

## **A Study of Cognition in Relation with Hand Dominance**

**Chaudhary<sup>1</sup>, S., Narkeesh<sup>2</sup>, A. and Gupta<sup>3</sup>, N.**

<sup>1</sup>MPT student, S.B.S.P.G.I., Balawala, Dehradun, Uttaranchal, India

<sup>2</sup>Reader, Department of Physiotherapy, Punjabi University, Patiala-147002, Punjab, India.

<sup>3</sup>Lecturer, Department of Physiotherapy, S.B.S.P.G.I., Balawala, Dehradun, Uttaranchal, India

### **Abstract**

This was an experimental study done on 60 female subjects between the age group of 18-25 years to determine the effect of hand dominance on cognition. The subjects were selected through convenient sampling by using inclusion and exclusion criteria and were divided in two groups viz - Group A (comprising of right handed individuals) and Group-B (comprising of left handed individuals). Both the groups were assessed for their cognitive functions i.e. attention, memory and learning using Trail Making Test, modified MMSE and VAK learning questionnaire. Data was analyzed using independent 't' test and descriptive statistics. The left handers were found to be better in performing memory and attention tasks as compared to the right handers. Majority of left handers were found to have auditory learning style while majority of right handers were found to have visual learning styles.

**Keywords: Hand Dominance, Cognitive Functions, Attention, Memory, Learning**

### **Introduction**

Cognitive processes are generally defined as the abilities that enable us to "think" which includes the ability to concentrate (pay attention), remember and learn. It is the method used by the central nervous system to process information and includes knowing, understanding and awareness (*Shimoda, 2008*). Assessment of cognition is the important component under physical examination of patient which includes assessment of memory, orientation and ability to assimilate and manipulate information. Because persons with cognitive deficit often cannot recognize their own impairments, cognitive intervention is being increasingly used for the treatment of many neurological conditions like Parkinson's disease, traumatic head injury, and stroke (*Peter & Durdging, 1979*). The cognitive intervention focuses on modification of individual thoughts and feelings, through examination of cognition that arises in response to

stressors. Complete understanding of cognition is important for planning effective treatment in patients with brain damaged due to various neurological insults like stroke and head injury. Various factors like age, gender, pregnancy, handedness, and systemic diseases like diabetes, hypertension etc are reported to affect patient cognition. *Naugels et al (1998)* stated that left hand dominant individuals are more prevalent among the patients suffering from dementia of Alzheimer disease which begins prior to the age of 65 as compared to right hand dominant individuals. The premotor area of cerebral cortex is involved with the control of hand movements and it is larger in left side of right handed individuals than in the left handed individuals (*Alexander, 1998*). Studies have found that the left hemisphere is important for language, logical decision making, in performing analytical task, mathematical calculation and performing fine motor skills (*Ferrari,*

2007). Each of the two cerebral hemispheres is responsible for specific functions that are not ordinarily performed by opposite hemisphere. The regional specialization is called as hemispheric lateralization (Simon, 1988).

Hand dominance has been a topic of investigation since so many years but the studies showing its influence over cognition are scarce. Thus, this study attempts to find out the effect of hand dominance on components of cognition like learning, attention and memory.

**Material and Methods**

Four hundred female subjects between the age group of 18-25 years from SBSPGI, Balawala, Dehradun were selected through convenient sampling by using inclusion and exclusion criteria. Experimental design finally consisted of 60 subjects (females) of age group 18 to 25 years and the subjects were allocated in two groups on the basis of their hand dominance for the study. Each group consisted of 30 subjects. Group A comprised of right handed and Group B of left handed subjects.

This study was an experimental study based on the comparison of cognitive functions (learning, attention, memory) in right and left handed individuals who were given Trail Making Test for assessing their attention and VAK (Visual, Auditory, Kinesthetic) learning style questionnaire for assessing their learning style and Modified Mini Mental Status Examination (MMSE) for assessing their memory.

