World Heart Journal
Volume 13, Number 1

ISSN: 1556-4002

Effects of Prayer and Meditation on Circadian Dysfunction

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Introduction and Objective

Prayer, meditation and mindfulness have been commonly used for healing in Vedic, Jainism, Buddhism, Egyptian, Greek and Mesopotemian cultures [1]. In Buddhism, mindfulness is a component of Eight Fold Path, therefore using mindfulness in the modern science is not absolutely correct. A definition of prayers of Mesopotamia was "*praise to god followed by request.*" The ancient mystic Hinduism wrote Rigveda prayer, Figure 1.

Meditation and prayer appear to be important practices for the management of emotional and spiritual wellbeing [1-4]. Prayer may also influence the physiology of circadian rhythms in our body and it has evolved possibly as adaptation to the rotation of the earth around its axis [4]. Circadian rhythms account for increased activity of the sympathetic nerves of the autonomic nervous system with marked releases of cortisol, catecholamines (norepinephrine and adrenaline), testosterone and thyroid hormones. In turn, these neurotransmitters and hormones occur at a circadian stage when endogenous melatonin level is decreased to low values in the morning [4]. There is a need to prevent the circadian rhythm of adverse biological functions observed between 6.00 to 12.00 hours during the day, because circadian dysfunction can predispose to cardiovascular diseases (CVDs). The circadian dysfunction may worsen due to risk factors, although protective factors such as prayer, meditation and moderate physical activity may prevent circadian dysfunction [2-4]. The aim of the present study is to emphasize the beneficial role of prayer, mindfulness and meditation in the protection against circadian dysregulation in the body, thereby preventing CVDs, especially sudden cardiac death (SCD).

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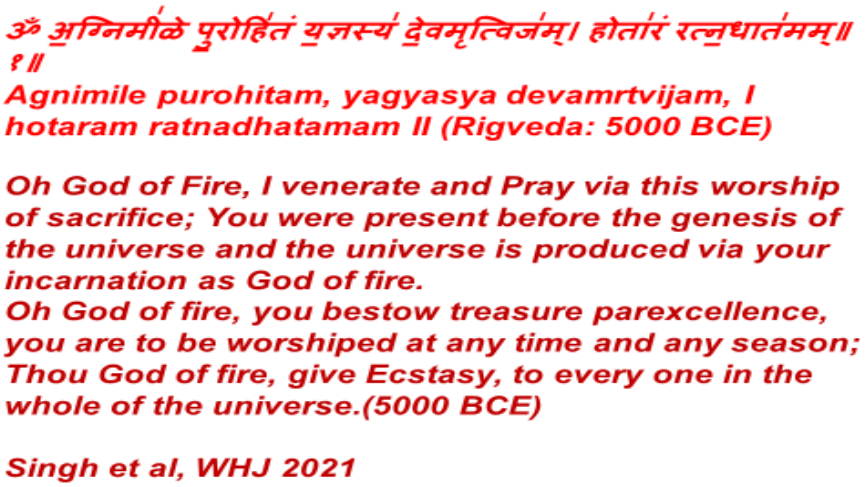

Figure 1. Prayer from the first book upon Earth; in Sanskrit followed by recitation in Sanskrit, then gist in English (Rigveda, 5000 BCE).

Review and Results

Religious traditions across the world display beliefs in healing by practice of meditation, prayer and mindfulness [1-4]. However, frequent communal prayer is correlated with an increased incidence of anxiety-related symptoms, although worship service attendance is negatively associated with reported anxiety [1]. Prayer and meditation appear to be powerful traditions, because they focus our thoughts on something outside ourselves such as environmental stress [1, 4]. Emotional stress may be associated with excitation of the central nervous system (CNS), with increased sympathetic activity, characterized by thrust in survival mode where one may freeze, fight and flight or flee the situation [1]. It segregates to move away from the present state of being into a future quiet state, with shutting down of executive functioning and inhibition of thought process, resulting in poor decision making [1-3]. There is much evidence that diet and lifestyle factors as well as behavioral factors may influence circadian clock function as depicted in Table 1.

In an epidemiological study, among 209 subjects above 25 years of age, ambulatory blood pressure (BP) monitoring was recorded every 30 minutes for 4-7 days and data were analyzed [4]. The MESOR of systolic and diastolic BPs increased with age, body mass index and alcoholism. The consumption of fruits, vegetables and legumes was inversely associated, whereas regular active prayer was associated with decreased heart rate or increased heart rate variability (HRV), as illustrated in Figure 2.

