Mantra yoga as a probable measure in improving sleep and reaction time among commercial drivers: An exploratory pilot study

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Title: **Mantra Yoga as a probable measure in improving sleep and reaction time among commercial drivers: An exploratory pilot study.**

**Running Title:** Mantra chanting for drivers

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**Authors Contribution:** NR was involved in conceptualization, design, execution of intervention, data collection and approved the final draft of the study; JK was involved in conceptualization, design, recruitment, facilitation of trial site and approved the final draft of the study; GRT was involved in conceptualization, design, execution and approved the final draft of the study; HS was involved in conceptualization, design, literature review, facilitation of trial site and approved the final draft of the study; PMKN was involved in conceptualization, design, data curation, statistical analysis and drafted the manuscript.
Mantra Yoga as a probable measure in improving sleep and reaction time among commercial drivers: An exploratory pilot study.

Abstract

Problem considered

Road accidents are a growing concern in developing countries that needs immediate attention. The present study evaluated the role of Maha Mrityunjaya mantra (MMM), a vedic practice in reducing reaction time, burnout and improving sleep among commercial drivers.

Methods

Fifty commercial drivers (Age 39.92±8.64) were enrolled for a 2 months MMM chanting session (21 rounds, 15 minutes daily, 5 sessions/week). The effects were measured at the baseline and at the end of 2 months using ruler drop test (RDT), Pittsburgh Sleep Quality Index (PSQI) and Oldenburg burnout inventory (OLBI).

Results

The average work experience and duration of working hours per day were 15.1±7.75 years and for 8.7±1.7 hours respectively. We observed significant changes in PSQI scores (Pre- 7.44±3.9, Post- 4.82±2.32; p<0.01), OLBQI (Pre-38.24±3.22, Post-34.24±2.64; p<0.01, effect size 1.000) and RDT scores (Pre-16±3.9, Post-10.28±2.79; p<0.01). Spearman's correlation revealed a weak positive association between improvement in sleep with reaction time (rs=0.247) and burnout scores(rs=0.097).

Conclusion
The present study concludes MMM chanting may be beneficial in improving the reaction time among drivers, which may be useful as a strategy in preventing road traffic accidents. However, robust randomized control trials are warranted before making generalized recommendations.

**Keywords:** Maha Mrityunjaya mantra; Mantra chanting; reaction time; road traffic accidents; sleep quality; mantra yoga
**Introduction**

Road traffic accidents and its related deaths and injuries are a growing concern across the globe. According to World Health Organization report on road traffic injuries, the fatality owing to road traffic accidents are close to 1.3 million and is more common in low and middle-income countries.\(^1\) India also has road traffic accidents as one of its growing health care concern which accounts for 2650 deaths and 9000 injuries per week.\(^2\) Further it is also noticed that the population between the ages of 30-60 years are most vulnerable to the accidents that warrants initiatives to prevent this unfortunate but preventable mishaps.\(^2\) The increasing number of road traffic accidents is alarming that needs urgent interventions.

A recent study collated the reasons for road traffic accidents suggested that driver distraction is responsible for 10-50% of car crashes.\(^3\) The common reasons for driver distractions includes the advertisement boards on the roads, co-passenger interaction, talking over phone while driving, tracking addresses and operating the audio systems in the vehicle.\(^3\)–\(^6\) Car divers who have an increased reaction time are more susceptible to automobile accidents\(^7\) and therefore reaction time is regarded as an important aspect in designing prevention strategies.\(^8\) Surprisingly, there are no much interventional studies conducted in this domain which can help in reducing the number of accidents and associated woes.

Numerous mind body practices are known to improve attention, reaction time in humans. This includes mantra yoga or mantra meditation which is nothing but “repetition of same word or phrase with the objective of maintaining attention on that specific object.”\(^9\) India has a rich culture of *Vedic* wisdom where we use lot of mantras like *OM chanting*, *gayathri mantra*, *Maha Mrityunjaya mantra* etc for spiritual and physical benefits.\(^10\) Earlier studies have addressed the use of *OM chanting* and *gayathri mantra* in improving neurocognitive functions of the body and
mind.\textsuperscript{11–13} \textit{Maha Mrityunjaya mantra} is also known as \textit{Mrita Sanjivini mantra} as this mantra was spiritually thought to conquer death. This is regarded as the one of the greatest recitation along with \textit{Gayatri mantra}\textsuperscript{14–16} Irrespective of the overwhelming traditional recommendation about the benefits of \textit{Maha Mrityunjaya mantra}, there are only fewer studies conducted to evaluate the clinical/practical benefits of this mantra. Despite anecdotal scriptures suggesting about pertinent role of \textit{Maha Mrityunjaya mantra} in attaining higher spiritual and mental control over pain and death,\textsuperscript{10,15,16} no contemporary literature is available to establish its effect on cognition and its related functions especially among drivers.

