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A STUDY OF COGNITIVE EXECUTIVE FUNCTIONING IN ADOLESCENTS WITH MENTAL RETARDATION

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ABSTRACT

The present study was a hospital based cross sectional study to assess cognitive executive functioning in adolescents with Mental Retardation and to compare cognitive executive functioning between adolescents with Mental Retardation and normal controls. A sample of 20 adolescent patients with mental retardation who were matched on the basis of age and sex with normal controls. All the subjects were selected on the basis of inclusion and exclusion criteria, GHQ-12 was administered on normal sample as a screening tool for the presence of any psychiatric condition. Similarly, adolescent mentally retarded patients were confirmed by scoring less than 70 on I.Q assessment using WISC, VSMS, GDT and DDT. All subjects were tested on different measures of cognitive executive functioning like Trial Making Test, Stroop test, and Wisconsin Colour Sorting Test. Independent t- test was used to compare patient and normal controls with respect to their different continuous demographic variables. Chi-square was used in order to compare the discrete demographic variables between the two groups. Multivariate linear model was used to see the difference between the two groups on their different neruo-psychological measures, while controlling education variable statistically. Results revealed significant difference between the two groups in all measures of tests administered. There was significant difference between adolescents with mental retardation and normal controls with respect to cognitive executive functioning. Cognitive executive functioning was found to be impaired in adolescent with mental retardation.

KEYWORDS: Cognitive Executive Functioning, Mental Retardation, Adolescents

INTRODUCTION

Cognitive Executive Functioning (CEF) is an important concept in cognitive psychology that has rarely been studied in people with Mental Retardation. Cognitive Executive Functioning (CEF) refers to the set of abilities involved in planning, self monitoring and purposive action, which, it has been argued, are 'at the heart of all socially useful, personally enhancing, constructive and creative activities' (Lezak 1982). Executive function was first described as a ―central executive by Baddeley and Hitch (1974) and later defined by Lezak (1983) as the dimension of human behavior that deals with ―how behavior is expressed. Executive functions were conceptualized as having four components: The abilities of goal formation, planning, carrying out goal-directed plans, and effective performance. According to Lezak, these behaviors are all necessary for appropriate, socially responsible and effectively self-serving adult conduct. Lezak et al. (2004), As long as executive functions are intact, a person who has sustained considerable cognitive loss has better prognosis and can still continue to be independent and productive. Executive abilities are generally described as high-level cognitive functions believed to be mediated primarily by frontal lobes (Stuss et al. 2002). Luria (1973) identified the frontal lobes as

―the essential apparatus for organizing intellectual activity as a whole, including the programming of the intellectual act and the checking of its performance‖. He conceptualized what currently is referred as executive functions.

Collette et al. (2005) suggests that parietal areas seem to play a critical role during the performance of executive tasks, and that the executive system is not sub-served by the frontal lobe alone, as previously thought. In fact, the parietal areas proved to show more activation than frontal ones. The authors hypothesized that the reason for this lies in the prefrontal areas mediating processes more strategic in nature that are not used the same way by different individuals. In contrast, parietal areas are involved in more basic attentional processes needed for executive performance.

LITERATURE REVIEW

Cognitive Executive functioning (CEF) refers to the set of abilities involved in planning, self monitoring and purposive action, which, it has been argued, are 'at the heart of all socially useful, personally enhancing, constructive and creative activities' (Lezak 1982). constructive and creative activities' (Lezak 1982). Many cognitive processes underpin CEF, including response initiation, response inhibition, attention, working memory, set shifting and fluency (see e.g. Pennington & Ozonoff 1996; Manly & Robertson1997; Busch et al. 2005a; Rowe et al. 2006). Numerous neuropsychological tests purport to assess aspects of CEF, and a number of batteries have been developed that combine tests in order to sample several of these putative underlying processes: examples include the Behavioural Assessment of the Dysexecutive Syndrome (BADS: Wilson et al. 1996), the Delis–Kaplan Executive Function System (Delis et al. 2004) and the Complex Task Assessment System (Wolf et al. 2008).

