Journal of Advances and Scholarly Researches in Allied Education

Vol. X, Issue No. XX, October-2015, ISSN 2230-7540

PSYCHOPHYSIOLOGICAL EFFECTS OF MEDITATION

AN INTERNATIONALLY INDEXED PEER REVIEWED & REFEREED JOURNAL

Journal of Advances and Scholarly Researches in Allied Education
Vol. X, Issue No. XX, October-2015, ISSN 2230-7540

Psychophysiological Effects of Meditation

Mr. Amit Kumar Singh*

Assistant Professor, Department of Physical Education, Government Degree College, Tilhar Shahjahanpur (U.P.)

Abstract – A number of studies investigating the psychological concomitants to meditation have been conducted with some consistency of results obtained. An important caveat when using subjective reporting of psychological functioning is that impact of expectancy and performance motivation within meditator participants is difficult to control (West, 1987; Shapiro & Walsh, 1984). Nevertheless, a number of the clinical reports—both psychological and medical—are suggestive of significant effects and together with the other psychological studies provide intriguing correlates of the meditation and brain activity findings summarized above.

---------------------------------x--------------------------------

INTRODUCTION

The primary psychological domain mediating and affected by meditative practice is attention (Davidson & Goleman, 1977), but relatively few empirical evaluations of meditation and attention have been conducted. Longitudinal studies of breath-focused meditation in children and adults have reported improved performance on the embedded figures test requiring the subject to ignore distracting stimuli (Kubose, 1976; Linden,1973). A cross-sectional study of children practicing TM and a cohort of age and sex match controls found that meditation practice led to improved measures of attention (Rani & Rao, 1996). Mindfulness and concentrative practices were compared using an auditory counting task susceptible to lapses in sustained attention (Sweet & Valentine, 1995; Wilkins, Shallice, & McCarthy, 1987). Superior attentional performance was obtained for meditators compared to controls, as well as long-term compared to short term meditator status.

Further, mindfulness meditators demonstrated better performance than concentrative meditators in a second task assessing sustained attention on unexpected stimuli. In contrast to these trait effects on attentive capacity, short-term meditation effects on a focusing task suggested that TM produced no improvement in concentrative functioning (Sabel, 1980), a finding consistent with the explicit lack of emphasis on concentrative effort using the TM technique.

The CNV studies reviewed above support the view that attentive capacities are increased in long-term TM meditators relative to controls (Travis et al., 2000, 2002). Given that meditation is a form of attentional training, the neurophysiologic findings imply increased activity in the frontal attentional system, with additional studies needed to confirm this hypothesis. A related clinical study assessed the impact of a Yogic concentrative meditative practice on attention deficit hyperactivity disorder in adolescents, with findings indicating a substantial improvement in symptoms following a six-week training intervention (Harrison, Manoch, & Rubia, 2004). The psychological trait ‘absorption’ is related to attentional deployment and appears to have relevance to meditative practice (Tellegen & Atkinson, 1974). Absorption refers to the tendency to have episodes of total attention that occupy representational resource mechanisms, thereby leading to transient states of altered self and reality perception. The data suggest that absorption and anxiety reduction are independently related to proficiency in meditative practice, but it is not clear whether this is due to a predisposition for meditative practice or a result of such practice (Davidson, Goleman, & Schwartz, 1976). Further research assessing the neurophysiologic functioning of meditators with regard to absorption might be of benefit in characterizing the individual differences for the range of brain and mind responses to meditative training (Ott, 2003).

Perceptual sensitivity is a psychological domain that appears to be impacted by meditation (Goleman, 1996). The ERP studies reviewed above are consonant with the general view that meditation may lead to improvements in perceptual acuity and/or processing, but rigorous tests of perception effects are scarce. A study on perceptually ambiguous visual stimuli with a binocular rivalry task demonstrated that one-pointed concentrative meditation may stabilize one of the perceptual possibilities in awareness (Carter et al., 2005). More germane to reports of enhance perceptual clarity, visual sensitivity threshold to short light flashes was lower in mindfulness meditators than controls, and a three-month intensive mindfulness meditation retreat seemed to produce further decreases in threshold (Brown et al., 1984a, 1984b). Studies of yogic concentrative meditation (Sahaj Yoga) have found that children, young adults, and adults all evince improvements in critical flicker fusion frequency after training compared to control groups who did not undergo such training (Raghuraj & Telles, 2002; Telles, Nagrathna, & Nagendra, 1995; Manjunath & Telles, 1999). Visual contrast sensitivity was also shown to increase secondary to Sahaj Yoga training in a group of epileptic dults (Panjwani et al., 2000). The long-standing descriptions of the enhancement of the perceptual field due to meditation combined with the suggestive effects reviewed here and the consistency with event-related potential findings warrant further studies of perceptual acuity, preferably in combination with neurophysiologic monitoring.

