



## “COMPARISON OF WORKING MEMORY BETWEEN MALE AND FEMALE STUDENTS OF 1ST YEAR MBBS IN NAGPUR”

### Physiology

**Dr. Rajratna N. Ramteke**

Assistant Professor, Deptt. of Physiology, Govt. Medical College, Nagpur.

**Dr. Manoj Jiwtode**

Associate Professor, Deptt. of Physiology, Govt. Medical College, Nagpur.

**Dr. Mrs. Neelam V. Mishra**

Professor and Head, Deptt. of Physiology, Govt. Medical College, Nagpur.

### ABSTRACT

**Background:** There is a need to study how males and females make use of working memory.

**Aim & objectives:** To study existence of any difference in Working Memory between male and female students of 1st year MBBS using N-Back Test.

**Methodology:** Study participants were 100 {50(50%) male & 50(50%) female} first year M.B.B.S. students. They were administered Dual N-Back Test. The responses were tallied and assessed for to compare their working memory.

**Results:** Females performed better as compared to males when their working memory was assessed using the Dual N-Back test. However this difference was not statistically significant.

**Conclusion:** The result of this present study suggests that there are no significant differences in working memory between males and females in the studied population.

### KEYWORDS

Working memory, Dual N-Back Test.

### INTRODUCTION

Working memory (WM) is defined as “a temporary storage system under attentional control that underpins our capacity for complex thought” (Baddeley, 2007). It is a major component of cognition.<sup>1</sup> Working memory is used in everyday, cognitive tasks such as reading a newspaper article, calculating the appropriate amount to tip in a restaurant, mentally rearranging furniture in ones living room to create space for a new sofa and comparing and contrasting various attributes of different apartments to decide which to rent often involving multiple steps with intermediate task results that need to be kept in mind temporarily to accomplish the task at hand successfully.<sup>2</sup> Working memory plays a key role in complex behaviors like reading comprehension, acquisition of language and fluid abilities (allows people to think and reason abstractly in novel situations). Working Memory is important clinically as it is impaired in a wide variety of neuropsychiatric conditions like Dementia, ADHD, and Schizophrenia. Its importance is noted across areas of psychology, like clinical psychologists have studied relationship of WM to deficits in schizophrenia and depression. Neuropsychologists have studied WM ability to identify the early onset of Alzheimer's disease.<sup>3</sup> Physiologically the working memory is managed by the central executive and divided into three main sub-systems, which are: phonological loop, visuo-spatial layout and the episodic buffer. The central executive is involved with the development of strategies that provide increased storage capacity of the sub-systems subordinated to it. It is related to more complex cognitive activities, being able to regularize, process, store and control the flow of information to the phonological loop and the visuo-spatial sketchpad. The central executive is also responsible for directing attention to relevant information, coordinating cognitive processes when more than one task must be performed at the same instance. The phonological loop is responsible for the processing of linguistic materials. The visual-spatial scheme involves especially the inferior parietal lobe and right dorsal visual cortex and is responsible for the temporary storage of visual and spatial information and assisting in activities such as: recognition of the way and the face of a known person. The episodic buffer is the third subsystem that compose the model of working memory, and a system that retrieves information from long-term memory, make it aware and allows to relate to phonological and visual space information, from the external environment.<sup>4</sup> In the laboratory setting, functioning of Working Memory is measured using The N-back test. This test has been referred to as the gold standard of working memory measures in the field of cognitive neuroscience. Recently it was used to examine WM function in neurological settings with brain injury patients, in the aging population, and to study focal attention.<sup>5</sup> Previous studies undertaken to study differences in working memory

between males and females have reported varied results.

### AIM AND OBJECTIVE:

To study existence of any difference in Working Memory between male and female students of 1<sup>st</sup> year MBBS using N-Back Test.

### METHODOLOGY:

- **Study Design:** A Cross-sectional Study.
- **Study Setting:** A tertiary care hospital and teaching institute.
- **Study Participants:** 1<sup>st</sup> year MBBS students
- **Sample Size:** 100 subjects (50 males and 50 females)
- **Inclusion Criteria:** all 1st year MBBS Students with Body mass index  $18.5 \geq \text{BMI} \leq 25 \text{kg/m}^2$ , Normotensive (systolic blood pressure  $\leq 140 \text{mmHg}$ , diastolic blood pressure  $\leq 90 \text{mmHg}$ ) and with good health status,
- **Exclusion criteria:** students with history of mental health disease in family, use of alcohol, tobacco, psychoactive substances, any sickness and use of any medication like sedatives and hypnotics.

Data was collected from consenting students fulfilling criteria (as determined by a questionnaire and physical examination). It involved personal information, anthropometric measurements, general examination and systemic examination. One Hundred (100) students consisting of 50 males and 50 females were then administered the Dual 2-back test. The data obtained was analysed statistically. Continuous variables like age, BMI, Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) were presented as Mean  $\pm$  Standard Deviation (S.D.). N-back Test scores between males and females were compared by applying paired t-test. Data obtained was analyzed statistically by the 'p' value; p-value < 0.05 was considered as significant, p-value > 0.001 were taken as highly significant and p-value > 0.05 considered as non-significant.

### RESULTS

**Table 1: Mean  $\pm$  SEM of Baseline Assessment and Characteristics of Subjects**

	Male (N=50)	Female (N=50)	p-value
Age (years)	18.42 $\pm$ 0.08127	18.24 $\pm$ 0.06101	Non significant
BMI (kg/m <sup>2</sup> )	20.68 $\pm$ 0.2737	20.73 $\pm$ 0.3651	Non significant
Systolic BP (mmHg)	112.42 $\pm$ 6.0124	110.56 $\pm$ 6.826	Non significant
Diastolic BP (mmHg)	76.56 $\pm$ 4.1238	72.42 $\pm$ 5.3642	Non significant
Pulse Rate	78.42 $\pm$ 2.8126	76.38 $\pm$ 2.0274	Non significant

Table 1 shows that when compared, there was no statistically

significant difference ( $p>0.05$ ) in all base line assessment and characteristics between the males and females.

