

## YOGA EXERCISES FOR WORKING MEMORY IN OBESE WOMEN

*Bitam Sadokpam<sup>1</sup> & T. K. Bera<sup>2</sup>*

<sup>1</sup>*Research Scholar, Physical Education, BharatiVidyapeeth (Deemed to be University),  
College of Physical Education, Pune, Maharashtra, India*

<sup>2</sup>*Professor and Principal, Physical Education, BharatiVidyapeeth (Deemed to be University),  
College of Physical Education, Pune, Maharashtra, India*

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### ABSTRACT

Research reviews indicate that working memory has a "short-term store" in human brain and is forgettable if the work is not continuously repeated within a gap of certain period. Various ways and means are available so far to improve one's memory power, but no research-based information is available till-date for improving the span of working memory. In fact, working memory is a mind-body complex and there is a need to improve homeostasis of such complexity. Nowadays, ample of researches indicate that yoga helps to improve the homeostasis between the human body, mind and spirit, which may in turn improve working memory. This study was, therefore, undertaken to find out the impact of the training of yogic exercises on working memory in obese people. Sixty obese female (n=60), age: 40-50 yrs., from different nearby housing societies in Pune (India), were randomly divided into two groups viz., 30 experimental and 30 control. The obese subjects were selected on the basis of their BMI (Body Mass Index). The level of working memory was assessed by employing self-made (standardize) questionnaire during pre-test, post-test and follow up test. Yoga exercise training was imparted to the experimental group for a period of 6 months, whereas the controlled subjects did not participate in the said program. The result of t-test revealed that the yoga exercises, training for three months was significantly effective in improving the level of working memory ( $t=3.72$ ,  $p<0.05$ ) and during follow-up trend of such improvement was gradually declined ( $t=3.69$ ,  $p<0.05$ ) whereas the controlled group could not. This result, in turn, suggests that yoga exercise program has a long term effect in maintaining the span of working memory among the female obese.

**KEYWORDS:** Working Memory, Mental Health, Obesity, Yoga

### INTRODUCTION

The term "working memory" was coined by Miller, Galanter, and Pribram and was used in the 1960s in the context of theories that likened the mind to a computer. In 1968, Atkinson and Shiffrin used the term to describe their "short-term store". What we now call working memory was formerly referred to variously as a "short-term store" or short-term memory, primary memory, immediate memory, operant memory, and provisional memory. Short-term memory is the ability to remember information over a brief period (in the order of seconds). Working memory is associated with cognitive development, and research shows that its capacity tends to decline with old age. Although many people are of the opinion that working memory is a theoretical concept; in reality it is centrally inter phase between both cognitive psychology and neuroscience. In addition, neurological studies have demonstrated a link between working memory and

learning and attention (D'Esposito and Postle, 2015; Mayer and Moreno, 1998).

The cognitive processes are sensitive to age and they lead to good mental health if positive thinking is imbibed to control obesity through working memory (Barak and Tsodyks, 2014). Since yoga is known for making a stronger emphasis on positive attitude, it may help to increase the span of working memory that in turn may work to control obesity.

In fact, yoga is a system of traditional Indian exercises for the wholesome development of personality by maintaining fitness and health. Although the term yoga is derived from the Sanskrit word *yuj*, it means the union of the individual consciousness or soul with the Universal Consciousness or Spirit. Yoga has a hoary past and contains a traditional Indian body of knowledge. Though many think of yoga only as a type of physical exercises where people twist, turn, stretch, and breathe in most complex ways, these are actually the most superficial aspect. In reality, this profound science (yoga) unfolding the infinite potentials of the human mind and soul. The science of yoga imbibes itself the complete essence of the *Way of Life*, including - *Gyan Yoga* or philosophy, *Bhakti Yoga* or the path of devotional bliss, *Karma Yoga* or path of blissful action, and *Raja Yoga* or path of mind control, etc. *Raja Yogais* further divided into eight-fold parts viz., *yama*, *niyama*, *asana*, *pranayama*, *pratyahara*, *dharana*, *dhyana*, and *Samadhi*. However, in this piece of research, the real sense of yoga has been restricted to a system of exercise for improving the span of working memory among the obese women. The basis of this idea is that yoga imbibes a state of psychophysiological and hormonal balance that might help to improve the short term memory and inhibit the process of obesity (Hagan, Upton, Wong and Whittam, 1986; Jakicic *et al.*, 2003; Jeffery, Wing, Sherwood and Tate, 2003). Therefore, the objective of this investigation was to develop a yoga training schedule for improving working memory of obese women.