A considerable body of research supports the idea that meditative training can mitigate the effects of anxiety and stress on psychological and physiological functioning. The functional plasticity of the central nervous system affords significant neurophysiologic state changes that may evolve into trait effects secondary to the long hours of practice, stylized attentional deployment, reframing of cognitive context, and emotional regulation involved in meditative training (R. J. Davidson, 2000). This possibility is consonant with the relationships among increased stress, increased corticosteroid levels, and inhibition of hippocampal neurogenesis (McEwen, 1999). Meditation decreases experienced stress load (Carlson, Speca, Patel, & Goodey, 2003; Gaylord, Orme-Johnson, & Travis, 1989; Holmes, 1984; Kabat-Zinn et al., 1992; Lehrer, Schoicket, Carrington, & Woolfolk, 1980), which appears related to decreased cortisol and catecholamine levels (Carlson, Speca, Patel, & Goodey, 2004; Infante et al., 1998; Infante et al., 2001; Kamei et al., 2000; MacLean et al., 1997; MacLean et al., 1994; Michaels, Parra, McCann, & Vander, 1979; Sudsuang, Chentanez, & Veluvan, 1991).

Some studies with meditators have assessed physiological responses to stressful stimuli, which is particularly relevant given the purported benefits of decreased automatization and reactivity combined with greater calm and compassion due to meditation (Kabat- Zinn, 1990; Goleman, 2003; Mahesh Yogi, 1963). Meditators exhibited a quicker return to baseline for heart rate and skin conductance measures after exposure to stressful film clips (Schwartz & Goleman, 1976). Meditators also were shown to lack frontal gamma induction found for non-meditators in response to stressful film clips (Aftanas & Golocheikine, 2005). These studies are preliminary but provide motivation to further study neurophysiologic response to emotionally challenging stimuli. Mindfulness-based practices have produced positive clinical outcomes for anxiety, immune-protective functioning assays, pain, and stress-related skin disorders (Beauchamp-Turner & Levinson, 1992; Carlson, Speca, Patel, & Goodey, 2003, 2004; R. J. Davidson et al., 2003; Kabat-Zinn, 1982, 2003; Kabat-Zinn, Lipworth, & Burney, 1985; Kabat-Zinn et al., 1998; J. J. Miller, Fletcher, & Kabat-Zinn, 1995; S. L. Shapiro & Walsh, 2003). These results are consistent with the hypothesis that meditation induces a significant reorganization of frontal hemispheric activity associated with emotional reactivity and outlook perhaps related to the increases in theta and alpha EEG activation (R. J. Davidson et al., 2003; Dunn, Hartigan, & Mikulas, 1999; Lazar et al., 2003).

Concentrative practices also have been examined in medical contexts (Castillo-Richmondet al., 2000; Murthy, Gangadhar, Janakiramaiah, & Subbakrishna, 1998; Schneider, 1995; Zamarra, 1996), with low-effort mantra-based TM the most frequently evaluated as a complementary therapy that contributes to decreasing the impact of stress (Gelderloos, Walton, Orme-Johnson, & Alexander, 1991; Jevning, Wallace, & Beidebach, 1992; Walton, Pugh, Gelderloos, & Macrae, 1995). In this context, it would be helpful to obtain concurrent neurophysiologic measures with the assessment of medical and/or psychological outcome in order to characterize the neural mediating factors associated with clinical improvement. Examples of this approach include observed left-over-right asymmetry shifts of frontal activity that correlated with increases in immune measures secondary to mindfulness meditation training (Davidson et al., 2003), as well as increased in auditory P300 amplitude correlated with improvements in depression in response to yogic meditation (Murthy et al., 1997, 1998). Further research into meditation and the biological mechanisms of stress/emotional reactivity would provide needed substantiation for theories implicating such practice in the functional reorganization of stress-related limbic structures (Esch, Guarna, Bianchi, Zhu, & Stefano, 2004).

Meditative practices employing mental role-playing and the generation of specific sustained feelings or intentions of love/compassion have begun to be investigated (Goleman, 2003; Lehmann et al., 2001; Lutz, Greischar, Ricard, Converse, & Davidson, 2003). However, meditation effects on emotional functioning have not been extensively explored with neuroimaging methods, even though clinical studies suggest that the psychological variable mindfulness is enhanced through meditative practice and seems to powerfully mitigate susceptibility to depression. In particular, Mindfulness-Based Cognitive Therapy, which commonly incorporates mindfulness meditation, has been successful in treating depression (Ma & Teasdale, 2004; O. Mason & Hargreaves, 2001; Rohan, 2003; Segal, Williams, & Teasdale, 2002; Teasdale, Segal, & Williams, 1995; Teasdale et al., 2000). The specific effects appear related to the prevention of depression relapse in patients already experiencing three or more previous depressive episodes (Teasdale et al., 2000).

