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Effects of Hatha Yoga and Omkar Meditation on Cardiorespiratory Performance, Psychologic Profile, and Melatonin Secretion

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ABSTRACT

Objectives: To evaluate effects of Hatha yoga and Omkar meditation on cardiorespiratory performance, psychologic profile, and melatonin secretion.

Subjects and methods: Thirty healthy men in the age group of 25–35 years volunteered for the study. They were randomly divided in two groups of 15 each. Group 1 subjects served as controls and performed body flexibility exercises for 40 minutes and slow running for 20 minutes during morning hours and played games for 60 minutes during evening hours daily for 3 months. Group 2 subjects practiced selected yogic asanas (postures) for 45 minutes and pranayama for 15 minutes during the morning, whereas during the evening hours these subjects performed preparatory yogic postures for 15 minutes, pranayama for 15 minutes, and meditation for 30 minutes daily, for 3 months. Orthostatic tolerance, heart rate, blood pressure, respiratory rate, dynamic lung function (such as forced vital capacity, forced expiratory volume in 1 second, forced expiratory volume percentage, peak expiratory flow rate, and maximum voluntary ventilation), and psychologic profile were measured before and after 3 months of yogic practices. Serial blood samples were drawn at various time intervals to study effects of these yogic practices and Omkar meditation on melatonin levels.

Results: Yogic practices for 3 months resulted in an improvement in cardiorespiratory performance and psychologic profile. The plasma melatonin also showed an increase after three months of yogic practices. The systolic blood pressure, diastolic blood pressure, mean arterial pressure, and orthostatic tolerance did not show any significant correlation with plasma melatonin. However, the maximum night time melatonin levels in yoga group showed a significant correlation ($r = 0.71$, $p < 0.05$) with well-being score.

Conclusion: These observations suggest that yogic practices can be used as psychophysiologic stimuli to increase endogenous secretion of melatonin, which, in turn, might be responsible for improved sense of well-being.

INTRODUCTION

Yoga, an ancient culture of Indian heritage, when adopted as a way of life is claimed to bestow the practitioner with ideal physical, mental, intellectual, and spiritual health. As a result, yoga is fast emerging as a new discipline for integrating mind and body into harmony. Regular yogic practices have been shown to cause profound improvement in cardiorespiratory (Udupa et al., 1975), thermoregulatory (Selvamurthy et al., 1983a), body flexibility, and psychologic functions such as mental performance, improvement of memory, and creation of a sense of well-being (Ray et al., 2001). Yogic practices have been also found to be most useful in alleviating stress-induced disorders such as insomnia, anxiety, depression (Selvamurthy et al., 1983b, 1998), hypertension (Murugesan et al., 2000), bronchial

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asthma (Sathyaprabha et al., 2001), diabetes (Telles and Naveen, 1997), and coronary artery disease (Manchanda et al., 2000; Ornish et al., 1998). Normal healthy subjects practicing yoga for a short period without rigorous discipline of yogic life have been demonstrated to show an improvement in lipid and carbohydrate metabolism (Joseph et al., 1981), cardiorespiratory performance (Nayar et al., 1975), and psychologic function (Ray et al., 2001). These effects of yogic practices appear to be mediated through an interaction between the autonomic nervous system and endocrine system, wherein pineal secretion of melatonin may be playing an important role. Melatonin is known not only to synchronize the organism to changing day and night cycle but has been also demonstrated to cause sleep-induced relaxation (James et al., 1987; Waldhauser et al. 1990), lowers cholesterol levels (Hoyos et al., 2000), prevents platelet aggregation (Kornblihtt et al., 1993), stimulates immune system (Akbulut et al., 2001), and is one of the most potent antioxidant hormone (Gitto et al., 2001). Administration of melatonin has been also shown to decrease blood pressure and influence central cardiovascular regulatory mechanism such as lowering of baroreflex set point (Kitajima et al., 2001). It is possible that yogic practices might be influencing pineal secretion of melatonin, which in turn may be responsible for some of the effects of yoga and meditation. Therefore, the present study has been undertaken to evaluate effects of yoga and meditation on cardiorespiratory function, psychologic profile, and melatonin secretion.