## METHODS

### The Subjects

Female veterans (age: 40-50 years) with obesity residing in Pune city, belonging to renowned veteran's clubs and willing to participate in the present experiment were the subjects of this study. Considering the paucity of fund and less availability of the participants, the duration of the experiment has been restricted for 6 months only.

### Inclusion and Exclusion Criteria

- The subjects, who have given a written consent to remain until the experiment is over, were included.
- The veteran subjects suffering from the various contagious diseases and whose health is at risk, as discarded by the physician, were excluded.
- Those who look obese, but not obese as per BMI (Body Mass Index) were excluded.

## MEASUREMENT OF WORKING MEMORY

Working memory was assessed with the help of a standard questionnaire (Bera and Sadokpam, 2017). The questionnaire contains sixteen dimensions viz., *fatigue*, *boredom*, *anxiety*, *tiredness*, *self-confidence*, *memory*, *concentration/attention*, *excessive expenditure of energy*, *difficulties in work completion*, *difficulty in understanding a task*, *difficulty in time management*, *both task in same time*, *helpless*, *difficult to dialogue with people* and *co-ordination and Reaction time* and finally 52 items (questions) retained with 3-point scale, which are gradable as per Likert's five-point scale. The answerable duration of this test was ranged from 30-35 minutes. Content validity of this test was maintained and the reliability coefficient was reported as 0.68 ( $p < 0.01$ ).

## EXPERIMENTAL INTERVENTION

The yoga intervention was imparted to the experimental group for 1 hour daily (morning), every day in a week except Thursdays and Sundays. For 1<sup>st</sup> 30 days, they were given training of an *Easy-Course of Yoga* and during the next 60 days they were trained with *Full Course of Yoga* program along with *OM recitation* as per Kaivalyadhama (Kavalayananda, 1956). The easy course contains *Ujjayi Pranayama, Bhujangasana, Ardha-Shalabhasana, Ardha-Halasanana, Vakrasana, Chakrasana, Paschimattanasana, and Yoga-Mudra*. The full course consists of *Sarvangasana, Halasana, Bhujangasana, Shalabhasana, Dhanurasana, Ardha-Matsyendrasana, Paschimattanasana, Mayurasana, Shavasana, Yoga Mudra, Ujjayi, and Bhastrika*.

## THE EXPERIMENT

Considering the principles of purposive sampling, the researcher selected 60 females with obesity and divided them into two groups, i.e. The first group of *yoga practices* and the second group *as sedentary controls*; each group consisting of 30 obese individuals.

Out of two groups, the Gr.I (yoga group) underwent a yoga training program for a period of 3 months; whereas the Gr.II (control group) was treated as control, but the subjects of the control group were kept busy with some recreational activities / library reading for the experimental period. One trainer, specialized in yoga exercises, was appointed for 3 months to render training to yoga group. The researcher himself took care of the control group and supervised the overall experiment. After completion of 3 months of training interventions, there was a follow-up period (i.e., detraining period) for next 3 months. Thus, total duration of the experiment was 6 months.

The schematic diagram of the experiment is as follows (Table 1)

**Table 1: Schematic Diagram of the Experiment**

Tests (Pre-, Post-, Follow-Up)	Gr.I	Gr.II
Test (Duration)	Pre-test (2 days)	
Training (Duration)	Yoga exercises (3months)	Control group (3months)
Test (Duration)	Post-test (2 days)	
Follow up (Duration)	No training intervention (3months)	
Test/ Duration	Final test (2 days)	

The researcher, with the help of a questionnaire (Bera and Sadokpam, 2017), collected the data for measuring the status of “*working memory*” during pre-test, post-test and follow-up test. The data on *working memory* were recorded nearest to 1 point.

The data were analyzed by using t-test and the level of significance was set on 0.05 level of confidence.

