CHAPTER 3
METHODOLOGY

Design

In any discipline whether it is social science, science or commerce, to find out the solution of the problems, methodology plays a leading role in carrying out the research study systematically and objectively. Research as defined by Redman and Mory, (1923) is “a systematized effort to find out the solution of the problem.” These efforts require certain method to be followed properly. Methodology in total sum of these steps / techniques being carried out by researches in order to find out the real dynamics operating for any problem and behavioral outcome. Mounton and Marais, (1993) defined methodology as “the logic of application of scientific methods to the investigation of the phenomena.” It is kind of decision making process in which researcher has to select appropriate problem, sampling techniques, measuring instruments, and data analysis method suitable for selected problem. The objectivity of scientific investigation is contingent upon the accuracy of research methodology adopted by the researcher. So, for any research work the methodology part is very important because the sound foundation of research is depends on it sound methodology objectivity in any research cannot be obtained unless it is carried out in a very systematic and planed manner. Methodology refers to systematic research and planning. Scientific investigation involves careful and proper adaptation of research design, use of standardized tools and tests, sampling techniques, sound procedure for collecting data, its careful study and tabulation and then, finally application of appropriate statistical tests. These steps basically enhance the predictive value of findings, thus, the findings may be generalized to predict the behavior of population from which the sample has been drawn.

To achieve the objectives of the study a multi group design was used. There were three experimental groups out of the diagnosed cases of ADHD. These were inattentive, hyperactive-impulsive and combined types of cases of ADHD. The fourth group was the control group of normal children matched on certain factors.

Sample

The sample of the study was consisted of 120 boys in the age range of 7 years to 13 years. 30 boys in each of the three ADHD type groups i.e. inattentive, hyperactive-impulsive
and combined type were taken. Only psychiatrically diagnosed cases were included in each of the above three groups. The ADHD boys having comorbid problem were excluded. A matched control group (matched on age, education, SES and area of residence), having thirty boys was also included. The mean age of the children included in the inattentive group was 9.14 (SD= 2.88) years and it was 9.17 (SD=2.00) and 8.54 (SD= 1.88) years respectively of the hyperactive-impulsive and combined subtype groups of ADHD children. In case of the control group the mean age was 9.06 (SD= 1.26) years. All the children included in the sample were diagnosed cases, taken from the Pediatrics outpatient department of PGIMS Rohtak and that from the private psychiatric nursing homes located at Rohtak, Haryana (India).

**Tools**

The following tools were used for the present study:

**Finger Tapping Test (Spreen and Strauss, 1998)**

Finger Tapping Test (Spreen and Strauss, 1998) was used to assess motor speed. This test has been found to be sensitive to the presence and laterality of brain lesion (Bigler & Tucker, 1981). Given the crossed nature of the motor system, performance tends to be worse in the hand contra lateral to the lesion (Bornstein, 1985). The material required is finger tapping instrument and a stop watch. Finger Tapping Test consists of an especially adopted electric finger-tapping instrument. This instrument comprises of a platform with a mounting key to be tapped and a monitor to read the number of taps. The subject is asked to tap the mounting key as rapidly as possible using the index finger of the preferred hand. A comparable set of measurements is then obtained with the non-preferred hand. The subject is given five consecutive trials of 10 seconds each with preferred and non-preferred hand. Fatigue may affect performance, so a brief rest period of 30 seconds is given after the 3rd trial. A practice trial is given before the test begins. Finalyson and Reitan, (1976) gave normative data for right-handed boys and girls in the age range of 6 to 14 years. Reliability coefficients range from .58 to .93 reported with both normal and neurologically impaired adult subjects (Ruff & Parker, 1993).

The subject is seated facing the finger-tapping instrument. The examiner is required to be ready with the stopwatch and following instructions are given: “This is a tapping instrument. I want you to tap the key as fast as you can. Rest your hand on the table and move only your index finger not the whole hand or arm. Start when I say start and stop when I say
stop.” Then say ‘start’. Allow the subject to tap for a few seconds and say ‘stop’. After this practice trial gives the following instructions: ‘Now, I want you to tap with your right hand as fast as you can. Remember, rest your hand on the table and move only your index finger not the whole hand or arm. Start when I say start and stop when I say stop’. The examiner should start the stopwatch immediately after giving the instructions. Photograph of the finer tapping test is given in Appendix-A.