The diversity of the concepts discussed in relation to CEF has stimulated debate over whether CEF can be considered as unitary (e.g. Duncan et al. 2000), or multidimensional (e.g. Andrez & van der Linden 2002), or something in between, involving a set of distinct processes with some over-arching coordination (e.g. Robbins et al. 1998; Miyake et al. 2000). There has been little investigation of CEF in people with Mental Retardation , and nothing is known about the extent to which CEF is a unitary or a multidimensional construct in this context. There is a small literature in some specific developmental disorders, such as Down syndrome (e.g. Das et al. 1995; Pennington et al. 2003; Rowe et al. 2006; Ball et al. 2008), Prader–Willi syndrome (e.g. Gross-Tsur et al. 2001; Walley & Donaldson 2005; Jauregi et al. 2007; Woodcock et al. 2009) and fragile X syndrome (e.g. Wilding et al. 2002; Cornish et al. 2009; Woodcock et al. 2009). With the notable exception of some of the studies in Down syndrome, these studies have typically used a narrow range of tests, targeted, often incidentally, at specific aspects of CEF, rather than a comprehensive test battery. When broader test batteries have been used (e.g. Pennington et al. 2003; Walley & Donaldson 2005; Rowe et al. 2006; Ball et al. 2008), these are never standardised across studies or directly comparable to the test batteries used with the general population.

Need For the Study

Neuropsychological constructs have been topic of interest among the clinical psychologists world wide. Researchers have found neuro-cognitive deficits and impairments among patients with Mental Retardation. Cognitive executive functions have been reported by some researchers as being impaired among adolescents with Mental Retardation. Keeping in mind the dearth of literature on Mental Retardation and lack of many such researches in India, the need for present study was felt. This study may prove to be a substantial contribution to the field of Clinical Psychology in understanding the Cognitive executive functioning of persons with Mental Retardation. This study may help us to appreciate the need and importance of guidance and psychological interventions for persons with Mental Retardation both at global level as well as at local level.This study may become a referent for the future researchers in this field.

OBJECTIVES

- To assess cognitive executive functioning in adolescents with Mental Retardation.
- To compare cognitive executive functioning between adolescents with Mental Retardation and normal controls (normal adolescents).

HYPOTHESIS

There will be significant difference in cognitive executive functioning between adolescents with Mental Retardation and normal controls.

METHODOLOGY

Design of Study

The present study was a cross sectional hospital based study. This study was conducted at Institute of Mental Health And Neurosciences Kashmir, Srinagar.

Sample

The present study was conducted on 20 children and adolescents with Mental Retardation. The criteria for the diagnosis were considered as per ICD-10 DCR (WHO, 1993). Clinical sample was taken from the OPD of Child and Adolescent Psychiatric Unit. Normal controls shall be taken from Elementary and High schools in Srinagar. Sample was collected by purposive sampling method.

Inclusion Criteria for Patient Population

- Adolescents who qualified for the diagnosis of Mental Retardation as per ICD-10 DCR.
- Adolescents included were in the age range between 11 to 16 years.
- Both the genders were included in the study.

Exclusion Criteria for Patient Population

- Patients who have any co-morbid psychiatric illnesses.
- Patients whose Mental Retardation is secondary due to any psychiatric illness.
- Any history of harmful use of any substance (other than caffeine).
- Any serious co-morbid medical condition.
- Patients who received ECT in past six months.

Inclusion Criteria for Normal Control Group

- Age between 11-16 years.
- Adolescents whose General Intelligence Quotient lies above 85.
- On General Health Questionnaire-12 who scored less than three.
- Appropriately matched socio-demographic parameters like sex and age for each individual patient.

Exclusion Criteria for Normal Control Group

- Personal history of any medical or psychiatric illness.
- On General Health Questionnair-12 scores more than three.

Test Materials to Be Used for Study

- Socio-demographic and Clinical Data Sheet.
- Malin's Intelligence Scale For Indian Children(MISIC), the Inaian adaptation of WISIC by Dr. Arthur J. Mallin.
- Vinland Social Maturity Scale (VSMS), enlarged edition(1992) by Dr. J. Bharat Raj.
- Denver Development Screening Test (DDST)
- General Health Questionnaire-12 (GHQ-12) (Goldberg and William, 1988).
- Trail Making Test (TMT) (Reitan & Wolfson, 1993).
- Stroop Colour Word Test (Golden & Freshwater, 1998).
- Wisconsin Card Sorting Tesst (WCST) (Heaton et al, 1993).

DESCRIPTION OF TOOLS

Socio-Demographic Data Sheet

This data sheet was specially prepared to serve the purpose of current study. This included all necessary demographic details and necessary clinical variable of patient like Case Record File number, age, sex, education, family history, age of onset, number of episodes, hospitalisation etc.