Firstly attention of both groups were assessed by using Trail Making Test and then memory of both groups were assessed by using MMSE scale and lastly learning styles were assessed through

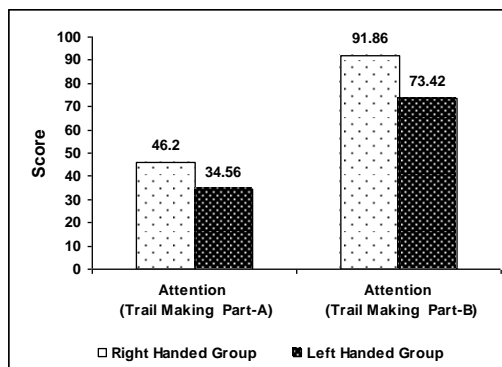
VAK learning questionnaire. Time for completing the attention task for Group-A and Group-B were noted. The score and duration of completing memory task were recorded and lastly learning style was assessed on the basis of number of maximum option as a, b, c. The values of both groups were compared through independent sample t test and descriptive statistics.

The data was analyzed by using SPSS version 11 software.

**Results & Discussion**

**Table-1: Mean and SD of Group-A and Group-B for their Trail Making Test**

Group	Attention (Trail Making Part-A)		Attention (Trail Making Part-B)	
	Mean	SD	Mean	SD
A	46.20	9.72	91.86	27.89
B	34.56	8.78	73.42	15.33
Unpaired t test	t = 4.87, p = 0.001		t =3.17, p =0.002	



**Figure 1: Comparison of Attention task scores between the right and left handed groups**

Table 1 & figure 1 compares the mean attention scores among right and left handed groups of females for Trail Making Test. The results showed that left handed individuals (Group B) took less time to complete the trail making test as compared to right handed individuals (Group A) in our study. Williams et al

(1985) and Paolo et al (1998) revealed in their study that corpus callosum, the main fiber tract connecting the two cerebral hemispheres, was larger by about 0.75 square centimeters, or 11 percent, in left-handed and ambidextrous people than in those with consistent right-handers which he believed played an important role in hemispheric integration. That may be one of the reasons why left handed individuals were found to be more attentive as compared to the right handed counterparts.

Table-2: Mean and SD of Group-A and Group-B for their memory (scores) and duration

Group	Memory Score		Memory - Duration	
	Mean	SD	Mean	SD
A	82.66	8.09	229.66	35.18
B	89.50	5.04	208.66	30.78
Unpaired t test	t = -3.93, p = 0.001		t =2.49, p =0.016	

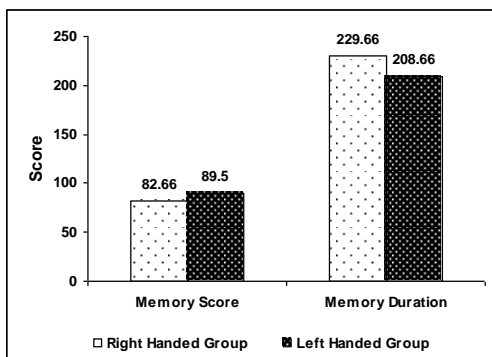


Figure 2: Comparison of Memory scores and Memory Duration between the right and left handed groups

Table 2 & figure 2 compares the mean Memory scores and duration among the right and the left handed groups of females. Left handers scored more in memory scale and they took less time to complete the task as compared to right handers in our study. This is in agreement with the similar findings of the study reported by Marzi (1988). He stated that superior episodic memory is associated with inter-hemispheric processing which

is stronger in left handed individuals. These findings were also supported by another study done by Toga & Thomson (2003) who stated that the anatomical connectivity of the anterior temporal and inferior frontal lobe is thought to be more highly developed in left handed individuals Tan (1988).

