CHAPTER 8.0

8.0 DISCUSSIONS

8.1 AUTONOMIC AND RESPIRATORY VARIABLES

It was clearly observed that LF was higher and HF was lower during LC in frequency domain measures and NN50 was found to be higher during all the sessions across all the four groups in the statistical measures. But pNN50 was lower during LC compared to during NC. In addition to this, the mean RR and HR were significantly higher during LM and LC.

Recently one of the studies showed a significant increase in HR and LF spectrum of HRV and a significant reduction in HF spectrum of HRV during the practice of Bhramari (production of humming sound following inhalation) (Nivethitha, Manjunath, & Mooventhan, 2017). But in the current study, there is a significant increase in mean HR, LF during LM and LC and pNN50 during LC and NN50 during all the sessions.

A higher trend of mean HR during LM and LC, the lower trend in HF, and higher trend in LF can be correlated with activation of sympathetic tone but a higher trend of NN50 during all the session of all the four groups is an indication of a mild shift towards the vagal activity. But, pNN50 revealed a lower trend during LC corresponding to sympathetic activation. In other words, we can interpret that there was sympathetic activity during LM and LC in the background of relaxation.

The HRV is interpreted based on both frequency and time domain analysis. In the frequency domain analysis, the HF component of the HRV mainly corresponds to parasympathetic activity (Wu, Gao, & Han, 1995), the LF is contributed to both sympathetic and parasympathetic modulation and the ratio between the LF and HF (LF/HF) it is an indication of sympathovagal balance (Pal et al., 2012). In time domain measures the average R-R interval, are recognized to be dependent on vagal activity (Doğru, Başar, Yuvanç, Şimşek, &Şahin, 2010; Massin, Derkenne, & Von Bernuth, 1999).

Many HRV studies have been done during different meditation techniques. Practitioners of Zazen meditation showed increased LF power, decreased HF power, and decreased LF/HF

ratio and this suggests that there is an increase in sympathetic activity and decrease in cardiac vagal activity with Zazen meditation (Fiorentini, Ora, &Tubani, 2013). In contrast, two separates studies on TM showed higher HF amplitude, suggestive of an increase in vagal activity (Fred Travis et al., 2009; Frederic Travis & Miskov, 1994). Further, a study on defocused meditation reported reduced sympathetic activity and increased vagal modulation during meditation (Shirley Telles et al., 2013). Attention is associated with increased sympathetic activity mediated through the locus coeruleus–noradrenergic (LC-NA) system. The LC nucleus is located in the dorsal pontinetegmentum and integrates functions related to arousal and attention (Aston-Jones, Rajkowski, & Cohen, 1999) with noradrenergic-mediated behaviour such as stress and anxiety (Counts, Mufson, Locus, InMai, &Paxinos, 2012). The LC-NA system is responsible for the supply of noradrenalin throughout the central nervous system, which modulates the collection and processing of sensory information within cortical and subcortical sensory, attention, and memory circuits as well as increases SNS activity (Berridge& Waterhouse, 2003).

8.2 COGNITIVE VARIABLES

It is quite obvious from the results that the scores of attention and short-term memory following SC and LC was higher but the score of attention was comparatively higher following LC and short-term memory following SC.

In this direction a study was carried out to compare the recitation of *Gayatri mantra* (GM) with Poem line chanting (PL) based on Digit letter substitution test (DLST) (Pradhan and Derle, 2012). It was noticed that both GM and PL have the higher score of attention but the scores of GM was higher than PL. While comparing the attention scores of the current study with the earlier, we found that the percentage change in the earlier study was higher (20.53%) than the LC of the current study (3.27%) which clearly indicates that the attention span is higher with a smaller magnitude following the recitation of MMM. But the percentage scores of mindfulness based on MAAS was higher following LC (6.51%) compared to LM (5.61%), which indicates that mindfulness during LC is higher. In addition, there was another observation with respect to SC; the short-term memory following the recitation of MMM in SC was higher.

To address how MMM effects in the improvement of mindfulness and short-term memory following the practice of LC ad SC, we need to understand the areas of the brain involved in synthesizing the above-mentioned functions following the practice of Meditation and *Mantra* recitation. Many previous studies reported improved functions associated with the prefrontal cortex with increased meditation (e.g., attention and working memory) and fewer studies examined the effects on meditation of the memory functions of the hippocampus/medial temporal lobe [Duchesne and Pruessner, 2013). Also, it has been demonstrated that *mantra*-meditation triggered activations in the inferior frontal gyrus bilaterally (Chung et al., 2016), the medial prefrontal cortex, anterior cingulate cortex, limbic and superior parietal areas (Reynolds et al., 2018), or the hippocampus, middle cingulate cortex, and precentral cortex bilaterally (Davenger et al., 2010). More directly *Mantra* repetition activates the Pre central gyrus, parietal cortex, and medial frontal gyrus (Wang et al., 2011).

Mindfulness of breathing elicits activations in the dorsal medial prefrontal cortex bilaterally and in the rostral anterior cingulate cortex (Engström and Söderfeldt, 2010). During the practice of the same, activations in bilateral dorsal anterior cingulate cortex and right medial anterior prefrontal cortex, and deactivations in the middle frontal gyrus, dorsolateral prefrontal cortex, precuneus, superior temporal gyrus, insula have been found (Holzel et al., 2007). It is evidenced in couple of studies that mindfulness impacts amygdale (Manna et al., 2010) associated with emotional processing and hippocampus (Lutz, Dunne and Davidson, 2006) associated with memory. Hence, we can indicate that both amygdala and hippocampus are found to be active during mindfulness. Likewise, Prefrontal cortex is deeply involved in processing of short-term memory.