

RESEARCH ARTICLE

Effect of mindfulness meditation on attention and visual scanning in elderly people – A randomized control trial

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ABSTRACT

Background: World population is aging. Elderly age is associated with decline in cognitive functions. **Aims and Objectives:** This study aims to study the effect of mindfulness meditation (MM) on elderly age-induced decline in attention and visual scanning. **Materials and Methods:** A total of 100 elderly participants were randomly divided into meditation group (MG; $n = 50$) and control group (CG; $n = 50$). MG participants followed 45 days of MM schedule. Six letter cancellation test (SLCT) was used for pre- and post-study evaluation of attention and visual scanning. **Results:** There was a significant improvement ($P < 0.05$) in scores of SLCT for MG participant. There was no significant change in SLCT scores of CG participants. **Conclusion:** MM practice counters the elderly age-induced decline in attention and visual scanning.

KEY WORDS: Elderly; Mindfulness; Meditation; Attention; Visual scanning; Six letter cancellation test

INTRODUCTION

Decline in fertility and improvement in survival have resulted in a global phenomenon known as population aging. It may be defined as inevitable increase in proportion of older people in the world population. According to the current scenario, the number of elderly people is supposed to get double by 2050.^[1]


Aging is an unavoidable normal physiological process. It is associated with decline in cognitive functions.^[2] Visual scanning is the cognitive aspect of visual perception. It is the ability to use vision for detecting and recognizing visual stimuli. The primary requirement for proper visual scanning

is visual attention. Visual scanning is involved in many day-to-day life activities such as reading and searching for some object at supermarket.^[3]

Many studies have been done to find out various pharmacological and non-pharmacological ways to counter the aging-associated cognitive decline. Mindfulness meditation (MM) has shown some promising results across the wide spectrum of cognitive functions.^[4,5] In this study, we studied the effect of MM on visual scanning and attention in elderly people.

MATERIALS AND METHODS

This study was a randomized control trial. The study duration was 45 days. It was conducted in the Department of Physiology, Manipal University, Mangalore, Karnataka, India. Ethical clearance was taken from the institutional scientific and ethical committee. A total of 100 healthy elderly subjects were recruited from general population of Mangalore.

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Inclusion Criteria

The following criteria were included in the study:

- Healthy elderly person
- Meditation naïve
- Normal or corrected to normal vision.

Exclusion Criteria

The following criteria were excluded from the study:

- History of alcohol or any substance abuse which could affect the cognitive functions.
- Ongoing or previous neurological or psychological disturbance
- Receiving any medication affecting central nervous system.

Volunteers submitted the duly signed informed consent forms. Subject's physical and mental health-related information was recorded with the help of questionnaire. The sample population was equally and randomly divided into meditation group (MG; $n = 50$) and control group (CG; $n = 50$). Lottery method was used for the process of randomization. In both the groups, the pre-study assessment of selective attention and visual scanning was done by the six letter cancellation test.

Activity of MG

MM was introduced to MG subjects. Thirty minute meditation sessions were scheduled for 6 days/week. Sunday was a free day. All these sessions were conducted under supervision of a qualified meditation instructor.

Activity of CG

During the study period, the CG subjects were free to get involved in activities such as reading books, walking, and watching TV.

After 45 days, as a part of post-study assessment, both groups were again evaluated on six letter cancellation test.

MM – It is a kind of ancient Buddhist meditation practice. The concept of “mindfulness” means observation of the present moment awareness with non-judgmental attitude.^[4-6]

These instructions were given to the subjects of MG for performing MM

- Sit comfortably on floor or chair with straight back
- Close your eyes and continuously observe the inflow and outflow of air during the process of breathing
- Do not try to control or alter the breathing pattern. Let it be normal
- Dealing with thoughts: If any thought appears in your mind, instead of suppressing it, appreciate its presence. However, do not get involved in further analysis of

thought. Just mark it as “thought” and redirect your attention on your breathing.