General Health Questionnaire-12 (Ghq-12)

This scale was first given by Goldberg and William (1988). GHQ-12 is a self administered screening test, which is sensitive to the presence of psychiatric disorders in individuals presenting in primary care settings and non psychiatric clinical settings. The original GHQ contains 60 items and a range of shortened versions of the questionnaire include GHQ-30, GHQ-28, GHQ-20 and GHQ-12. General Health Questionnaire majorly focuses on main areas, the ability to carry out normal and the appearance of new and distressing experiences. Thus the scale is administered to healthy controls to rule out any psychiatric problems. The validity of GHQ-12 was found to be 0.78 (Baksheev et al., 2011) and reliability was reported by one study to be 0.90 (Hankins, 2008).

Malin's Intelligence Scale for Indian Children (MISIC), the Indian Adaptation of WISIC by Dr. Arthur J. Mallin

The Mallin's Intelligence Scale for Children (WISC), originally developed by David Wechsler, is an Indian adaptation of it.It is an individually administered intelligence test for children between the ages of 6 and 16 inclusive that can be completed without reading or writing. The WISC takes 65–80 minutes to administer and generates an IQ score which represents a child's general cognitive ability.

The subtests are organized into Verbal and Performance scales, and provided scores for Verbal IQ (VIQ), Performance IQ (PIQ), and Full Scale IQ (FSIQ). In addition to the traditional VIQ, PIQ, and FSIQ scores, four new index scores are introduced to represent more narrow domains of cognitive function: the Verbal Comprehension Index (VCI), the Perceptual Organization Index (POI), the Freedom from Distractibility Index (FDI), and the Processing Speed Index (PSI).

Vinland Social Maturity Scale (VSMS), Enlarged Edition (1992) By Dr. J. Bharat Raj

This scale consist 89 items. The Vineland social maturity scale was originally devised by E. A.Doll in 1935 since then this test is being used in many parts of the country. this scale is not only providing social age and social quotient measures but also indicate the social deficits and social assets in a growing child. It is for age level from 0 to 15 years. It is good to locate mentally retarded.) This is an assessment scale of personal and social skills pertaining to individuals from birth to 18 years, 11 months (including low-functioning adults). This evaluation measures four domains of adaptability, including communication, daily living, socialization, and motor skills, through semi structured interviews administered to the primary caregiver.

Denver Development Screening Test (DDST)

The Denver Developmental Screening Test (DDST), commonly known as the Denver Scale, is a test for screening cognitive and behavioral problems in preschool children. It was developed by William K. Frankenburg and first introduced by him and Josiah.B. Dobbs in 1967. Tasks are grouped into four categories (social contact, fine motor skill, language, and gross motor skill) and include items such as smiles spontaneously (performed by 90% of three-month-olds), knocks two building blocks against each other (90% of 13-month-olds), speaks three words other than "mom" and "dad" (90% of 21-month-olds), or hops on one leg (90% of 5-year-olds).According to a study commissioned by the Public Health Agency of Canada, the DDST is the most widely used test for screening developmental problems in children. While this study acknowledges the test's utility for detecting severe developmental problems, the test has been criticized to be unreliable in predicting less severe or specific problems

Trail Making Test (TMT)

Trial Making Test is one of the best neuro-psychological tools and has been included in most of the neuro-psychological batteries. TMT provides information on visual search, scanning, speed of processing, mental flexibility and executive 25 Sustained attention and executive functioning in adolescents with mental retardation functions. Originally it was part of Army Individual Test Battery and subsequently it was incorporated into Halstead-Reitan Battery. This involves two sets of series of numbers, Trial A and Trail B. Trial A consists of 25 numbers and in Trial B there are series of alternating letters (A-L) and numbers (1-12). Subject is asked to connect those numbers as quickly as possible with committing errors. On both the trials time taken to complete them is used for analysis. Trial A is usually considered as the test for visual search and motor speed. While as Trial B is thought to be the test of higher cognitive skill for example mental flexibility. The difference between two trials i.e. Trail B- Trial A measures task switching ability. Lezak (1983) has found reliability of TMT A to be 0.98 and for trial B reliability was 0.67. Construct validity was calculated by using an object finding test and a hidden pattern test and the correlation was found to be 0.36 & 0.98.

Stroop Colour-Word Test

This test was first given by Stroop (1935) and is based on the Colour Word Interference Effect. This test is considered to measure cognitive inhibitory control. The subject has to inhibit his automatic word naming response and has to name the colour by which that word is written. There are different forms of Stroop test where directions are used instead of words. The original version this test had five colours but subsequently, it was reduced to three. The subjects are instructed to read the word page as quickly as they can in 45 seconds. Similarly scores on colour page and colour word page is obtained. In the colour word page, subject has to read the colour by which the word is written and not the word as such. This page is the actual measure of response inhibition which is the construct of executive functioning. The reliability of all the three subtests was found by Golden (1975b) to be 0.89, 0.84 and 0.73 respectively.