Table 1. Risk Factors of circadian dysfunction

1 .Too much exercise causing too much exertion
2. Disturbed sleep, late night sleep, short sleep (<6 hours)
3. Depression
4. Anxiety and stress
5. Aggression
6. Alcoholism (>10 drinks per week)
7. Tobacco (.1 or more per week)
8. Western diet and general modern life style habits

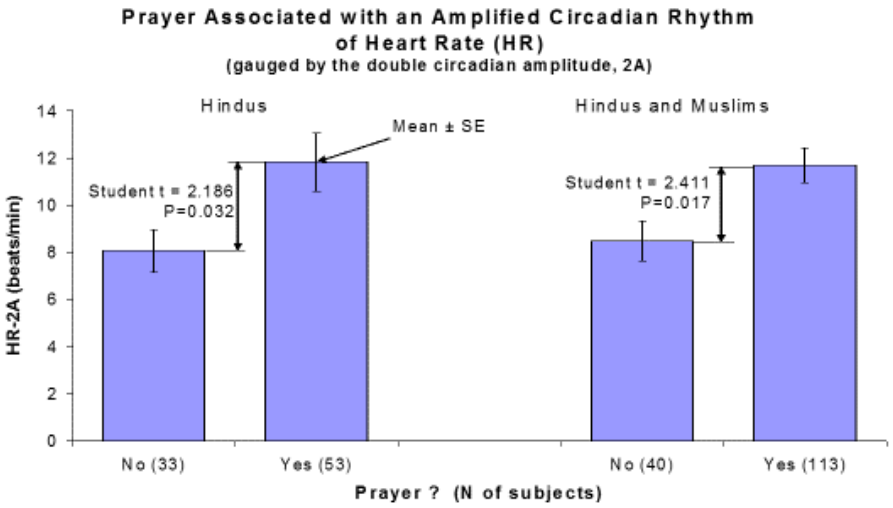

Figure 2. Charts showing the association of active prayer with increased heart rate variability (from [4]).

In a cohort study involving 9,868 subjects, 10% had optimal sleep and the rest 90% sleep difficulties [5]. Of the paying subscribers to Calm (App in a mobile) who have used one of the sleep components, about 90% had sleep difficulties and 77% started using Calm primarily for sleep. These descriptive data point to areas of focus for continued refinement of app features and content, followed by prospective trials testing efficacy of consumer-based meditation mobile apps for improving sleep [5]. In a functional imaging study with 8 mentally healthy spiritual subjects and 8 matched controls, the effects of psychotic experiences were examined [6]. The results showed stronger activation in the lateral occipital cortex, posterior cingulate cortex (PCC), temporal pole, middle temporal gyrus and orbitofrontal cortex during the mediumistic-trance state. There was an increased functional connectivity within auditory and sensorimotor Resting State Networks (RSN) during mediumistic-trance compared to resting and imaginative-trance conditions. It is possible that preserved engagement of prefrontal cortex and connectivity of the default-mode network that indicate maintained introspective control over non-pathological psychotic-like experiences [6].

In a randomized, controlled trial, the effects of a standardized mindful awareness practices (MAPs) intervention (n = 24) or a sleep hygiene education (SHE) intervention (n = 25) were examined [7]. After receiving a 6-week intervention (2 hours per week) with assigned homework, the subjects in the Intervention Group (MAPs) group showed significant ($p < 0.05$) improvement compared to those in the Control Group (SHE group) on the Pittsburg Sleep Quality Index (PSQI). The mean (SD) PSQIs were 10.2 (1.7) at baseline and 7.4 (1.9) at post-intervention, whereas in the control group, with the SHE intervention, the mean (SD) PSQIs were 10.2 (1.8) at baseline and 9.1 (2.0) at post-intervention. The between-group mean difference was 1.8 (95%CI: 0.6–2.9), with an effect size of 0.89. The MAPs group showed significant improvement relative to the SHE group on secondary health outcomes of symptoms due to insomnia, depression, fatigue interference, and fatigue severity ($p < .05$ for all). Since these psychological disorders are known to have adverse effects on sleep quality and circadian dysfunctions, it poses the possibility that intervention with mindfulness may be protective against circadian dysfunction (Figures 3 and 4) [4, 7].

Neurobiological Effects of Meditation and Mindfulness

Mindfulness and meditation may be components of worship prayer, hence worship prayer may have the following biological effects [4-8]:

1. Functional and also structural alterations in grey and white matter, particularly in areas related to attention and memory, interoception and sensory processing, or self- and

auto-regulation with control of stress and emotions.