Studying the impact of \textit{Maha Mrityunjaya mantra} would be beneficial to impart this chanting among the drivers as an easiest method to improve their reaction time and thereby possibly preventing future accidents. The present study was conducted to test the hypothesis that \textit{Maha Mrityunjaya mantra} to reduce the reaction time among the drivers who are working for longer hours and also subsequently improve the sleep quality among them.

\section*{Methods}

The study was conducted as an exploratory quasi experimental study and is registered with Clinical trial registry of India (CTRI/2021/09/036624). Institutional Ethics Committee of the study site approved the study protocol (F.No:12/SHMCNYS-IEC/P27/2020-2021) and all the participants signed an informed consent before participating in the mantra chanting program.

\textbf{Study setting and participants:} The study was conducted at the yoga hall of a private medical college in North India and the participants were commercial drivers (n=50) aged between 30 to 60 years working full time at a private educational institute. The participants were invited to be a part of this trial through flyers and intern-institute notices. The participants were enrolled in to
the study after an initial orientation session on the importance of *mantra* chanting by the principal investigator. Any participant who were participating any other clinical trial, yoga or mind-body programs, who are under any psychiatric medications and not willing to participate in the study were excluded.

**Study design:** This was conducted as a single group pre-post experimental study where all the patients after initial screening were enrolled in to a *Maha Mrityunjaya mantra* chanting group. The flow of trial events are depicted in figure 1.

**Intervention:** The participants were taught to chant *Maha Mrityunjaya mantra*, a mantra that is thought to eternalize humans according to Indian traditional knowledge systems (the Rig veda-7.59.12).\(^{15,16}\) The chanting was practiced regularly for 2 months under the supervision of a licensed yoga and naturopathy physician, in which the participants recited the mantra for 21 rounds for a span of 15 minutes daily, 5 sessions per week.

**Outcome measures:** The impact of the chanting on sleep was evaluated through a Pittsburg Sleep Quality Index which is a 19 item self-rated questionnaire with a maximum score of twenty one which indicates severe difficulty in falling asleep and a least score of zero depicts no difficulty.\(^{17}\) Further we evaluated the reaction time through a Ruler Drop Test, in which the investigator holds the ruler (30 cm) between the outstretched index finger and thumb of the participants’ dominant hand. The participants were instructed to catch the ruler as soon as the investigator drops it. The distance between the bottom of the ruler and the top of the subjects thumb where the ruler has been caught was recorded as the reaction time. Each participant was made to undergo this test for 5 times and the average of the 5 readings were considered as the final score.\(^{18}\) An Oldenburg burnout inventory (OLBI) was used to assess the burn out among the
participants. OLBI evaluates burnout under two components exhaustion and disengagement from work, in which the higher scores indicate extreme burnout. All the evaluations were done at the baseline before the intervention and after two months at the end of intervention.

Results

Participant Characteristics

All the 50 participants completed the study. The participants had an average age of 39.32±9.52 years and have an average work experience of 15.1±7.75 years. Most of the participants were bus drivers (68%) and few of them drive cars (32%), whose primary job was to carry passengers from the educational institution to their residences. The daily driving distance per trip as reported by the participants ranged between 9 to 35 kilometers. The participants on an average worked for 8.7±1.7 hours per day. Most of the participants (92%) reported that, apart from the working hours they usually stay for an additional hour for meeting the occupation related chores or as a stand-by. The detailed demographic features are tabulated in table 1.

Effect of MMM chanting on sleep, reaction time and burnout

Shapiro-Wilk test was used to test the normality of the data. Most of the study participants were having moderate issues with their sleep at the baseline as reported in PSQI scale. A Wilcoxon signed-rank test has shown significant reduction in the PSQI scores after the intervention compared to baseline (Pre- 7.44±3.9, Post- 4.82±2.32; p<0.01, effect size 1.00). At baseline the study participants has shown an increased reaction time. Similar to the PSQI scores, a Student t-test has shown significant reduction in the reaction time of the participants intervention compared to baseline (Pre-16±3.9, Post-10.28±2.79; p<0.01, effect size 2.017). We also observed a significant reduction (fig 3) in the work related burnout among our participants
compared to the baseline (Pre-38.24±3.22, Post-34.24±2.64; p<0.01, effect size 1.000) tested using a Wilcoxon signed-rank test. The results are plotted in figure 1.

Results of the Spearman correlation indicated that there was a weak positive association between the improvement in sleep and, reduction in the reaction time ($r_s=0.247$) and burnout ($r_s=0.097$) respectively. The schematic representation of the association is plotted in figure 2.