**Table 2: Mean  $\pm$  SEM of N-Back Test scores of Subjects**

	Male (N=50)	Female (N=50)	p-value
<b>N-Back Test Score (%)</b>	50.35 $\pm$ 2.059	54.45 $\pm$ 2.364	0.1933

Table 2 shows that there was no statistically significant difference ( $p>0.05$ ) in the working memory assessed between the males and females using the N-back test score.

## DISCUSSION

Working memory is a central construct in cognitive psychology and cognitive neuroscience. There are good numbers of working memory tests. However, the test used in this study was the N-back test. This test has been referred to as the gold standard of working memory measures in the field of cognitive neuroscience.<sup>5</sup>

Individuals between 18 years to 35 years of age belong to the formal operational period and are capable of constructive logical reasoning and scientific deductions.<sup>6</sup> The mean age of the male population (18.42 years) and the female population (18.24 years) fell within the age range chosen for the study.

Cognition has negative correlation with factors like hypertension and obesity.<sup>7</sup> The mean values for the males and females for blood pressure are 112/76mmHg and 110/72mmHg respectively. The mean BMI values for the males and females are 20.68 kg/m<sup>2</sup>, 20.73 kg/m<sup>2</sup> respectively. All these values are within the normal range.

The result of the present study showed that there is no significant sex difference in working memory. Study by J. A. Tende and colleagues got similar results.<sup>8</sup> The findings are consistent with previous research by Lambourne and Rahman et al.<sup>9,10</sup> These findings are inconsistent with Kaufman which showed male advantage in the spatial visualization and mental rotation tests.<sup>11</sup> Previous work has shown that there are significant differences in spatial tasks and verbal tasks Men do better on spatial memory tasks than do women and female advantage seen on the visual working-memory task and showed significantly greater recall than men.<sup>12,13,14</sup> Women do better on object memory and location memory tasks (McBurney, Gaulin, Devineni, and Adams, 1997). The nature, onset, prevalence and magnitude of such differences vary. Working memory has components which have subcomponents. Dual N-back test uses both the phonological loop and visuo-spatial notepad to test working memory and would thus balance out any preferential differences in cognitive abilities between males and females. Further studies are recommended to determine the generalization of the study findings.

## CONCLUSION

The result of this present study suggests that there are no significant differences in working memory between the males and females in the studied population.

## REFERENCES

- [1]. A. Baddeley. Working Memory: the Interface between Memory and Cognition. *Journal of cognitive neuroscience* 1992; 4(3): 281-88.
- [2]. A. Miyake, and P. Shah. Toward a unified theory of working memory: Emerging general consensus, unresolved theoretical issues and future research directions. In Miyake, A. and Shah, P. (eds). *Models of working memory: Mechanisms of active maintenance and executive control*. Cambridge, Cambridge University Press, 1999: Pp.442-81.
- [3]. Jill T. Shelton, Emily M. Elliott, B. D. Hill, Matthew R. Calamia, and Wm. Drew Gouvier Louisiana State University. A Comparison of Laboratory and Clinical Working Memory Tests and Their Prediction of Fluid Intelligence. *Intelligence*. 2009; May 1; 37(3): 283. doi:10.1016/j.intell.2008.11.005.
- [4]. Mariana Cristina Pedrassa Sagrilo, Tais de Lima Ferreira. Difference between verbal and visual span in genders: pilot study. *Rev.CEFAC* 2013; vol.15; no.3.
- [5]. J. T. Shelton, R. L. Meizger and E. M. Elliot. A group-administered lag task as a measure of working memory, *Behaviour Research Methods*. 2007; 39 (3): 482-93.
- [6]. G. Claxton, Routeledge and Kegan Paul 3. *Understanding piaget*, Cognitive psychology. 2002:26-28.
- [7]. J. M. Starr, I. J. Dreary, H. Fox and L. J. Whalley. Blood pressure and cognition. *Gerontology*. 2007; 53(6):432-37.
- [8]. J. Tende, et al. Sex differences in the working memory of students in Ahmadu Bello University, Zaria, Nigeria using the N-back task. ISSN: 2279-0853, ISBN: 2279-0861. (Nov.-Dec. 2012); Volume 2; Issue 6: PP 08-11.
- [9]. Lambourne, K. The relationship between working memory capacity and physical activity rates in young adults. *J. Sports Sci. Med.* 2006; 5: 149-153.
- [10]. Rahman, Q., M. Bakare and C. Serinsu. No sex differences in spatial location memory for abstract designs. *Brain Cognition*. 2011; 76: 15-19. DOI: 10.1016/j.bandc.2011.03.012.
- [11]. Kaufman, S.B. Sex differences in mental rotation and spatial visualization ability: Can they be accounted for by differences in working memory capacity? *Intelligence*. 2007; 35: 211-223. DOI: 10.1016/j.intell.2006.07.009.
- [12]. R. Lynn. "Sex differences in intelligence and brain size: a developmental theory" *Intelligence*. 1999; 7: 1-12.

- [13]. Harness, A., L. Jacot, S. Scherf, A. White and J.E. Warnick. Sex differences in working memory *Psychol. Rep.* 2008; 103: 214-218. DOI: 10.2466/PRO.103.5.214-218.
- [14]. Voyer, D., A. Postma, B. Brake and J. ImperatoMcGinley. Gender differences in object location memory: A meta-analysis. *Psychonomic Bull. Rev.* 2007; 14: 23-38. DOI: 10.3758/BF03194024.