2. The levels of neurotransmitters such as dopamine and melatonin are found to increase, serotonin activity is modulated, and cortisol, as well as norepinephrine, have been proven to decrease.
3. These findings are reflected in functional and structural changes documented by imaging techniques such as functional magnetic resonance imaging (fMRI) or electroencephalography (EEG).
4. They may be relevant for medicine and health care, especially with reference to therapeutic strategies; change in behavior and life-style modification, or in association with stress regulation and the treatment of addiction.
5. Neuronal mechanisms of mindfulness can be divided into four areas including regulation of attention, body awareness, regulation of emotion and optimism and feeling of well-being.
6. Absolute mindfulness with meditation can provide the feeling of ecstasy.

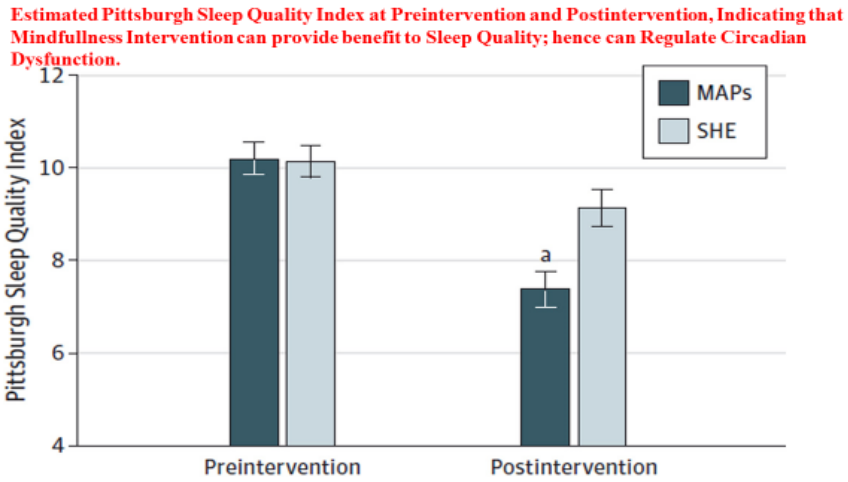

Figure 3. Estimated Pittsburgh Sleep Quality Index at Pre-intervention and Post-intervention, indicating that mindfullness intervention can provide benefit to sleep quality, and hence can regulate circadian dysfunction (Adapted from [7]).

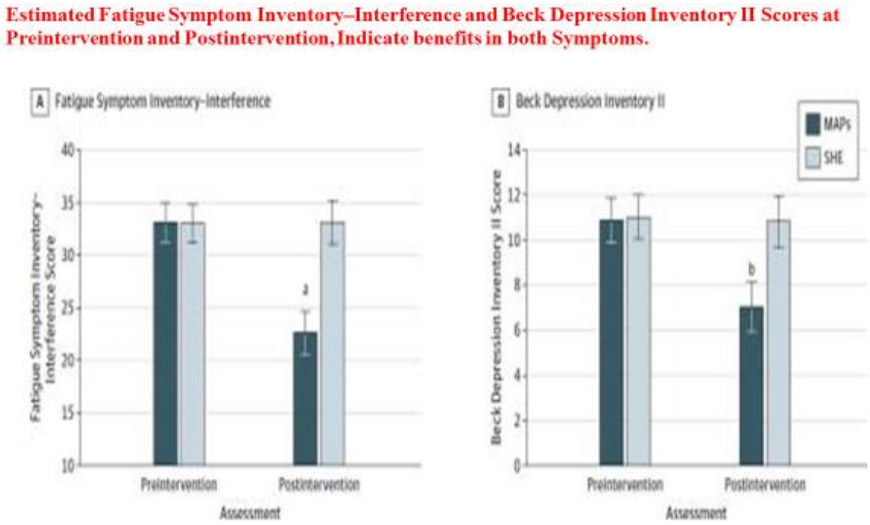

Figure 4. Estimated Fatigue Symptom Inventory–Interference and Beck Depression Inventory II Scores at Pre-intervention and Post-intervention indicate benefits in both symptoms. (Adapted from [7]).

In conclusion, the religious perspective of research on this area may help toward a better understanding of the human experience of spirituality and religion. Research on intervention with prayer, meditation and mindfulness may help elucidate the complex workings of the human brain as well as the overall relationship between brain states and body physiology and circadian function. Regular practice of prayer as worship, meditation and mindfulness intervention may have beneficial effects on psych-ological disorders with improvement in sleep quality, leading to decrease in circadian dysfunction.

Acknowledgements

The authors declare that they have no conflict of interest with this work. Acknowledgments are given to the Tsim Tsoum Institute, Krakow, Poland, for providing logistic support to write this article.

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