Wisconsin Card Sorting Test (WCST)

This test was first developed by Grant and Berg (1948). This test is to assess abstract reasoning ability and the ability to shift cognitive strategies in response to changing environmental stimuli. Thus WCST can be considered as a measure of 26 Sustained attention and executive functioning in adolescents with mental retardation executive functioning, requiring the ability to develop and maintain an appropriate problem solving strategy across changing stimulus conditions in order to achieve a future goal. Similar to other measures of executive functions, the WCST requires strategic planning, organised searching, utilizing environmental feedback to shift cognitive sets, directing behaviour toward achieving a goal, and modulating impulsive responding.

It consists of four stimulus cards and 128 response cards that depict figures of varying form, colours, and numbers. These four stimulus cards are placed before the subject and the client is then handed over a deck of 64 response cards and is instructed to match each consecutive cards from the deck with one of the four stimulus cards whichever he or she thinks matches with the stimulus card.

The client is told only whether each response is right or wrong and is never told the correct sorting principle. Once the client is made a specified number of consecutive correct matches to the initial sorting principle (usually to colour), the sorting principle is changed without any warning, requiring the client to use the examiners feedback to develop a new sorting strategy. The interscorer reliability of this test was found to be 0.93 for perseverative responses, 0.92 for perseverative errors and 0.88 for non perseverative errors by Axelrod et al. (1992).

The construct validity for the test was described by one study (Shute & Huertas, 1990). They found that perseverative responses (0.94), perseverative errors (0.95), non perseverative error (0.80), failure to maintain set (0.94), total number of errors (0.97) were best related to assessing executive functioning.

Procedure

Sample was selected from the outpatient department of Child and Adolescent psychiatric unit of Institute of Mental Health And Neurosciences Kashmir, Srinagar. Patients were screened by using MISIC, VSMS and DDST Informed consent was taken from the guardians. Different socio-demographic and clinical details were recorded in the respective response sheets. Similarly, normal controls were selected from the local schools and screened for I.Q and rated on GHQ-12 in addition to the fulfilment of other inclusion and exclusion criteria. Written informed consent was taken individually from guardians of children as well as from school authorities. Both patient and normal controls were tested on different neuro-psychological tools measuring cognitive executive functioning.

Statistics

After data collection was completed, hypothesis proposed were tested by using advanced version of SSPS 16.0 for Windows. Independent t- test was used to compare patient and normal controls with respect to their different continuous demographic variables. Chi-square was used in order to compare the discrete demographic variables between the two groups. Multivariate linear model was used to see the difference between the two groups on their different neruo-psychological measures, while controlling education variable statistically. All variable were considered significant at 0.05 levels

RESULTS AND INTERPRETATION

Socio-Demographic Characteristics

Table 1: Comparison of Socio-Demographic Profile between Adolescents With Mental Retardation and Matched Controls

Variables	Adolescents With Mental Retardation (N=20, %)	Controls (N=20, %)	X2 Value	Df	P
Gender					
Male	13 (65%)	13(65%)	0.00	1	1.00
Female	7(35%)	7 (35%)			
Economic Status					
Low	7 (35%)	4(20%)	4.80	2	0.09
Lower Middle	9(45%)	10(50%)			
Upper Middle	4(20%)	6(30%)			
Habitat					
Rural	14(70%)	3 (15%)	10.42	1	0.001**
Urban	6(30%)	17 (35%)			
Family Type					
Nuclear	12(60%)	15 (75%)	0.13	1	0.72
Joint	8(40%)	6 (25%)			

**** Significant at 0.01 level of significance**

Table 2: Comparison of Socio-Demographic Variables (Age and Education) between Adolescents with Mental Retardation and Matched Controls

Variables	Adolescents With Mental Retardation (N=20) Mean ± SD	Controls(N=20) Mean ± SD	T - Value	Df	P
Age (in years)	14.85 ± 1.04	14.85 ± 1.04	0.00	38	1.00
Education (in years)	7.60 ± 1.14	11.55 ± 1.23	-2.53	38	0.02*

*** Significant at 0.05 level of significance**

Table 1 and Table 2 describe the socio-demographic profile of the clinical sample and control subjects. Patient and control group consisted of 20 adolescents in each group . Total of 13 (65%) subjects were males in both the groups and the number of females were 7(35%) in both groups.