TABLE-3: Comparison of learning styles in both the groups

Groups	Auditory	Visual	Kinesthetic
Group-A	73%	20%	6.7%
Group-B	36.7%	43.3%	20%

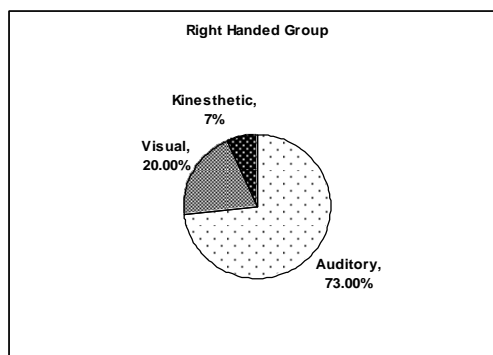


Figure 3: Comparison of learning styles in the right handed group of females

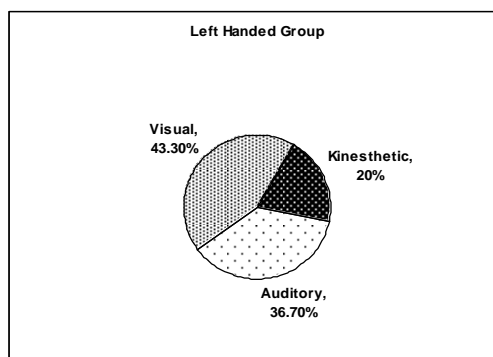


Figure 4: Comparison of learning styles in the left handed group of females

Table 3 and figures 3 & 4 compare the mean scores in the various learning styles among the right and the left handed groups of females. Majority of the right handed individuals were found to

have auditory learning style while majority of the left handed individuals had visual learning style. The physiological reason for the difference in their learning style may be ascribed to the differences in the processing of the information through right and left hemisphere or in combination as reported by *Volkman et al (1998)* and *Ali (2006)*. They concluded in their studies that learning styles were found to be associated with brain hemi-sphericity.

It was concluded from the present study that the left handers were better in performing attention and memory tasks as compared to the right handed individuals. This finding may be explained by the fact that broader and deeper connections exist between the two hemispheres of the left handlers as compared to the right handlers. Differences in learning styles were also observed among the right and the left handed individuals in the present study.

On the basis of these results, it may be concluded that handedness has an important impact on cognition. The study thus provides an important contributing tool for setting the treatment goal and planning strategies for the treatment of the patients.

## References:

- Alexander 1998. Hand dominance and motor unit firing behaviour. *Journal of Neurophysiology*. 1373-1382.
- Ali, R. M. 2006. *Journal of Neuropsychologia* University Sains Malaysia. **112**: 995-998
- Ferrari, M. 2007. Genetic performance and left handedness comparative analysis in adults with seizures, physical, psychological and learning disorder in rehabilitation setting. *Journal of Rehabilitation*. **8(4)**: 297-306.
- Marzi, C, A. 1988. Left hemisphere superiority for visuospatial functions in left handers. *Behaviour and Brain Sciences*. **30(2)**: 183-192.
- Naugles, R.I., Cullum C, Braddom, D. 1998. Handedness and Dementia. School of Medicine, University of California, and Diego. 1145-1152
- Paolo, V., Daniela, P., Franco G., Valetino, B., Ferruccio F. 1998. Hemispheric asymmetries and bimanual asynchrony in left and right hander, *Experimental Brain Research*, **120**: 531-53
- Peter, M. and Durdig, B.M. 1979. Footedness of left and right handers. *American Journal of Psychol*, **92(1)**: 133-42
- Shimoda 2008. Cerebral laterality differences in handedness: A mental rotation study with NIRS” *Journal of Neurosciences*. **430(1)**: 43-7.
- Simon J.E. 1988. Hand preference in a normal population. *Cortex*. **24**:157-163
- Tan, U. 1988. The relationship between nonverbal intelligence, familial sinistrality and geshwind score in right handed female subjects. *Neuropsychologia*. **43(3-4)**: 177-182
- Toga, A. and Thompson, P.M. 2003. Mapping brain asymmetry. *Journal of Neurosciences*. **4**: 37-48.
- Volkman, J.A., Schnitzler, O. and Witte, W. 1998. Handedness and asymmetry of hand representation in human motor cortex. *Journal of Neurophysiology*. **79(4)**: 2149-2154.
- William, R., Collis, S. Witelson, F. 1985. The brain connection - the corpus callosum is larger in left handers. *Journal of Neurosciences*. **229**: 665.