Instrument

Six letter cancellation test (SLCT) [Table 1] – In this test, six English alphabets were given as target letters. These six letters were written on the top of the worksheet. Subjects were instructed to identify and cancel out these target letters from the random letters given below the six letter list. The score comprised time taken to complete the task, total number of missed target letter (omission), and total number of wrong canceled letters (commission). This test assesses visual scanning, response speed, and sustained attention.^[7]

Statistical Analysis

Wilcoxon signed-rank test was used to compare baseline SLCT scores of MG and CG. Mann–Whitney U-test was to compare the pre- and post-study SLCT score for MG and CG. SPSS 16.0 version was used for statistical analysis. $P < 0.05$ was considered to be statistically significant.

RESULTS

Mean age for MG (Male= 34; Female = 16) and CG (Male= 37; Female = 13) was 63.86 ± 3.01 years and 64.42 ± 2.96 years, respectively. MG and CG did not differ significantly in age distribution ($P = 0.31$) and sex distribution ($P = 0.66$). Table 2 shows that there was no significant difference ($P = 0.699$) in the baseline SLCT score between two groups. Table 3 shows that after completion of MM schedule, there was a significant improvement in score (time taken – $P = 0.003$; commission – $P = 0.02$; and omission – $P = 0.001$) for MG. Table 4 indicates toward no significance variation in pre- and post-study score for CG.

DISCUSSION

In the current study, we observed the effect of MM on SLCT in elderly people. SLCT assesses visual scanning, response speed, and sustained attention. Pre- and post-study SLCT comparison showed significant improvement in test scores (time taken – $P = 0.003$; omission – $P = 0.001$; and commission – $P = 0.02$) for MG. On the other hand, there was no significant variation in the test scores (time taken – $P = 0.294$; omission – $P = 0.399$; and commission – $P = 0.173$) of CG. This result indicates toward the beneficial effect of MM on visual scanning, response speed, and sustained attention.

We hypothesize that MM-induced primary improvement in attention and working memory is the basic cause of improvement in visual scanning and response speed in MG subjects. Working memory is a type of cognitive function which is associated with storing, manipulation, and retrieval

Table 1: A modal sheet for SLCT

Cancel (x) these alphabets – C, U, O, N, R, M

| | | | | | | |
|---|---|---|---|---|---|---|
| D | W | E | T | U | O | M |
| R | V | I | D | N | J | W |
| Y | Q | G | C | F | S | B |
| A | O | P | H | M | V | W |
| H | E | N | A | T | R | L |
| M | A | B | V | S | A | D |
| I | R | C | J | V | G | F |
| B | U | N | I | W | V | A |
| R | F | A | L | B | Q | L |
| C | J | U | Q | R | D | N |

Scores

Time taken=..... Sec Omission=..... Commission=.....

SLCT: Six letter cancellation test

Table 2: Comparison of pre-study SLCT scores between meditation and CG

| Parameters | MG (n=50) | CG (n=50) |
|-----------------------------|-----------|-----------|
| Parameter – time taken (s) | | |
| Mean | 65.68 | 64.84 |
| Median | 63.50 | 66.00 |
| SD | 10.80 | 12.92 |
| Mann–Whitney <i>U</i> -test | 1194.00 | |
| <i>P</i> | 0.699 | |
| Parameter – commission | | |
| Mean | 0.98 | 0.88 |
| Median | 1 | 0.50 |
| SD | 1.02 | 1.023 |
| Mann–Whitney <i>U</i> -test | 1175.00 | |
| <i>P</i> | 0.581 | |
| Parameter – omission | | |
| Mean | 3.92 | 4.1 |
| Median | 4 | 4 |
| SD | 1.66 | 1.89 |
| Mann–Whitney <i>U</i> -test | 1158.00 | |
| <i>P</i> | 0.520 | |

SD: Standard deviation, SLCT: Six letter cancellation test, MG: Meditation group, CG: Control group

of task-related information for short duration. Baddeley and Hitch (1974) proposed the working memory model. According to this model, working memory is consist of – (a) central executive – it is the chief control of working memory. It is also responsible to allocation of attention directed information to appropriate subsystem. (b) Visuospatial scratchpad – it is associated with storage of visual information. (c) Phonological loop – it is concerned with storage and maintenance of spoken or written information. In this way, written information is also stored in verbal working memory. It has two components – (i) phonological loop – it is the short-term storing component