With respect to socio-economic status, 7 (35%) of patients were from low socio-economic status, 9 (45%) were lower middle and 4 (20%) were from higher middle economic status. Whereas 4 (20%) of controls were from low socio-economic status and 10(50%) from lower middle and 6 (30%) were from higher middle socio-economic status. A total of 14 (70%) patients were from Rural background and 6 (30%) were from Urban background. Among controls, 3 (15%) were Rural and 17 (85%) were from Urban background. 12 (60%) of patients came from nuclear families and 8 (40%) were from joint families and in case of control group, 15 (75%) subjects were from nuclear families and 5 (25%) come from joint families. There was no significant difference among patients and control group with respect to age, sex, economic status and family type, but there was significant difference in religion, education and habitat.

There was significant difference between two groups (patient and controls) with respect to their education. Education can have effect on the neuro-psychological test performances and thus was considered as a confounding variable. There was a need to attenuate the effects of education and thus education was statistically controlled. The mean age of experimental group was14.85 years with the standard deviation of 1.04. The mean education of patients was 7.60 years with the SD of 1.14 while as the mean education of control group was 11.55 with the SD of 1.23.

Clinical Characteristics

Table 3: Family History of Mental Illness in Adolescents with Mental Retardation

Family History of Mental Illness	Number (Percentage)
Yes	14(70%)
No	6 (30%)
Total	20 (100%)

Table 3 shows some of the clinical characteristics of patient population. Family history of mental illness was found to be in 14 (70%) of patients where as 6 (30%) had no family history of mental illness**.**

Neuro-Psychological Test Performances

Table 4: Comparison of Trail Making Test (TMT) Performances between Adolescents with Mental Retardation and Normal Controls

Variables	Patients(N=20) Mean ± SD	Controls(N=20) Mean ± SD	F Value	Df	P
TMT A	80.55 ± 21.96	34.40 ± 15.41	8.72	2	0.001**
TMT B	154.90 ± 67.46	78.20 ± 19.99	4.35	2	0.02*
TMT B-A	68.35 ± 59.58	46.35 ± 23.91	1.24	2	0.30 **

*** Significant at 0.05 level of significance**
**** Significant at 0.01 level of significance**

Table 4 shows Trail making test performances, patient group completed trails A in mean time of 80.55 seconds with the standard deviation of 21.96 and controls completed the same in mean time of 34.40 seconds (SD= 15.41). With respect to their Trail B performances patient group completed it in mean time of 154.90 seconds (SD= 67.46) and controls had better performances relatively (Mean= 78.20; SD= 19.99). The differences between Trial A and Trail B, patients had mean time score of 68.35 with the standard deviation of 59.58 while as control group had mean of 46.35 with the standard deviation of 23.91. Results showed that there was no significant difference between the patient and control group with respect to the scores of difference between the two trials. There was significant difference between the two groups with respect to their Trial A and Trial B performances.

Table 5: Comparison f Stroop Test Performances between Adolescents with Mental Retardation and Normal Controls

Variables	Patients (N=20) Mean ± SD	Controls(N=20) Mean ± SD	F Value	Df	P
Stroop Word Score	55.25 ± 16.71	86.95 ± 13.37	5.45	2	0.008**
Stroop Colour Score	35.10 ± 8.53	57.70 ± 13.12	9.04	2	0.001**
Stroop Colour Word Score	14.60 ± 6.39	32.65 ± 6.25	12.07	2	0.00**

**** Significant at 0.01 level of significance**

Table 5 shows the stroop test performances and patients mean Stroop Word score was found to be 55.25 with the standard deviation of 16.71 while as controls mean score was 86.95 with the SD of 13.37. Patients mean Stroop Colour score was 35.10 (SD= 8.53) and controls had mean of 57.70 (SD=13.12). The Stroop Colour Word score of patients had mean of 14.60 (SD= 6.39) and controls‘ mean score was 32.65 (SD= 6.25). Results show that patient group and control group differed significantly with respect to their Stroop test performances.