## RESULTS

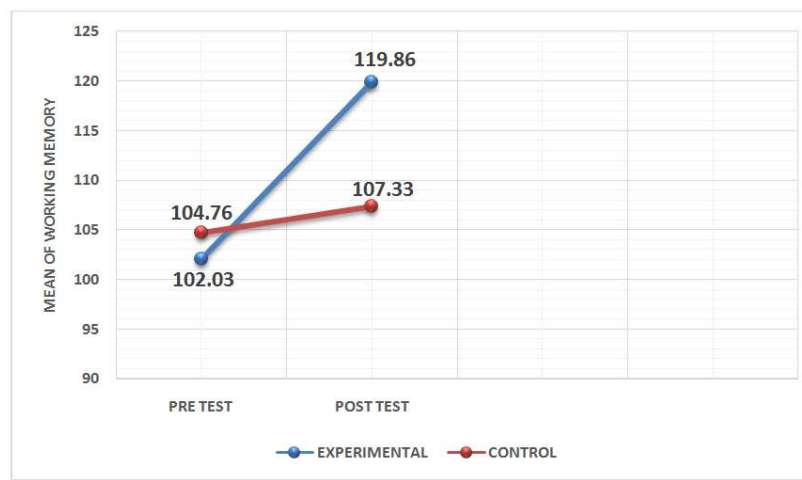
From the Table-2, in case of working memory, it is evident that the obtained t-value of the experimental group (pre- and post-test comparison) is a **5.38** ( $p < 0.05$ ), which is greater than the tabulated t-value (28) 3.67. Therefore, there is a significant difference between pre- and post-test means on working memory in the experimental group. However, the obtained t-value of control group (pre- and post-test comparison) is a **0.89** ( $p > 0.05$ ) which is lesser than the tabulated t-value (28) 3.67. Therefore, there is no significant difference in control group (pre-post-test comparison) on working

memory. The result finally indicates that yoga exercise training (i.e., experimental group) could contribute to improve working memory of obese people, whereas the control group could not (Figure 1).

**Table 2: Pre-posttest Comparison of Working Memory of Experimental and Controlled Obese Women**

Group	n	Mean (SD)		MD (Mean Difference)	df	SEM	t-ratio
		Pre	Post				
Experimental	30	102.03 (SD=13.91)	119.86 (SD=13.85)	-17.83	28	3.31	<b>5.38*</b>
Control	30	104.76 (SD=12.60)	107.33 (SD=18.20)	-2.56	28	2.86	<b>0.89</b>

\*Significant at 0.05 levels; Tab 0.05 (28) = 3.67



**Figure 1: Graphical Representation of Pre-post Scores of Experimental and Control Groups on Working Memory**

The result of post-test comparison of mean values of working memory revealed that the mean value of the experimental group was higher than the control group ( $t=3.72$ ,  $p<0.05$ ) (Table 3). This indicates that yoga exercise training for three months was found effective in improving working memory.

**Table 3: Posttest Comparison of Working Memory Among Experimental and Controlled Obese Women**

Group	n	Mean (ng/ml) (SD)	MD (Mean Difference)	df	SEM	t-ratio
		Post-test				
Experimental	30	119.86 (SD=13.85)	12.53	28	3.36	<b>3.72*</b>
Control	30	107.33 (SD=18.20)				

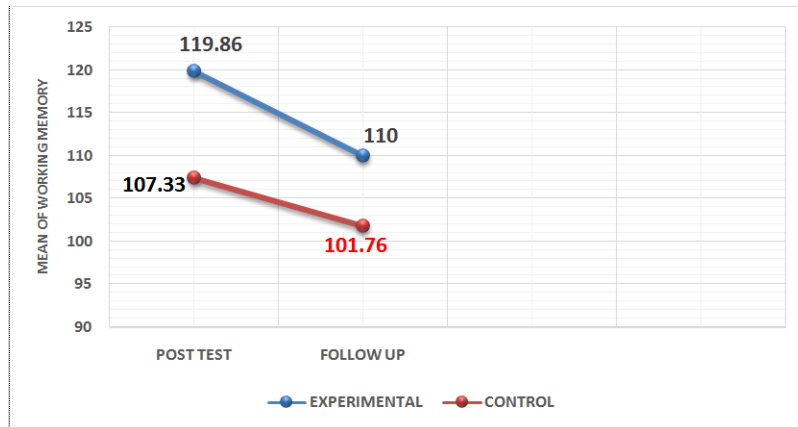
\*Significant at 0.05 levels; Tab 0.05 (28) = 3.67

The result of post-test and follow-up comparison in the scores of working memory, it is evident from the Table-4 that the obtained t-value of the experimental group (posttest Vs follow-up comparison) is a **3.83** ( $p<0.05$ ), which is greater than the tabulated t-value (28) 3.67. This indicates that there is significant improvement in working memory in the experimental group (post-test Vs follow up test comparison) during follow-up period. However, the obtained t-value of control group (posttest Vs follow-up comparison) is a **1.24** ( $p>0.05$ ), which is lesser than the tabulated t-value (28) 3.67. Therefore, there is no significant change in working memory between posttest and follow up test of control group (Figure 2).