Number of taps for each of the 10 second trials is recorded. Number of taps for each of the five trials for right hand and each of the five trials for left hand are recorded separately. The mean number of taps on five consecutive trials comprises the score for each hand separately.

**Color Cancellation Test (Kapur, 1974)**

Color Cancellation Test (Kapur, 1974) was used to measure sustained attention. It is also a measure of accurate visual scanning and activation and inhibition of a rapid response. More number of omissions reflects poor visual scanning and poor selective attention. More number of commissions reflects problems in inhibition of a rapid response. The material required is color cancellation sheet, pencil and stop watch.

The subject is presented with a sheet having 150 circles in 5 different colors i.e., red, yellow, blue, black, and gray. Subject is required to cancel only the red and yellow circles as fast as possible. Time taken to complete the test is recorded and errors of omissions and commissions are noted. (A copy of the Color Cancellation Sheet is given in Appendix ‘B’)

The child before the start of the test is to be instructed by saying that, “this is a sheet having circles in 5 different colors. I want you to cancel only the red and yellow circles in the whole sheet as fast as you can”. The color chart is given in appendix ‘B’. Time taken in seconds and errors of omission and commission comprise the score.

**FAS Phonemic Fluency Test (Lezak, 1995)**

FAS Phonemic Fluency Test was used to measure verbal fluency. This test evaluates spontaneous production of words beginning with a given letter within a limited time. Deficits in verbal fluency have been found to be more in left frontal damage (70%) compared to right frontal damage (38%)(Benton, 1968). An FMRI study of brain activity during a verbal fluency task i.e., FAS Phonemic Fluency Test showed activation in left prefrontal and right cerebellar areas (Schlosser et al., 1998). The test- retest reliability of the FAS test in 8 yrs old children is
reported to be .54. Concurrent validity has also been established indicating better validity for letter fluency than for category fluency (Lezak, 1995).

The subject is asked to produce orally as many words as possible beginning with a given letter F, A, and then S. The subject should not give proper nouns. One minute is given for each letter. Words produced for each letter are noted on the record form. For children studying in Kannada medium letters ‘Ka’, ‘Pa’ and ‘Ma’ can be given instead of F, A and S and same can be given in Hindi. Before the start of the test the following instructions are given: “I will say a letter. I want you to give me as many words that begin with that letter as quickly as you can. You have one minute for this. Do not give the same word again with a different ending i.e., someone, somewhere etc. Do not give proper nouns. Do not give numbers, names of places and people. Likewise I’ll be giving three letters one by one. Begin as I say the first letter. The first letter is ‘F’ go ahead”. One minute is allowed for each letter. Words produced are noted down in the order produced. Wrong words, variations of the same word, names, and repetitions are not scored as correct (Lezak, 1995). The test is given in appendix ‘C’. A sum of all admissible words for the three letters comprises the score.

**N back Task (Smith & Jonides, 1995)**

N back task (verbal) was used as a measure of verbal working memory. Development of working memory proceeds dimensionally, starting with refinement of basic perceptual and sensorimotor functions and culminating with the physiological maturation of widespread neural networks that integrate complex processing demands inherent to working memory tasks. N back task has been used to assess verbal working memory. PET studies have revealed two major sites of activation in the N back task particularly the ‘2 back’ verbal working memory task: Activation is observed in the posterior parietal cortex in the left hemisphere which is thought to be responsible for storage of verbal material. The sites of activations are a trio of locations in the prefrontal cortex: These are in the inferior frontal gyrus, posterior to this in premotor cortex, and in the supplementary motor area. These activations primarily mediate the production of internal speech code required for rehearsal (Smith & Jonides, 1995). The material required is list of phonemes and record form.