MATERIALS AND METHODS

Thirty (30) healthy normotensive male volunteers, of 25–35 years of age, mean ± standard error of the mean (SEM), 29.6 ± 0.89, were randomly selected for the study. It was ensured that none of the subject selected had any metabolic or endocrine disease and were not having previous experience of yoga and meditation. All were army soldiers working in the same unit receiving identical diet (3000–3500 kcal). The study was approved by the institute's ethical committee and informed consent was obtained from all the subjects.

The subjects were randomly divided in 2 groups of 15 each using a table of random numbers. Group 1 subjects served as control and performed routine army physical training (PT) exercise daily for 1 hour in the morning and 1 hour in the evening. These exercises consisted of body flexibility exercises for 40 minutes and slow running for 20 minutes during morning hours and games for 1 hour in the evening. Group 2 subjects performed only yoga and meditation, consisting of selected yogic asanas (yogic postures/exercises) for 45 minutes and pranayama (yogic breathing exercises) for 15 minutes in the morning whereas during the evening hours these subjects practiced preparatory yogic postures for 15 minutes, pranayama for 15 minutes, and meditation for 30 minutes daily for 3 months under the supervision of two qualified instructors from Morarji Desai National Institute of Yoga, New Delhi (Table 1A, B). The yogic asanas, pranayama, and meditation were performed as described earlier from this laboratory (Joseph et al., 1981; Ray et al., 2001; Selvamurthy et al., 1983). The sequence of practice of the yogasanas is listed in Table 1A. The posture of each asana was maintained for approximately 2 minutes. The shavasana was intermittently practiced for about 2 minutes after completing four asanas in this sequence. Subjects were instructed to perform these asanas in a relaxed state of mind, being fully conscious of the physical movements. During the morning hours subjects practiced Bhastrika and Bhrahmari pranayama whereas during the evening hours they performed Sheetali, Sheetkari, Bhrahmari, and Nadi Shodhan pranayama. The ratio of inhalation, retention, and exhalation of breath in Nadi Shodhan pranayam was 1:2:2. The evening meditation schedule consisted of preparatory yogasanas for 15 minutes, pranayama for 15 minutes, and Omkar meditation for 30 minutes (Table 1B). The pranayama and meditation were performed in pad-

TABLE 1. DETAILS OF YOGIC PRACTICES

A. Morning yogic schedule:
Yogasanas:
1. Yogic prayer (Chanting of mantra)
2. Kapal bhati (Rapid shallow breathing)
3. Surya namaskar (Sun salutation in 12 different postures)
4. Savasan (Relaxed supine posture)
5. Suptadasan (Hands & legs stretched in supine posture)
6. Paschimotanasan (Bending forward in supine posture)
7. Ushterasan (The camel posture)
8. Shushankasan (The hare posture)
9. Veerasan (The posture of an archer)
10. Shithilasan (Relaxed prone posture)
11. Bhujangasan (Cobra posture)
12. Dhanurasan (Posture of bow)
13. Pavanmuktasan (Folding the body in supine posture)
14. Singh garjana (The lion posture)
15. Aathas (Laughing loudly)

Pranayama:
1. Bhastrika (Forceful expulsion of breath)
2. Bhrahmari (Producing buzzing sound of bee with closed ears and lips)

B. Evening meditation schedule:
Yogasanas:
1. Suptadasan (Hands & legs stretched in supine posture)
2. Viprit karani mudra (The inverted posture)
3. Yog nidra (Conscious sleep)

Pranayama
4. Sheetali (Breathing air through folded tung)
5. Sheetkari (Breathing air through teeth)
6. Bhrahmari (Producing buzzing sound of bee with closed ears and lips)
7. Nadi shodhan (Alternate nostril breathing)

Meditation
1. Omkar meditation (Om Chant)

TABLE 2. SELF "WELL-BEING" INVENTORY

Name *Age*	*Weight*	*Height*	*Marital status*	*Food habits*	*Profession* *Drinking habits*	*Smoking habits*
Yrs.	*Kg.*	*Ft.*	*Married* *Single* *Widower*	*Vegetarian* *Non-vegetarian*	*Alcohol* *Pegs* *Tea/Coffee cups daily*	*Cigarettes daily*

The questions given below are aimed to see what attitudes and interests you currently have. There are no "right" and "wrong" answers because everyone has the right to his or her own feelings and views. Your reactions will not be used for any other purpose except research. So please give the first natural answer as it comes to you.