Table 6: Comparison of Wisconsin Card Sorting Test (WCST) Performances between Adolescents with Mental Retardation and Normal Controls

Variables	Patients(N=20) Mean ± SD	Controls(N=20) Mean ± SD	F Value	Df	P
WCST trials administered	145.95 ± 6.81	113.00 ± 17.90	4.79	2	0.014**
WCST total correct	90.70 ± 15.30	79.25 ± 9.70	2.44	2	0.101
WCST total errors	55.25 ± 18.11	33.75 ± 14.87	8.20	2	0.001**
WCST perseverative resp.	64.10 ± 24.70	20.95 ± 9.21	7.53	2	0.002**
WCST perseverative error	56.15 ± 18.25	18.90 ± 8.19	7.25	2	0.002**
WCST Non Perseverative error	39.10 ± 9.32	14.85 ± 7.94	1.21	2	0.31
WCST Conceptual level	74.50 ± 19.58	70.30 ± 12.95	4.49	2	0.018**
WCSTcategories complete	5.40 ± 1.60	4.90 ± 1.21	6.12	2	0.005**
WCST trials for first category	44.85 ± 33.3	17.00 ± 8.18	1.02	2	0.312
WCST Failure to Maintain set	3.65 ± 1.39	1.65 ± 1.42	0.00	2	1.00
WCST Learning to learn	-22.81 ± 13.95	-3.94 ± 7.25	3.81	2	0.031*

*** Significant at 0.05 level of significance**
**** Significant at 0.01 level of significance**

Table 6 shows Wisconsin Card Sorting test performances. The mean number of trials administered to complete the test was 145.95 (SD= 6.81) while as controls completed the test in mean trials of 113 with the standard deviation of 17.90. The mean total correct score was 90.70 (SD= 15.30) among patients and controls had mean of 79.25 (SD= 9.70). With respect to total errors committed on the test, patients had mean score of 75.25 (24.70) and controls had mean score of 33.75 with the standard deviation of 14.87. Mean score of Perseverative responses among patient group was 64.10 (SD= 24.70) and control group had mean value of 20.95 (SD= 9.21). Mental retardationadolescents had mean score of Perseverative errors equal to 56.15 (SD= 18.25) and Controls had mean of 18.90 (8.19). Mean score on non perseverative errors is 39.10 (SD= 9.32) for patients and for controls mean score was 14.85 (SD= 7.94). For patient group, the mean conceptual level score was 74.50 (SD= 19.58) and for controls mean value is 70.30 (SD= 12.95).

The mean number of categories completed by patients was 5.40 (SD= 1.60) and 4.90 was the mean value (SD= 1.21) for categories completed by controls. Patients took mean of 44.85 (SD= 33.3) trials to complete first category on WCST and controls took less trials to complete first category (Mean= 17.00; SD= 8.18). The mean value of failure to maintain set was 3.65 (SD= 1.39) for clinical population and for controls mean value was 1.65 (SD= 1.42). WCST mean score for learning to learn for patients was -22.81 (SD= 13.95) and for control group mean value was -3.94 (SD= 7.25). Results showed that there was significant difference between the adolescents with mental retardation and controls on different sub domains of WCST except WCST total correct responses, WCST non perseverative error score, WCST trials for first category and WCST Failure to Maintain set.

DISCUSSIONS

The present study was a hospital based cross sectional study to investigate the difference between adolescent with mental retardation and normal controls on cognitive functions like sustained attention and executive functioning. There are studies depicting that cognitive deficits are present in acute mental retardation (Martinez-Ara`n et al., 2004) and such deficits are present even in borderline intellectual functioning (Clark & Goodwin, 2004). Studies have indicated high heritability of Sustained attention and executive functions (Antila et al., 2007).

The study sample included 20 adolescent patients with mental retardation. All patients were selected after they were screened on the basis of inclusion and exclusion criteria .These patients were matched with normal controls on age and sex and were measured on different sustained attention and executive functioning tests. Age and sex has been considered as one of the confounding variables while assessing neuro-psychological constructs. Neuropsychological

functioning can be different among genders and is different across different age groups. Thus efforts were made to match the mentally retarded adolescents with normal controls on age and sex. Normal controls selected for the study were tested on GHQ-12 in order to assess their mental status. Also, those normal controls were selected who had no family history of mental retardation or any other psychiatric illness. Thereby, we tried to control the effects of genetic loadings for psychiatric illnesses on neuropsychological tests.

A socio-demographic data sheet was used for collecting the socio-demographic details of patients and normal group. For normal control group, their mental status was assessed by GHQ-12. Both the groups were measured on different measures of sustained attention and executive functions. Letter Cancellation Test (LCT) was used primarily as a measure of sustained attention and Total time, Commission and Omission scores were calculated (Lazak, 2004). Sustained attention is being measured by different version of Continuous Performance Task (CPT) in most of the studies (Anci'n et al., 2010) but in present study we used Letter Cancellation Test. This is simple to administer and easily understood by subjects. Trial Making Test (TMT), Stroop Colour Word Test, Wisconsin Card Sorting Test (WCST) were used to assess planning and organisation, problem solving, response inhibition, cognitive flexibility, conceptualisation, abstract reasoning, set shifting, processing speed, self monitoring, utilizing error feedback and rule abstraction. Trail Making Test (TMT) A & B were scored as total time to complete these trials and B-A was calculated as it is considered to provide information about task switching ability (Lazak, 2004). Wisconsin Card Sorting Test (WCST) is considered one of the best neuropsychological tools to assess frontal lobe functioning. This tool has been widely used in assessing executive functions of subjects.