The psychological variable most associated with the increased resistance to depression after Mindfulness-Based Cognitive Therapy is “metacognitive awareness,” the shift towards experiencing negative thoughts as observable mental contents rather than the self (Teasdale et al., 2002). As with stress, depression is linked to increased cortisol and decreased hippocampal neurogenesis (E. S. Brown, Rush, & McEwen, 1999; Gould, Tanapat, Rydel, & Hastings, 2000; B. L. Jacobs, 2002; Malberg & Duman, 2003; Thomas & Peterson, 2003; Vollmayr, Simonis, Weber, Gass, & Henn, 2003), implicating meditative training in eliciting a cascade of neuroprotective events that are possibly related to the enhancement of the frontal attentional control system and/or the decreased arousal associated with alpha increases. The increase in metacognitive awareness that seems associated with the efficacy of mindfulness-based approaches to therapy is difficult to reconcile with current neuroimaging data but appears related to the fundamental goals of meditative practice in producing lasting impact on the self-non-self-relationship (Austin, 2000; Levenson, Jennings, Aldwin & Shiraishi, 2005; Walsh, 1982). The recent development of a number of experimental paradigms aiming to assess the subtleties of self-referential processing in health and illness provide a means to quantify further psychometrically-derived claims for changes in self-experience with brain-based measures (Kircher & David, 2003; Kircher et al., 2000; Lou et al., 2004; Platek, Keenan, Gallup, & Mohamed, 2004).

Understanding the state and trait neurophysiologic and psychological changes induced through meditative practices requires better psychometric assessment of the elicited states and traits. Several investigators have produced such measures for both state and trait changes (Brown & Ryan, 2003; Buchheld, Grossman, & Walach, 2001; Levenson et al., 2005; Ott, 2001; Piron, 2001). Such trait-based research suggests that the psychological variable mindfulness, which has influenced theories of psychological intervention, is increased after meditative training and associated with the experience of well-being (Brown & Ryan, 2003). A recent proposal to pare down altered states of consciousness into a four-dimensional "state space" consisting of activation, awareness span, self-awareness, and sensory dynamic constructs is an appealing proposal for meditation research as well (Vaitl et al., 2005). This approach provides encompassing signatures of experienced state that may map more easily than higher dimensional state spaces onto neurophysiologic differences, although this limited four-dimensional space may not adequately address the full range of alterations induced by meditation (Travis, Arenander & DuBois, 2004; Walsh, 1982; Wilber, Engler, & Brown, 1986).

Given the wide range of possible meditation methods and resulting states, it seems likely that different practices will produce different psychological effects and also that different psychological types will respond with different psychobiological alterations. Indeed, recent reports have shown that novices in Zen meditation demonstrated low trait anxiety correlated with frontal alpha coherence effects (Murata et al., 2004), whereas novelty seeking scores correlated with frontal alpha power increases and harm avoidance scores correlated with frontal theta increases (Takahashi et al., 2005). These findings are preliminary in nature but serve as a potentially important model for how psychological set may be related to meditation state neurophysiology. Quantification of the trait changes elicited by given different mental sets may foster insight into specific avenues of meditation's psychobiologic impact, with rigorous comparison of techniques needed to identify specific psychological outcomes.

ADDITIONAL FUTURE DIRECTIONS

As outlined above, several recent studies have suggested that different meditation practices lead to different neurophysiologic outcomes, so that the neurophenomenological comparison of meditative practices with other methods of altered state induction are becoming warranted to isolate the functional brain activity associated with psychological states. Assessments of psychological changes, clinical outcomes, and state-trait neuroactivity markers across meditative practices will be necessary for developing the clinical utility of these methods. Targeted assays of theta, alpha, and gamma power as well as coherence effects in both state and trait studies of meditation will help establish a necessary data base for future applications. A major challenge for basic meditation research remains the clear quantitative differentiation and topographic mapping of the difference between meditation and early sleep stages. The most widely found state effects of meditation—periods of alpha and theta enhancement—overlap significantly with early drowsing and sleep states (Corby, Roth, Zarcone, & Kopell, 1978; Pagano, Rose, Stivers, & Warrenburg, 1976; Rechtschaffen & Kales, 1968; Younger, Adriance, & Berger, 1975). The increases in theta power observed in some long-term meditators may be related to learning to hold awareness at a level of physiological processing similar but not identical to sleep Stage I.