**Discussion**

This exploratory experimental study was conducted to assess the role of *Maha Mrityunjaya mantra* chanting on the neurocognitive function like reaction time, quality of sleep and subsequent burnout among commercial drivers. The result from this study favours the use *Maha Mrityunjaya mantra* in improving sleep and reaction time among drivers as a preventive strategy. However, lack of control group prevents the authors from making a recommendation using the present data. The reaction time was almost halved after 2 months intervention which indicates the impact of the chanting on the preparedness/alertness of drivers. Indian culture is enriched with numerous ways and means to attain spiritual, physical and mental enlightenment. *Vedas* form the center-point of Indian ethos which discusses on many *mantras* or sacred sounds or utterances.\(^{10}\) It is contemplated that each of these *mantras* has medico-spiritual benefits and this has been demonstrated by various studies.\(^{11,20–24}\) However, most of these studies conducted on school students. These studies has shown that *mantra* chanting improves memory, attention, concentration, learning power,\(^{11,20,24}\) enhance the workplace well-being,\(^{21}\) enhances the stability of cardiac function by modulating autonomic functions,\(^{22,23}\) reduce anger and anxiety.\(^{25}\)

Reaction time is an important skill required in all profession, however it has a greater value among drivers, as the increased reaction time is correlated to increased number of road traffic
accidents. Studies suggest sleeplessness, driving fatigue etc to have negative impact on the reaction time. A previous study on *Maha Mrityunjaya mantra* chanting on school children have shown to improve memory and reduce reaction time. Another study on 40 participants has shown *Maha Mrityunjaya mantra* to annihilate self-inferiority and depression.

The results of the present study showing *Maha Mrityunjaya mantra* to improve the sleep and reduce the reaction time may have practical implications, as there is a need to negate the fatigue, sleeplessness to reduce the reaction time in drivers. Neurophysiological studies on religious chanting suggest chanting increases the endogenous neural oscillations present in the delta-band specifically in posterior cingulate cortex region of the brain. This is said to act as an inhibitor of brain oscillations that can prevent the mind from swaying away while doing a focused process. *Maha Mrityunjaya mantra* may possibly reduce the brain oscillations which results in distraction during driving. However, this needs to be confirmed by future studies. Further our study cohort consisted of people from different religion and all of them have shown good adherence to the program. This demonstrates the acceptance of mantra chanting among all strata of society.

In addition to sleep and reaction time, our participants reported significant reduction in work-related burnout. Commercial drivers are reported to have increased occupational stress and burnout. Occupational burnout is pointed to be a potential cause for accidents among commercial drivers. The present study has demonstrated a beneficial effect of MMM chanting over burnout stress among the drivers.

To our knowledge this is the first study to exploring the practical utility of MMM on occupational health. The insights gained from this study will open avenue for future research in mantra yoga and its utility in contemporary public health issues. This remains as the strength of
the present study. Nevertheless, being an exploratory study, this study has demonstrable weakness and limitations like lack of a control group, limited sample size, non-usage of advanced outcome measures like brain imaging or EEG, Heart rate variability, non-inclusion of other outcome variables like quality of life, vitals etc. Further we do not have any direct evidence to report the impact of MMM chanting on preventing accidents. This limits the authors from making any generalized recommendation. However, the present inferences points out to the need of future controlled studies with advanced neuroimaging techniques and adequate follow-up among the participants to understand the real-time benefit of *Maha Mrityunjaya mantra* chanting in preventing road traffic accidents.

**Conflicts of interest:** None declared

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Table 1: Socio-demographic features of the study participants

<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>Values</th>
</tr>
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| Religion                | Hindus-46  
                         | Muslims-4 |
| Diet                    | Vegetarian-18  
                         | Non-vegetarian-32 |
| Habits                  | Alcohol alone-3  
                         | Smoking alone-13  
                         | Smoking & Alcohol- 20  
                         | None-14 |
| Symptoms or Concomitant conditions reported | Neuromuscular symptoms (numbness, weakness, pain in limbs)-7  
                                                  | Anxiety-1  
                                                  | Constipation/Irregular bowel movements-7  
                                                  | Heart Disease-1  
                                                  | Diabetes Mellitus-1  
                                                  | Cancer-1  
                                                  | Obesity-1  
                                                  | Glaucoma-1  
                                                  | None-30 |
Figure 1: Trial Profile
a) Mean changes in sleep quality before at after the intervention

b) Mean changes in burnout scores before at after the intervention

c) Mean changes in reaction time before at after the intervention

PSQI: Pittsburgh Sleep Quality Index
RT: Reaction Time
OLBI: Oldenburg burnout inventory
a) Correlation between Sleep quality & reaction time

b) Correlation between Sleep quality & burnout scores

PSQI: Pittsburgh Sleep Quality Index
RT: Reaction Time
OLBI: Oldenburg burnout inventory
Highlights

- We examined associations between Maha Mrityunjaya mantra (MMM) chanting and reaction time.
- Maha Mrityunjaya mantra chanting decreases the reaction time among drivers.
- Maha Mrityunjaya mantra chanting helps in improving sleep quality.
- Maha Mrityunjaya mantra chanting may be a potential tool for preventing road traffic accidents.
- Focused mantra chanting may help in reducing distraction among drivers.