	1 *Usually*	*2* *Often*	*3* *Sometimes*	*4* *Rarely*	*5* *Never*
1. My appetite is good:					
2. Noise awakens me:					
3. I am troubled by constipation:					
4. I find hard to keep my mind on a task:					
5. I feel fatigued:					
6. My sleep is fitful and disturbed:					
7. I enjoy good physical health:					
8. I feel happy:					
9. I experience forgetfulness:					
10. I dream about things that are best kept to myself:					
11. I feel like crying:					
12. I feel useless and unworthy:					
13. I feel frustrated:					
14. Criticism or scolding hurts me terribly:					
15. I worry about catching disease:					
16. I brood a great deal:					
17. I have spells of headache and high fever:					
18. I go to sleep without thoughts or ideas bothering me:					
19. I lack self-confidence:					
20. I enjoy mixing with others:					
21. I find difficult to start a thing:					
22. I work under great deal of tension:					
23. I am troubled by attacks of vomiting and nausea:					
24. I feel nervous:					
25. I really feel fresh in the morning after sleep:					
26. Domestic problems worry me:					
27. I experience isolation and boredom:					
28. I suffer from cold and cough:					
29. I get along well with others:					
30. I find it difficult to concentrate on the job I do:					
31. I think over trivial troubles again and again and have to make a real effort to put them out of mind:					
32. Obstacles do not deter me from my goals:					
33. Changes in weather affect my efficiency and mood:					

(*continued*)

Table 2. Self "Well-Being" Inventory (Cont'd)

	1 Usually	2 Often	3 Sometimes	4 Rarely	5 Never
34. When given a set of rules, I follow them exactly to the letter:					
35. I get hurt more by the way people say things than by what they say:					
36. I get overexcited in upsetting situations:					
37. It is difficult for me to control my fears and worries:					
38. I take things easy:					
39. Noise in darkness frightens me:					
40. While alone I worry about my near and dear ones:					
41. I am happy about my physical endurance and stamina:					
42. I have feelings of premature ageing:					
43. My keenness and interest in work is high:					
44. I feel emotionally upset:					
45. I get along with others quite well:					
46. I remain depressed and anxious:					
47. I feel discontented with my surroundings:					
48. Others are noncooperative:					
49. Medical assistance is available in time:					
50. I feel on top of the world:					

masan (sitting) posture. During meditation the subjects were asked to concentrate on the Agya Chakra presumably located near the prefrontal area and then on Sahasrar Chakra near the location of pineal gland for each breath of expiration while they chanted "OM" in a soft voice.

All the physiologic parameters were monitored in the morning between 6:00 AM and 8:00 AM under thermoneutral conditions (24 ± 2°C and 45%–55% RH) before and after 3 months of yogic training in both of the groups. The subjects reported to the laboratory at 6:00 AM and rested in a supine position for approximately 10 minutes before physiologic measurements were carried out. The heart rate (HR) was monitored from the standard configuration of limb lead electrocardiogram (ECG) (lead II) for 5 minutes using a BM 5289 (BPL-India, Banglore, India) bedside monitor. Blood pressure was measured using an arm mercury sphygmomanometer. The mean arterial pressure (MAP) was derived using the formula, diastolic pressure plus one third of pulse pressure from individual systolic and diastolic BP values. The respiratory rate (RR) was counted while the subjects were lying in the supine position. Dynamic lung functions such as forced vital capacity (FVC), forced expiratory volume in 1 second (FEV_1), forced expiratory volume percentage (FEV%), peak expiratory flow rate (PEFR), and maximum voluntary ventilation (MVV) were studied with the help of a computer-automated portable vitalograph (Vitalograph Compact, Vitalograph Ltd., Buckingham, UK). The orthostatic tolerance was evaluated to assess the effects of change of posture on the BP and HR and to quantify the vasomotor reactivity of the subjects. The BP and HR were measured while subjects were lying down and after 3 minutes of change in posture to standing position. The degree of variation of these parameters during the change in posture was analyzed using Crampton's index. In this scoring system, the highest scores are awarded to increase in BP with negligible rise in HR and subjects whose BP cannot be

Table 3. Resting Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP) in Control and Experimental Subjects

	Controls		*Yoga and meditation*	
	Before	*After*	*Before*	*After*
HR (beats/min)	58.4 ± 2.2	62.1 ± 1.9	59.2 ± 2.4	58.2 ± 2.2
SBP (mm Hg)	117.5 ± 2.3	116.0 ± 2.5	117.0 ± 1.7	107.8 ± 2.2[a]
DBP (mm Hg)	78.1 ± 2.0	76.4 ± 1.9	77.4 ± 1.9	67.8 ± 1.5[a]
MAP (mm Hg)	83.1 ± 1.9	85.9 ± 2.1	90.9 ± 1.7	80.6 ± 1.7[a]

[a]Versus before $p < 0.001$.
Values are mean ± standard error of the mean (SEM).