Awareness maintenance practice may enhance awareness even as deep sleep develops thereby affecting associated neurophysiologic markers. This hypothesis provides a phenomenological link between the physiological similarities of the meditative and sleep-related states. In both cases there is an increased access to a witnessing awareness of state. It may be that the difference between the slow activity in meditative practices and that of normal sleep reflects the distribution of theta *versus* alpha power changes, the increases in theta and alpha coherence during meditation *versus* decreases during sleep, and possibly the high frequency activity that accompanies increases in low frequency power with meditation practice that are decreased in sleep. The theta increase in meditative states is the frontal midline theta generated by the anterior cingulate, dorsal, and medial prefrontal cortices (Aftanas & Golocheikine, 2001; Asada, Fukuda, Tsunoda, Yamaguchi, & Tonoike, 1999;

Hebert & Lehmann, 1977; Ishii et al., 1999). The theta typically seen at the transition from Stage I to Stage II sleep is less stable across time and also originates from more widespread sources. A comprehensive empirical distinction of these two increased theta states could provide a much needed differentiation between the phenomenology of meditative experience and that of sleep.

CONCLUSION

Meditation states and traits are being explored with neuroelectric and other neuroimaging methods. The findings are becoming more cohesive and directed, even though a comprehensive empirical and theoretical foundation is still emerging. Central nervous system function is clearly affected by meditation, but the specific neural changes and differences among practices are far from clear. The likelihood for clinical utility of meditation practice in conjunction with psychological and neuropharmacological therapies is a strong impetus for future studies. The present review has attempted to set the stage for this development by providing an organized state-of-the-art summary of how meditation affects the brain.

REFERENCES

West, M. A. (1987). The psychology of meditation. New York: Clarendon Press.

Shapiro, D. H., & Walsh, R. N. (1984). Meditation: Classical and contemporary perspectives. New York: Aldine.

Davidson, R. J., & Goleman, D. J. (1977). The role of attention in meditation and hypnosis: A psychobiological perspective on transformations of consciousness. International Journal of Clinical and Experimental Hypnosis, 25, pp. 291–308.

Kubose, S. K. (1976). An experimental investigation of psychological aspects of meditation. Psychologia, 19, pp. 1–10.

Linden, W. (1973). Practicing of meditation by school children and their levels of field dependence-independence, test anxiety and reading achievement. Journal of Consulting and Clinical Psychology, 41, pp. 139–143.

Rani, N. J., & Rao, P. V. K. (1996). Meditation and attention regulation. Journal of Indian Psychology, 14, pp. 26–30

Valentine, E. R., & Sweet, P. L. G. (1995). Meditation and attention: A comparison of the effects of concentrative and mindfulness meditation on sustained attention. Mental Health, Religion and Culture, 2, pp. 59–70.

Wilkins, A., Shallice, T., & McCarthy, R. (1987). Frontal lesions and sustained attention. Neuropsychologia, 25, pp. 359 –365.

Sabel, B. (1980). Transcendental meditation and concentration ability. Perceptual and Motor Skills, 50, pp. 799–802.

Travis, F., Tecce, J. J., & Guttman, J. (2000). Cortical plasticity, contingent negative variation, and transcendent experiences during practice of the transcendental meditation technique. Biological Psychology, 55, pp. 41–55.

Travis, F., Tecce, J., Arenander, A., & Wallace, R. K. (2002). Patterns of EEG coherence, power, and contingent negative variation characterize the integration of transcendental and waking states. Biological Psychology, 61, pp. 293–319.

Harrison, L. J., Manoch, R., & Rubia, K. (2004). Sahaja yoga meditation as a family treatment programme for children with attention deficithyperactivity disorder. Clinical Child Psychology and Psychiatry, 9, pp. 479 – 497.

Tellegen, A., & Atkinson, G. (1974). Openness to absorbing experience and self-altering experiences (“absorption”), a trait related to hypnotic susceptibility. Journal of Abnormal Psychology, 83, pp. 268 –277.

Davidson, R. J., Goleman, D., & Schwartz, G. E. (1976). Attentional and affective concomitants of meditation: A cross-sectional study. Journal of Abnormal Psychology, 85, pp. 235–238.

Goleman, D. J. (1996). The meditative mind: Varieties of meditative experience. New York: Penguin Putnam.

Carter, O., Presti, D., Callistemon, C., Ungerer, Y., Liu, G., & Pettigrew, J. (2005). Meditation alters perceptual rivalry in Tibetan Buddhist monks. Current Biology, 15, pp. R412–R413

Brown, D. P., Forte, M., & Dysart, M. (1984a). Differences in visual sensitivity among mindfulness meditators and non-meditators. Perceptual and Motor Skills, 58, pp. 727–733.