Table 3: Comparison of pre- and post-study SLCT scores between MG

| Parameter | Pre-study scores | Post-study scores |
|----------------------------|------------------|-------------------|
| Parameter – time taken (s) | | |
| Mean | 65.68 | 63.02 |
| Median | 63.50 | 62 |
| SD | 10.80 | 7.05 |
| <i>Z</i> | -2.93 | |
| <i>P</i> | 0.003 | |
| Parameter – commission | | |
| Mean | 0.98 | 0.56 |
| Median | 1 | 0 |
| SD | 1.02 | 0.76 |
| <i>Z</i> | -2.33 | |
| <i>P</i> | 0.02 | |
| Parameter – omission | | |
| Mean | 3.92 | 2.92 |
| Median | 4 | 3 |
| SD | 1.66 | 1.61 |
| <i>Z</i> | -3.39 | |
| <i>P</i> | 0.001 | |

SD: Standard deviation, SLCT: Six letter cancellation test, MG: Meditation group

Table 4: Comparison of pre- and post-study SLCT scores between CG

| Parameter | Pre-study scores | Post-study scores |
|----------------------------|------------------|-------------------|
| Parameter – time taken (s) | | |
| Mean | 64.84 | 67.02 |
| Median | 66.00 | 65.5 |
| SD | 12.92 | 10.49 |
| <i>Z</i> | -1.049 | |
| <i>P</i> | 0.294 | |
| Parameter – commission | | |
| Mean | 0.88 | 0.66 |
| Median | 0.50 | 0 |
| SD | 1.023 | 0.91 |
| <i>Z</i> | -1.363 | |
| <i>P</i> | 0.173 | |
| Parameter – omission | | |
| Mean | 4.10 | 4.18 |
| Median | 4 | 4 |
| SD | 1.89 | 1.98 |
| <i>Z</i> | -0.844 | |
| <i>P</i> | 0.399 | |

SD: Standard deviation, SLCT: Six letter cancellation test, CG: Control group

of information. In the absence of information renewal, it can store information only for 2 s. (ii) Articulatory rehearsal process – it is responsible for subvocal rehearsal of

information stored in the phonological loop which leads to constant refreshing of stored information. This “refreshing” process prevents the decay of stored information. The selection of particular information from all the sensory input depends on the “attention.”^[8] Many previous studies results indicate toward the beneficial effect of MM on attention and working memory. One of the parts of this study, in which we used digit span test as the assessment method for the attention and working memory, showed positive influence of MM on attention and working memory in elderly people.^[9] Moore *et al.* performed an EEG study to observe the effect of brief bet regular MM on electrophysiological markers of attention control. This study results indicated that MM improves the activity of attention associated areas.^[10] MM practice develops the capacity of attention control as well as capacity of disengaging the attention from the random thoughts and sensation, which manifest as improvement in attention and working memory.^[9-11] Now, the question arises – How does working memory affect visual scanning? Let’s take example of SLCT for understanding the expected role of working memory during visual scanning. In this examination, subject stores all mentioned six letters in his verbal working memory while he/she is doing scanning for these letters. The person with better attention and working memory would be able to remember the “6 letter information” for longer duration and would do lesser number of mistakes during visual scanning. If we generalize this example, we can say that, as MM has positive effects on attention and working memory, it might result in improvement in visual scanning capacity.

Previously, very less attention had been paid to study the “visual scanning” in elderly people. In this way, our study would play a significant role in this new direction. We would like to acknowledge some of our study limitations. Our study proposes a “hypothesis,” MM-induced improvement in attention and visual scanning in elderly people could be due to improvement in working memory. We did not give any experimental evidence regarding to relation between the working memory and visual scanning. Further studies are required to assess this interrelation.

CONCLUSION

Elderly age is associated with decline in cognitive functions. The current study shows that MM improves the attention and visual scanning in elderly people. Our study supports the

notion that MM could be used as an effective tool to counter this age-induced cognitive degradation.

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