TABLE 4. ORTHOSTATIC TOLERANCE IN CONTROL AND YOGA GROUP

	Before	*After*
Yoga group	73.53 ± 3.4	80.01 ± 4.5[a]
Control group	72.14 ± 3.8	75.71 ± 4.9

[a]Versus before $p < 0.05$.
Values are in mean ± standard error of the mean (SEM).

maintained in spite of tachycardia get the lowest score. Anxiety was tested using IPAT Anxiety Scale questionnaire (Cattell and Scheier, 1963) and depression was measured using Minneasota Multiphasic Personality Inventory (MMPI) questionnaire (Hathaway and Charnely, 1943). Each test consisted of 40 questions, higher the score more were the anxiety and depression. The well-being was evaluated using a questionnaire to answer questions about general health, quality of sleep, mental condition and feelings towards peers and superiors (Table 2). A five-point scale was used and the total score of subjective well-being was calculated. These psychologic questionnaires were administered to both the groups together during the morning hours after the physiologic variables were recorded. Serial venous blood samples were drawn simultaneously at 8:00 AM, 12:00 PM, 1:00 PM, 2:00 PM, 12:00 AM, 2:00 AM, 3:00 AM, and 4:00 AM to study melatonin rhythmicity. Blood samples during night were collected under dim light conditions (<200 lux) to avoid light-induced inhibition of pineal melatonin synthesis. Circulatory levels of melatonin were estimated in 1 mL of plasma using double-antibody radioimmunoassay based on the Kennaway G280 antimelatonin antibody kits from Buhlmann Labs, Postfach, Switzerland. Reversed-phase column-extracted plasma samples, reconstituted standards, and controls were incubated with antimelatonin antibody and ^{125}I melatonin. After 20 hours of incubation, solid-phase second antibody was added to the mixture in order to precipitate the antibody bound hormone. The supernatant was aspirated and the antibody-bound ^{125}I melatonin was counted in an automated gamma counter. Melatonin levels of individual samples were calculated from the standard curve. The interassay and intra-assay variability at three different points was less than 10%. All the samples of the study were processed in two consecutive assays using the same batch of reagents to avoid interassay variations.

The statistical analysis was done using independent Student's t test for comparing two different sets of data. The analysis of variance (ANOVA) Newman-Kaul's multiple range test with Bonferroni-Holm method was used for multiple comparisons. A result was considered significant if $p < 0.05$. Pearson correlation was used to determine the correlation coefficient between two different parameters.

RESULTS

Table 3 shows HR, systolic blood pressure (SBP), diastolic blood pressure (DBP), and MAP in yoga and control groups before and after 3 months of yogic practices. In control group, the mean HR, SBP, DBP, and MAP after 3 months of follow-up were not significantly different ($p > 0.05$) than the initial basal values. In the yoga group, after 3 months of yogic practices, the mean HR did not show any significant ($p > 0.05$) change. The systolic, diastolic, and mean arterial BP showed a significant reduction ($p < 0.001$) after the yogic practices. The orthostatic tolerance in the yoga group showed a slight but significant increase ($p < 0.05$) and did not show any significant alterations in the control group (Table 4).

Table 5 shows RR, FVC, FEV_1, FEV%, PEFR, and MVV in the control and yoga groups. The RR in yoga group tended to decline but the change was not statistically significant ($p > 0.05$). The FVC, FEV_1, and FEV% in the control group did not show any appreciable change but showed a significant increase ($p < 0.05$) in the yoga group. The PEFR and MVV also showed a significant increase ($p < 0.01$) after yogic practices but did not show any significant change ($p > 0.05$) in the control group.