Brown, D. P., Forte, M., & Dysart, M. (1984b). Visual sensitivity and mindfulness meditation. Perceptual and Motor Skills, 58, pp. 775–784.

Raghuraj, P., & Telles, S. (2002). Improvement in spatial and temporal measures of visual perception following yoga training. Journal of Indian Psychology, 20, pp. 23–31.

Telles, S., Nagarathna, R., & Nagendra, H. R. (1995). Improvement in visual perception following yoga training. Journal of Indian Psychology, 13, pp. 30–32.

Manjunath, N. K., & Telles, S. (1999). Improvement in visual perceptual sensitivity in children following yoga training. Journal of Indian Psychology, 17, pp. 41–45.

Panjwani, U., Selvamurthy, W., Singh, S. H., Gupta, H. L., Mukhopadhyay, S., & Thakur, L. (2000). Effect of Sahaja yoga meditation on auditory evoked potentials (AEP) and visual contrast sensitivity (VCS) in epileptics. Applied Psychophysiology and Biofeedback, 25, pp. 1–12.

Davidson, R. J. (2000). Affective style, psychopathology, and resilience: Brain mechanisms and plasticity. American Psychologist, 55, pp. 1196–1214.

McEwen, B. S. (1999). Stress and hippocampal plasticity. Annual Review of Neuroscience, 22, pp. 105–122.

Carlson, L. E., Speca, M., Patel, K. D., & Goodey, E. (2003). Mindfulness based stress reduction in relation to quality of life, mood, symptoms of stress, and immune parameters in breast and prostate cancer outpatients. Psychosomatic Medicine, 65, pp. 571–581.

Gaylord, C., Orme-Johnson, D., & Travis, F. (1989). The effects of the transcendental meditation technique and progressive muscle relaxation on EEG coherence, stress reactivity, and mental health in black adults. International Journal of Neuroscience, 46, pp. 77–86.

Holmes, D. S. (1984). Meditation and somatic arousal reduction. A review of the experimental evidence. American Psychologist, 39, pp. 1–10

Kabat-Zinn, J., Massion, A. O., Kristeller, J., Peterson, L. G., Fletcher, K. E., Pbert, L., et al. (1992). Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. American Journal of Psychiatry, 149, pp. 936–943.

Lehrer, P. M., Schoicket, S., Carrington, P., & Woolfolk, R. L. (1980). Psychophysiological and cognitive responses to stressful stimuli in subjects practicing progressive relaxation and clinically standardized meditation. Behaviour Research and Therapy, 18, pp. 293–303.

Carlson, L. E., Speca, M., Patel, K. D., & Goodey, E. (2004). Mindfulness based stress reduction in relation to quality of life, mood, symptoms of stress and levels of cortisol, dehydroepiandrosterone sulfate (DHEAS) and melatonin in breast and prostate cancer outpatients. psych neuroendocrinology, 29, pp. 448–474.

Infante, J. R., Peran, F., Martinez, M., Roldan, A., Poyatos, R., Ruiz, C., et al. (1998). ACTH and beta-endorphin in transcendental meditation. Physiology and Behavior, 64, pp. 311–315.

Infante, J. R., Torres-Avisbal, M., Pinel, P., Vallejo, J. A., Peran, F., Gonzalez, F., et al. (2001). Catecholamine levels in practitioners of the transcendental meditation technique. Physiology and Behavior, 72, pp. 141–146.

Kamei, T., Toriumi, Y., Kimura, H., Ohno, S., Kumano, H., & Kimura, K. (2000). Decrease in serum cortisol during yoga exercise is correlated with alpha wave activation. Perceptual and Motor Skills, 90, pp. 1027–1032.

MacLean, C. R., Walton, K. G., Wenneberg, S. R., Levitsky, D. K., Mandarino, J. P., Waziri, R., et al. (1997). Effects of the transcendental meditation program on adaptive mechanisms: Changes in hormone levels and responses to stress after 4 months of practice. psych neuroendocrinology, 22, pp. 277–295.

MacLean, C. R., Walton, K. G., Wenneberg, S. R., Levitsky, D. K., Mandarino, J. V., Waziri, R., et al. (1994). Altered responses of cortisol, GH, TSH and testosterone to acute stress after four months' practice of transcendental meditation (TM). In E. Ronald de Kloet & Efrain C. Azmitia (Ed.), Annals of the New York Academy of Sciences: Vol. 746. Brain corticosteroid receptors: studies on the mechanism, function, and neurotoxicity of corticosteroid action (pp. 381–384). New York: New York Academy of Sciences.

