlation with the behavioural issue of the child. However, a research was conducted in Mumbai, India on school going ADHD children having learning disability. The study concluded that there was a gap of average 5.8 years between identifying the behaviour and learning difficulties in the children and diagnosing them. This delay in observation could relate to the lack of knowledge on ADHD with the parents and teachers (Karande, satam, kulkarni, sholapurwala, shan, chitre (2007). Thus the awareness about ADHD is needed among teachers and parents.

Wilcox, Washburn, Patel (2007) conducted a study with the parents whose children are with ADHD. In understanding the awareness of the parents with respect to ADHD, studies show that, the parents initially concluded that their children had the academic problem due to the difficulty in learning and memory. However the parents understood that the academic problem was due to ADHD after the diagnosis with doctors. Wilcox, Washburn, Patel (2007) conducted a study with the parents of ADHD children and concluded the same.

The above studies bring to light the poor awareness of the Indian population about ADHD and its consequences. This may be due to the lack of research on ADHD and creating public awareness. Malhi & Singhi (2000)
confirmed that research on ADHD in India is still in emerging phase and also predicted that 5-10% of the general Indian population might be ADHD individuals.

ADHD-Executive functioning in Indian context

The neurocognitive Intervention program improved the attention and working memory and reduced problematic behaviour. Uma and Thenmozhi (2018) studied the impact of cognitive intervention on executive functions of 50 male ADHD children. The researcher gave neurocognitive Intervention Program for 45 minutes, 3 sessions per week for 22 weeks. The intervention had 4 modules in enhancing attention, working memory, planning and organizing and instrumental enrichment. The researchers concluded Neurocognitive treatment program as one of remedial measures of ADHD-Executive functioning.

A study was conducted by Ghafoor et al (2015) to evaluate the attention, psychomotor speed, response inhibition and set-shifting in ADHD children. The children showed high impairments in attention, however showed no significant impairments in executive function like response inhibition. The researcher concluded that the result of this study was due to smaller samples, as the samples taken for this study were only 16 children of 6 to 12 years old (8 children with ADHD and 8 children without ADHD).

Sinha, Sagar, and Mehta (2008), conducted a study on Executive dysfunction among Indian students with ADHD (30 children with ADHD and 30 non-ADHD children). The children were compared on executive functions measures like response inhibition, working memory, etc. The result showed that children with ADHD had considerable deficits in executive function measures. The study was concluded stating that deficit in executive functioning is the main factor of ADHD.

Researches on improving executive functioning

Computerized working memory training enhances the executive function in children with ADHD. Bigorra, Garolera, Guijarro , Hervás (2016) analysed the effect of computerized working memory training(CWMT) to enhance executive functioning among 7 to 12 years old, 66 ADHD-combined type children. The result showed a significant improvement in executive functions and ADHD symptoms after the training.

The frequency-neurofeedback and Cogmed working memory training are the other non-pharmacological interventions for treating ADHD children. A study was conducted to investigate the efficacy of cogmed working memory and neuro-feedback among 41 (8-15 years) children with ADHD. The result of the training however, did not show significant improvement in treating the children and the researcher suggested improvement were needed for both the methods (Van Boomsma , Vollebregt, Slaats-Willemse, Buitelaar (2015)

A study was conducted with 25 sessions of home based computer training for 89 children who were clinically diagnosed with ADHD, in an attempt to enhance short term and long term memory. The result showed improvement in visuospatial short term and long term memory (Dovis, Van der Oord, Wiers , Prins (2015).

Training on cognitive flexibility and working memory enhances executive function. The effect of executive function remediation training to enhance short and long term efficacy among 40 children (aged 8-12 years) through 25 sessions training on cognitive was revealed in this finding (Van der Oord , Ponsioen , Geurts , Ten Brink, Prins (2014)

Computer based cognitive training is one of the trainings to enhance attention, impulse control, social functioning, academic performance and reasoning skills. Rapport, Orban, Kofler, Friedman, (2013) in their meta-analytic review found improvement in short-term memory, but did not show improvement in attention and other measures like behavioural, cognitive and academics.

IV. CONCLUSION

ADHD is a childhood disorder. Barkley well explained the psychological aspects of the ADHD behaviour and many studies augment the theory with proven researches. Individuals with ADHD have impairments in cognitive functioning, attention and executive functioning (Beaumeister&Vohs, 2003; Mirsky& Duncan, 2001). Executive function is responsible for planning, organizing and cognitive functions. The samples considered by the researchers were children, adolescents and adults. In the western world, most of the studies support and prove Barkley’s theory of ADHD. Those studies reveal that impairment of executive functioning is highly associated with symptoms of ADHD. Dawson and Guare (2000) suggested that planful problem solving may be affected due to executive dysfunctioning.
In the Indian context, studies on executive functioning among ADHD are limited. Also the Indian studies concentrated only on children and not adolescents and adults. Recent researches in ADHD showed that ADHD symptoms may persist in adolescence as well as in adulthood (Barkley and Murphy, 1998). Hence, it is necessary to study with adolescents and adult samples. The lack of awareness on ADHD leads to delay in diagnosis (karande, 2007).

The intervention studies showed when proper training and intervention are given, there could be possible improvements in the memory and other executive functions, reduces symptoms of ADHD and reduces problematic behaviour.

REFERENCES

16. censes report (2020) retrieved from website https://censusindia.gov.in