All the patients were matched on age and sex with normal controls. Both the groups had mean age of (13.5, SD= 1.04) and total of 13(65%) were males out of 20 in each group. Thus the both groups had fewer females and naturally findings would not be equally representing both the sexes. This problem arose due to purposive sampling method selection. The two groups did not differed significantly in terms of their socio-economic status. Similarly, no difference was found between the two groups with respect to their family type.

Results revealed that there was significant difference between the two groups with respect to habitat. Most of patients 41 Sustained attention and executive functioning in adolescents with mental retardation were from rural background and majority of the controls were from urban background. Results also revealed that mean education (in years) of patients was 7.60 (SD= 1.14) whereas, normal controls had mean of 11.55 (SD= 1.23). Thus the two groups differed from each other significantly. It is usually difficult to match patients and normal controls on this variable as many patients lack behind in their education because of their active phases of illnesses (Saykin et al., 1991). Education may have substantial effects on performances on different neuropsychological tests. Thus education was found to be confounding variable as found in earlier studies (Chen et al., 1998; Hsieh et al., 2005; Anci'n et al., 2010). An effort was made to control the effects of education on neuropsychological test performances and was thus statistically controlled.

Results found that a significant number (14out of 20) of patients had family history of mental illness which gives us clue regarding the increased chances of mental retardationllness among those who have positive family history of mental retardation or other mental illnesses.Pavuluri et al. (2006) found that there was no difference between the medicated and unmedicated adolescents with respect to sustained attention, executive functioning, working memory and verbal memory. Similarly DelBello et al., (2004) found no association between errors of commission and medications used. Kumar et al. (2010) found no relation between sustained attention and family history of mental illness.

In this study cognitive executive functions were measured by Trial Making Test (TMT), Stroop Colour Word Test and Wisconsin Card Sorting Test (WCST). Adolescents with mental retardation had performed less well than normal controls. Adolescents with mental retardation had mean score of 80.55 (SD= 21.96) on TMT-A, whereas normal controls had mean of 34.40 (SD= 15.41). On Trial B, patients‘ mean score was 154.90 (SD= 67.46) and normal controls had mean of 78.20 (SD= 19.99). The difference of Trail B and Trial A lead to the mean score of 68.35 (SD= 59.58) in patient group and among normal controls, mean was 46.35 (SD= 23.91). Results showed significant difference between the two groups with respect to TMT Trial A and Trail B scores. Similar findings were found by researcher (Ferrier, 1999; Kolur, 2006; Normala, 2010) on adult patients and even on pediatric population (Pavuluri, 2006). Significant difference was found with respect to Trial B- 43 Sustained attention and executive functioning in adolescents with mental retardation. Trial a scores in the present study. Trial B-A score measures task switching ability but studies have not calculated this score. With respect to Stroop test, adolescents with mental retardation had mean Stroop word score of 55.25 (SD= 16.71) and that of normal control group mean score was 86.95 (SD= 13.37).

Similarly, patient group had mean colour score of 35.10 (SD= 8.53) and the mean Stroop colour score of normal controls was 57.70 (SD= 13.12). With respect to Stroop Colour Word Score, patients had mean of 14.60 with the Standard Deviation of 6.39 and mean score of normal controls was 32.65 (SD= 6.25). Results suggest that adolescents with mental retardation differed significantly on all the three Stroop test performances with normal controls. Thompson et al. (2005) confirmed present study findings that there was significant difference between adults and normal controls on Stroop test. Kolur (2006) found significant difference with respect to all the performances of Stroop test on adult population. Among adolescent population, Doyle (2005) did not found any significant difference with normal controls on Stroop Word score but found significant difference with respect to Stroop Colour Score and Stroop Colour Word Score. Impaired Stroop test performance was found in another test findings (Lera-Miguel et al., 2011) among pediatric patients.