Michaels, R. R., Parra, J., McCann, D. S., & Vander, A. J. (1979). Renin, cortisol, and aldosterone during transcendental meditation. Psychosomatic Medicine, 41, pp. 50–54.

Sudsuang, R., Chentanez, V., & Veluvan, K. (1991). Effect of Buddhist meditation on serum cortisol and total protein levels, blood pressure, pulse rate, lung volume and reaction time. Physiology and Behavior, 50, pp. 543–548.

Kabat-Zinn, J. (1990). Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness. New York: Dell.

Goleman, D. J. (2003). Destructive emotions: How can we overcome them? A scientific dialogue with the Dalai Lama. New York: Bantam Books

Mahesh Yogi, M. (1963). The science of being and art of living. New York: Penguin Books.

Aftanas, L. I., & Golocheikine, S. A. (2005). Impact of regular meditation practice on EEG activity at rest and during evoked negative emotions. International Journal of Neuroscience, 115, pp. 893–909.

Beauchamp-Turner, D. L., & Levinson, D. M. (1992). Effects of meditation on stress, health, and affect. Medical Psychotherapy: An International Journal, 5, pp. 123–131.

Carlson, L. E., Speca, M., Patel, K. D., & Goodey, E. (2003). Mindfulness based stress reduction in relation to quality of life, mood, symptoms of stress, and immune parameters in breast and prostate cancer outpatients. Psychosomatic Medicine, 65, pp. 571–581

Carlson, L. E., Speca, M., Patel, K. D., & Goodey, E. (2004). Mindfulness based stress reduction in relation to quality of life, mood, symptoms of stress and levels of cortisol, dehydroepiandrosterone sulfate (DHEAS) and melatonin in breast and prostate cancer outpatients. Psych neuroendocrinology, 29, pp. 448 – 474.

Davidson, R. J. (2003). Affective neuroscience and psychophysiology: Toward a synthesis. Psychophysiology, 40, pp. 655–665.

Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. General Hospital Psychiatry, 4, pp. 33–47

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. Clinical Psychology: Science and Practice, 10, pp. 144 –158.

Kabat-Zinn, J., Lipworth, L., & Burney, R. (1985). The clinical use of mindfulness meditation for the self-regulation of chronic pain. Journal of Behavioral Medicine, 8, pp. 163–190.

Kabat-Zinn, J., Wheeler, E., Light, T., Skillings, A., Scharf, M. J., Cropley, T. G., et al. (1998). Influence of a mindfulness meditation-based stress reduction intervention on rates of skin clearing in patients with moderate to severe psoriasis undergoing phototherapy (UVB) and photochemotherapy (PUVA). Psychosomatic Medicine, 60, pp. 625–632.

Miller, J. J., Fletcher, K., & Kabat-Zinn, J. (1995). Three-year follow-up and clinical implications of a mindfulness meditation-based stress reduction intervention in the treatment of anxiety disorders. General Hospital Psychiatry, 17, pp. 192–200.

Shapiro, S. L., & Walsh, R. (2003). An analysis of recent meditation research and suggestions for future directions. Humanistic Psychologist, 31, pp. 86 –114.

Dunn, B. R., Hartigan, J. A., & Mikulas, W. L. (1999). Concentration and mindfulness meditations: Unique forms of consciousness? Applied Psychophysiology and Biofeedback, 24, pp. 147–165.

Lazar, S. W., Rosman, I. S., Vangel, M., Rao, V., Dusek, H., Benson, H., et al. (2003, November). Functional brain imaging of mindfulness and mantra-based meditation. Paper presented at the meeting of the Society for Neuroscience, New Orleans, LA.

Castillo-Richmond, A., Schneider, R. H., Alexander, C. N., Cook, R., Myers, H., Nidich, S., et al. (2000). Effects of stress reduction on carotid atherosclerosis in hypertensive African Americans. Stroke, 31, pp. 568–573.

Murthy, P. J., Gangadhar, B. N., Janakiramaiah, N., & Subbakrishna, D. K. (1998). P300 amplitude and antidepressant response to Sudarshan Kriya yoga (SKY). Journal of Affective Disorders, 50, pp. 45–48.

Schneider, R. H., Staggers, F., Alexander, C. N., Sheppard, W., Rainforth, M., Kondwani, K., et al. (1995). A randomized controlled trial of stress reduction for hypertension in older African Americans. Hypertension, 26, pp. 820–827.

Zamarra, J. W., Schneider, R. H., Besseghini, I., Robinson, D. K., & Salerno, J. W. (1996). Usefulness of the transcendental meditation program in the treatment of patients with coronary artery disease. American Journal of Cardiology, 77, pp. 867–870.