**Table 4: Comparison of Post-Test and Follow-up-Test Means on Working Memory between Experimental and Controlled Obese Women**

Group	n	Mean (ng/ml) (SD)		MD (Mean Difference)	df	SEM	t-ratio
		Post	Follow up				
Experimental	30	119.86 (SD=13.85)	110 (SD=10.89)	9.86	28	2.57	<b>3.83*</b>
Control	30	107.33 (SD=18.20)	101.76 (SD=11.87)	5.56	28	4.47	<b>1.24</b>

\*Significant at 0.05 level; Tab 0.05 (28) = 3.67

**Figure 2: Graphical Representation of Post-follow up Scores of Experimental and Control Groups on Working Memory**

The result of the post-follow-up-test comparison between experimental and control groups on mean values of working memory revealed that there was a significant difference between the experimental and control groups of post follow up test on working memory ( $t=3.69$ ,  $p<0.05$ ) (Table-5). This in turn indicates that yoga exercise training had a follow-up effect on working memory.

**Table 5: Post Follow-Up Test Means of Working Memory among Experimental and Controlled Obese Women**

Group	n	Mean (ng/ml) (SD)	MD (Mean Difference)	df	SEM	t-ratio
		Post Follow-Up Test				
Experimental	30	110 (SD=10.89)	8.23	28	2.40	<b>3.69*</b>
Control	30	101.76 (SD=11.76)				

\*Significant at 0.05 levels; Tab 0.05 (28) = 3.67

## DISCUSSIONS OF RESULTS

Working memory has a short span of human and its span can positively be altered with repeated practice of the particular task (Barak and Tsodyks, 2014).

Many reports also revealed that participation in physical exercise program also contributes to improving the span of working memory and helps in fat reduction (Hagan, Upton, Wong and Whittam, 1986; Jakicic *et al.*, 2003; Jeffery, Wing, Sherwood and Tate, 2003). It was, therefore, hypothesized that yoga exercises program may facilitate to increase working memory so that the obese people can accelerate the process of fat reduction.

The result, in this experiment, revealed that yoga exercises, training for a total duration of 3 months contributed to improve working memory among the obese females ( $t=3.72$ ,  $p<0.05$ ) (Table 3). The result, as appeared seems to be logical and in turn supports the findings of many of the earlier research reports about role of yoga in controlling obesity (Bera, Gore, Kulkarni, Bhogal, and Oak, 2003; Murugesan, Govindarajulu, and Bera, 2000); it seems the yoga practitioners might have improved their working memory. The result of this experiment also suggests that there must be a relationship with working memory and reduction of body fat. Finally, it is confirmed that 3-month yoga exercises, training helps to increase working memory of obese women. Since increased working memory is inversely proportional to obesity, the result suggests for reduction of body fat in obese women.

Many of the earlier literature also indicates that yoga has follow-up effects for a longer period of time (Bera, Gore, Kulkarni, Bhogal, and Oak, 2003). Similar results were evident in this investigation because yoga exercises had follow-up effects ( $t=3.69$ ,  $p<0.05$ ). Different *shlokas or sutras* in the traditional texts of yoga also support the result of this experiment and stressed the impact of regular practice of yoga has a long term effect. Moreover, a repeated practice of exercises for a longer period of time help to reduce aggression and anxiety that in turn enhance working memory (D'Esposito and Postle, 2015; Mayer and Moreno, 1998), regular yoga exercises might have played a similar role in enhancing and maintaining working memory.

Thus, the result finally concludes that the working memory is effectively increased after a 3-months training session of yoga exercises, which might have reduces the body fat level of the obese women. In addition, regular practice of yoga exercises had a long term effect to improve span of working memory.

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