Wisconsin Card Sorting Test performances differed significantly between the two groups. Patient group took mean total of 135.95 (SD= 6.81) trials to complete WCST. Whereas, normal controls took mean total of 113.00 (SD= 17.90) trials to complete WCST. Patient had mean total of 90.70 (SD= 15.30) correct responses and normal controls had mean total of 79.25 (SD= 9.70). Patients committed mean total of 75.25 (SD= 18.11) errors and normal controls committed mean total of 33.75 (SD= 14.87) errors on the test. Mean total of perseverative responses in patients was 64.10 (SD= 24.70) and in normal controls value was 20.95 (SD= 9.21). Patients committed more perseverative errors (Mean= 56.15, SD= 18.25) and normal controls had relatively less errors (Mean=18.90, SD= 8.19). With respect to non perseverative errors, patients (Mean=39.10, SD= 9.32) committed more errors than normal controls (Mean=14.85, SD= 7.94). Mean value on WCST conceptual level was 74.50 (SD= 19.58) in patients and 70.30 (SD= 12.95) in normal controls. Patients took more trials to complete first category (Mean= 44.85, SD= 33.3) than normal controls (Mean= 17.00, SD= 8.18). Mean score of failure to maintain set in patients was 3.65 (SD= 1.39) and mean score of normal controls was 1.65 (SD= 1.42). Learning to learn score was also less in patients (Mean= -22.81, SD= 13.95) than controls (Mean= -3.94, SD= 7.25).

Kolur (1999) found significant difference between adult mentally retarded and normal controls with respect to total categories completed and perseverative errors. Similar results were found by Trivedi (2006) on adult population. In another study (Oliveira, 2011 adults with showed significantly inferior performance compared to normal controls in number of tests administered total number of errors and number of categories completed. On Adolescent mental retarded subjects, Doyle (2005) found no significant difference on total categories completed, perseverative error and non perseverative error scores. Lera-Miguel (2011) found significant difference between adolescent mentally retarded subjects

and normal controls in WCST non perseverative errors and no significant difference was found on WCST perseverative errors.

Thus most of the facets of WCST, TMT, Stroop and LCT were significantly different between the two groups, with adolescents with mental retardationperforming significantly less well relatively. This suggests sustained attention and executive functioning deficits exist even in states in adolescents.

There is definitely relationship between mental retardation and cognitive dysfunctions but the real causality becomes difficult and only way left out is to assess temporal relationship between mood symptoms and cognitive functioning.

CONCLUSION AND CONCLUSIONS

The present study was a hospital based cross sectional study by including a sample of 20 adolescent patients with mental retardation who were matched on the basis of age and sex with normal controls.

All the subjects were selected on the basis of inclusion and exclusion criteria, GHQ-12 was administered on normal sample as a screening tool for the presence of any psychiatric condition. Similarly, adolescent mentally retarded patients were confirmed by scoring less than 70 on I.Q assessment using WISC, VSMS, GDT and DDT. All subjects were tested on different measures of cognitive executive functioning like Trial Making Test, Stroop test, and Wisconsin Colour Sorting Test.

Results revealed significant difference between the two was found in LCT Omission scores and trend towards significance was in Total time taken to complete the test.

Trial Making Test (TMT) performance was different between the two groups. Normal controls were significantly better performers on Trial A and Trial B than patients.

Stroop Colour Word Test results revealed that patients were significantly different from normal controls. Patient‘s performance was significantly poor in relation to normal controls with respect to Stroop Word Score, Stroop Colour Score and Stroop Colour Word Score.

There was significant difference between patients and normal controls with respect to Wisconsin Card Sorting Test (WCST) scores. Significant difference was in WCST trials administered, WCST total correct, WCST total errors, WCST perseverative responses, WCST perseverative errors, WCST conceptual level, WCST categories complete and WCST learning to learn.

There was significant difference between patients and normal controls in terms of their Trial B- Trial A score on Trial Making Test (TMT).

On WCST, there was significant difference between two groups with respect to WCST total correct, WCST non perseverative errors, WCST trials for first category and WCST failure to maintain set.

CONCLUSIONS

There was significant difference between adolescents with mental retardation and normal controls with respect to cognitive executive functioning.

Cognitive executive functioning was found to be impaired in adolescent with mental retardation.

FUTURE DIRECTIONS

- Future studies should increase the sample size so that results could be better generalized.
- Gender difference should be minimised and results should represent both the gender fairly equally.
- Patient group should be compared with normal controls by matching as much demographic variables as possible.
- Effects of other variables like number and kind of hospitalisation, family history of mental illness and effects of medications should be statistically assessed.
- More than one test should be used to measure any neuropsychological construct and more standardised measure should be used.
- Study design selected should include prospective or longitudinal one rather than cross sectional.

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