Gelderloos, P., Walton, K. G., Orme-Johnson, D. W., & Alexander, C. N. (1991). Effectiveness of the transcendental meditation program in preventing and treating substance misuse: A review. International Journal of the Addictions, 26, pp. 293–325.

Jevning, R., Wallace, R. K., & Beidebach, M. (1992). The physiology of meditation: A review. A wakeful hypometabolic integrated response. Neuroscience and Biobehavioral Reviews, 16, pp. 415–424

Walton, K. G., Pugh, N. D., Gelderloos, P., & Macrae, P. (1995). Stress reduction and preventing hypertension: Preliminary support for a psychoneuroendocrine mechanism. Journal of Alternative and Complementary Medicine, 1, pp. 263–283.

Murthy, P. J., Gangadhar, B. N., Janakiramaiah, N., & Subbakrishna, D. K. (1997). Normalization of P300 amplitude following treatment in dysthymia. Biological Psychiatry, 42, pp. 740 – 743.

Esch, T., Guarna, M., Bianchi, E., Zhu, W., & Stefano, G. B. (2004). Commonalities in the central nervous system's involvement with complementary medical therapies: Limbic morphinergic processes. Medical Science Monitor, 10, pp. MS6 –17.

Lehmann, D., Faber, P. L., Achermann, P., Jeanmonod, D., Gianotti, L. R., & Pizzagalli, D. (2001). Brain sources of EEG gamma frequency during volitionally meditation-induced, altered states of consciousness, and experience of the self. Psychiatry Research, 108, pp. 111–121.

Lutz, A., Greischar, L., Ricard, M., Converse, A., & Davidson, R. J. (2003, November). Comparative study of synchrony patterns during three meditative states: Preliminary data. Paper presented at the meeting of the Society for Neuroscience, New Orleans, LA.

Ma, S. H., & Teasdale, J. D. (2004). Mindfulness-based cognitive therapy for depression: Replication and exploration of differential relapse prevention effects. Journal of Consulting and Clinical Psychology, 72, pp. 31–40.

Mason, O., & Hargreaves, I. (2001). A qualitative study of mindfulnessbased cognitive therapy for depression. British Journal of Medical Psychology, 74, pp. 197–212.

Rohan, K. J. (2003). Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse and overcoming resistance in cognitive therapy. Psychiatry: Interpersonal & Biological Processes, 66, pp. 272–281

Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2002). Mindfulness based cognitive therapy for depression: A new approach to preventing relapse. New York: Guilford Press

Teasdale, J. D., Segal, Z., & Williams, J. M. G. (1995). How does cognitive therapy prevent depressive relapse and why should attentional control (mindfulness) training help? Behaviour Research and Therapy, 33, pp. 25–39.

Teasdale, J. D., Segal, Z. V., Williams, J. M. G., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A. (2000). Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. Journal of Consulting and Clinical Psychology, 68, pp. 615– 623.

Brown, E. S., Rush, A. J., & McEwen, B. S. (1999). Hippocampal remodeling and damage by corticosteroids: Implications for mood disorders. Neuropsychopharmacology, 21, pp. 474–484.

Gould, E., Tanapat, P., Rydel, T., & Hastings, N. (2000). Regulation of hippocampal neurogenesis in adulthood. Biological Psychiatry, 48, pp. 715–720.

Jacobs, B. L. (2002). Adult brain neurogenesis and depression. Brain, Behavior, and Immunity, 16, pp. 602– 609.

Malberg, J. E., & Duman, R. S. (2003). Cell proliferation in adult hippocampus is decreased by inescapable stress: Reversal by fluoxetine treatment. Neuropsycho pharmacology, 28, pp. 1562–1571.

Thomas, R. M., & Peterson, D. A. (2003). A neurogenic theory of depression gains momentum. Molecular Intervention, 3, pp. 441–444.

Vollmayr, B., Simonis, C., Weber, S., Gass, P., & Henn, F. (2003). Reduced cell proliferation in the dentate gyrus is not correlated with the development of learned helplessness. Biological Psychiatry, 54, pp. 1035–1040.

Austin, J. H. (2000). Consciousness evolves when the self dissolves. Journal of Consciousness Studies, 7, pp. 209–230.

Levenson, M. R., Jennings, P. A., Aldwin, C. M., & Shiraishi, R. W. (2005). Self-transcendence: Conceptualization and measurement. International Journal of Aging and Human Development, 60, pp. 127–143.

Walsh, R. (1982). The original goals of meditation. American Journal of Psychiatry, 139, pp. 1525–1526.