Verbal working memory has three important components i.e. storage, manipulation of information and rehearsal. N back Task is based on the theoretical premise that two variables can affect verbal working memory i.e. word length and phonemic similarity. It consists of a ‘1
back task’ and a ‘2 back task’. The ‘1 back task’ consist of a list of phonemic is kept out of the subject’s view. Each phoneme is presented at the rate of one phoneme per second. The subject is required to respond in terms of yes and no for phonetically similar and dissimilar sounds respectively. The subject has to say ‘yes’ for each consecutively repeated sound and for the other sounds the response is ‘no’. In the ‘2 back task’ as each sound is presented the subject as to decide whether or not it matched the sound that appeared to items back in the sequence and if so the subject has to respond in terms of yes or no. In this condition the subject must always maintain representations of the two most recent sounds in memory to compare with the current one. (The list of phonemes for 1 back and 2 back task is given in Appendix ‘D’).

The following instructions are given for 1 back and 2 back task:

1 back task: “I will be reading out a list of sounds such as ga, na, ja. As each sound appears, you have to decide whether or not it matched the sound that appeared just before the present sound. If so, I want you to say ‘otherwise say no’. Listen carefully.”

2 Back task: “Again, I will be reading out sound such as ga, ma, pa. As each sound appears you have to decide whether it matched the sound that appeared to items/sounds back in the sequence. I want you to say ‘yes’ if it is so otherwise say ‘no’.

The N back task (verbal) obtains 2 scores. One score is called a ‘hit’ that is the number of correct responses. The other score is called misses that is scored when the subject has missed a correct target and said ‘no’ or a phoneme when he should have said ‘yes’. Each of the two scores are obtained separately for the ‘1 back’ and ‘2 back’ tasks.

**Picture Completion Test (Malin, 1969)**

Picture completion test was used as a measure of visuo conceptual ability, visual organization and visuo-conceptual reasoning. Picture completion test has been found to be vulnerable to decreased visual acuity. It requires organizations and reasoning ability. This test involves judgment about practical and conceptual relevancies. It also elicits concrete thinking (Lezak, 1995). The material required for the test is 20 cards with incomplete picture and record form.

Picture completion test is a subtest in Weschler’s Intelligence Scale (WISC-R) for children. The picture completion test included in the present battery has been taken from Malin’s Intelligence Scale for children (Malin, 1969), and Indian adaptation of WISC. Picture completion test consists of 20 cards, each of which has incomplete pictures of human features,
familiar objects or scenes arranged in order of difficulty. The examiner presents each card for 15 seconds. The subject is required to point out the missing part in each card as it is presented. Test is discontinued after for consecutive failure (picture completion test can be obtained from the publishers of this test).

The following instructions are to be given before the start of the test: the examiner should present one card at a time to the subject. Each card should be presented for 15 seconds. “I will be presenting some cards to you one by one. Each card has a picture on it i.e, picture of human features, familiar objects or scenes. I want you to look carefully and point out the missing part in each of these cards”. Number of correct responses comprises the raw score. The scoring chart is appended at appendix-‘E’.

Procedure

Only those children diagnosed as having ADHD as per DSM-IV TR (APA, 2000) criteria were taken in the patient group and normal children matched for age and demographic factors were taken in to the control group. First of all children diagnosed with ADHD were selected to be included in one of the three groups viz .inattentive, hyperactive-impulsive and combined types of ADHD. A matched control group of children was also taken. The participants were selected only on the basis of availability from outpatient department of Paediatrics department of PGIMS, Rohtak and from the psychiatric nursing homes of Rohtak. Those children whose parents / attendants gave the consent (after duly informed) for the testing were included in the study. After this the test were administered to them one by one. Considering the problems of these children the testing time was flexible in the sense that rest pauses were given as and when dimmer appropriate.

Scoring & Statistical Analysis

Scoring was done as per standard scoring procedure prescribed in the manual. The obtained data were analyzed with the help of suitable statistical techniques. Simple ANOVA was done for the comparison of performance of different group comparison Duncan’s post hoc test was also done wherever required. For comparing the groups the mean scores were also displayed graphically in the form of figures.