Kircher, T. T., & David, A. (Eds.). (2003). The self in neuroscience and psychiatry. Cambridge, UK: Cambridge University Press.

Kircher, T. T., Senior, C., Phillips, M. L., Benson, P. J., Bullmore, E. T., & Brammer, M., et al. (2000). Towards a functional neuroanatomical of self-processing: Effects of faces and words. Cognitive Brain Research, 10, pp. 133–144.

Lou, H. C., Luber, B., Crupain, M., Keenan, J. P., Nowak, M., Kjaer, T. W., et al. (2004). Parietal cortex and representation of the mental self. Proceedings of the National Academy of Sciences, USA, 101, pp. 6827–6832.

Platek, S. M., Keenan, J. P., Gallup, G. G., & Mohamed, F. B. (2004). Where am I? The neurological correlates of self and other. Cognitive Brain Research, 19, pp. 114–122.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. Journal of Personality and Social Psychology, 84, pp. 822– 848.

Buchheld, N., Grossman, P., & Walach, H. (2001). Measuring mindfulness in insight meditation (Vipassana) and meditation-based psychotherapy: The development of the Freiburg Mindfulness Inventory (FMI). Journal for Meditation and Meditation Research, 1, pp. 11–34.

Ott, U. (2001). The EEG and the depth of meditation. Journal for Meditation and Meditation Research, 1, pp. 55–68

Piron, H. (2001). The meditation depth index (MEDI) and the meditation depth questionnaire (MEDEQ). Journal for Meditation and Meditation Research, 1, pp. 69–92.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. Journal of Personality and Social Psychology, 84, pp. 822– 848

Vaitl, D., Birbaumer, N., Gruzelier, J., Jamieson, G. A., Kotchoubey, B., Kubler, A., et al. (2005). Psychobiology of altered states of consciousness. Psychological Bulletin, 131, pp. 98 –127.

Travis, F., Arenander, A., & DuBois, D. (2004). Psychological and physiological characteristics of a proposed object-referral/self-referral continuum of self-awareness. Consciousness and Cognition, 13, pp. 401– 420

Wilber, K., Engler, J., & Brown, D. P. (1986). Transformations of consciousness: Conventional and contemplative perspectives on development. Boston: Shambhala

Murata, T., Takahashi, T., Hamada, T., Omori, M., Kosaka, H., Yoshida, H., & Wada, Y. (2004). Individual trait anxiety levels characterizing

Takahashi, T., Murata, T., Hamada, T., Omori, M., Kosaka, H., Kikuchi, M., et al.. (2005). Changes in EEG and autonomic nervous activity during meditation and their association with personality traits. International Journal of Psychophysiology, 55, pp. 199 –207.

Corby, J. C., Roth, W. T., Zarcone, V. P., Jr., & Kopell, B. S. (1978). Psychophysiological correlates of the practice of tantric yoga meditation. Archives of General Psychiatry, 35, pp. 571–577.

Pagano, R. R., Rose, R. M., Stivers, R. M., & Warrenburg, S. (1976). Sleep during transcendental meditation. Science, 191, pp. 308 –310.

Rechtschaffen, A., & Kales, A. (1968). A manual of standardized terminology, techniques, and scoring system for sleep stages of human subjects. Los Angeles: BIS/BRI University of California, Los Angeles.

Younger, J., Adriance, W., & Berger, R. J. (1975). Sleep during transcendental meditation. Perceptual and Motor Skills, 40, pp. 953–954.

Aftanas, L. I., & Golocheikine, S. A. (2001). Human anterior and frontal midline theta and lower alpha reflect emotionally positive state and internalized attention: High-resolution EEG investigation of meditation. Neuroscience Letters, 310, pp. 57– 60.

Asada, H., Fukuda, Y., Tsunoda, S., Yamaguchi, M., & Tonoike, M. (1999). Frontal midline theta rhythms reflect alternative activation of prefrontal cortex and anterior cingulate cortex in humans. Neuroscience Letters, 274, pp. 29 –32.

Hebert, R., & Lehmann, D. (1977). Theta bursts: An EEG pattern in normal subjects practicing the transcendental meditation technique. Electroencephalography and Clinical Neurophysiology, 42, pp. 397– 405.

Ishii, R., Shinosaki, K., Ukai, S., Inouye, T., Ishihara, T., Yoshimine, T., et al. (1999). Medial prefrontal cortex generates frontal midline theta rhythm. Neuro Report, 10, pp. 675– 679.

Corresponding Author

Mr. Amit Kumar Singh*

Mr. Amit Kumar Singh*

Assistant Professor, Department of Physical Education, Government Degree College, Tilhar Shahjahanpur (U.P.)