The psychologic parameters, such as anxiety and depression, did not show any significant change ($p > 0.05$) in both

TABLE 5. THE RESTING RESPIRATORY RATE AND LUNG FUNCTIONS IN CONTROL AND EXPERIMENTAL SUBJECTS

	Controls		*Yoga and meditation*	
	Before	*After*	*Before*	*After*
RR (cycles/min)	17.0 ± 0.89	17.5 ± 1.1	16.4 ± 0.73	14.5 ± 0.63
FVC (L)	3.7 ± 0.12	3.9 ± 0.11	3.6 ± 0.11	4.8 ± 0.12[a]
FEV_1 (L)	3.2 ± 0.12	3.3 ± 0.13	3.2 ± 0.12	3.8 ± 0.12[a]
FEV %	86.1 ± 1.2	86.8 ± 1.1	88.3 ± 1.02	93.9 ± 1.15[a]
PEFR (L/min)	545 ± 29.0	554 ± 27.0	555.6 ± 28.7	589 ± 27.4[b]
MVV (L/min)	121 ± 3.4	122 ± 4.6	119.5 ± 4.3	132.0 ± 8.7[b]

[a]Versus before $p < 0.05$.
[b]Versus before $p < 0.01$.
RR, respiratory rate; FVC, forced vital capacity; FEV_1, forced expiratory volume in 1 second; FEV%, forced expiratory volume percentage; PEFR, peak expiratory flow rate; MVV, maximum voluntary ventilation.
Values are mean ± standard error of the mean (SEM).

TABLE 6. EFFECT OF YOGA AND MEDITATION ON PSYCHOLOGIC PROFILE IN CONTROL AND YOGA GROUP

	Controls		*Yoga and meditation*	
	Before	*After*	*Before*	*After*
Anxiety	18.90 ± 5.84	19.50 ± 6.18	15.00 ± 3.77	15.21 ± 4.02
Depression	18.00 ± 5.75	15.70 ± 6.73	14.94 ± 4.48	14.05 ± 5.34
Well being inventory	106.7 ± 18.23	117.6 ± 22.93	94.05 ± 14.49	107.89 ± 13.09[a]

[a]Versus before $p < 0.001$.
Values are mean ± standard error of the mean (SEM).

the groups (Table 6). However, the well-being inventory score increased significantly ($p < 0.001$) in the yoga group compared to control. Figure 1 shows melatonin levels at different times of the day in yoga group before and after 3 months of yogic practices. The plasma melatonin before yogic practices at 8:00 AM varied between 1.1 pg/mL to 8.5 pg/mL with a mean value of 3.91 ± 0.91 mg/mL. The mean value of 1.92 ± 0.61 pg/mL at 12:00 PM was not significantly different ($p > 0.05$) than the 8:00 AM values. The mean melatonin levels at 12:00 PM, 1:00 PM, and 2:00 PM were not significantly different ($p > 0.05$) from each other. The lowest melatonin levels were observed in samples drawn at 1:00 PM, whereas the highest levels were seen between 12:00 AM to 4:00 AM. The yogic practices did not alter melatonin rhythmicity and the lowest melatonin levels after yoga were seen between 12:00 PM to 1:00 PM and the highest levels were observed between 12:00 AM to 4:00 AM. The melatonin levels at 8:00 AM, 12:00 PM, 1:00 PM, 2:00 PM, and 12:00 AM were not significantly different ($p > 0.05$) than the initial control values. However, the mean melatonin levels at 2:00 AM, 3:00 AM and 4:00 AM after yoga and meditation were significantly higher ($p < 0.05$) than before administration of yoga and meditation (Fig. 1). The systolic, diastolic, mean BP, and orthostatic tolerance in the control and yoga groups did not show any correlation with plasma melatonin. However, in the yoga group the rise in melatonin during night hours (2:00 AM, 3:00 AM and 4:00 AM) showed a significant correlation with well-being score ($r = 0.71$, $p < 0.05$).

DISCUSSION

The present study demonstrates that regular practice of Hatha yoga and Omkar meditation causes alterations in autonomic balance, respiratory performance and well being. Significant reduction in systolic, diastolic, and mean arterial pressure indicates a trend of gradual shift of autonomic equilibrium toward relative parasympathodominance because of the reduction of sympathetic activity. This modulation of autonomic nervous system activity probably might have been brought about through the conditioning effects of yoga on autonomic function, mediated through limbic system and higher areas of the central nervous system. The individuals practicing yoga have been demonstrated to develop some degree of resistance against physical stress (Udupa et al., 1975). This may be useful for the personnel who are likely to be exposed to various kinds of stressful environments as in the case of armed forces, where stable autonomic equilibrium may be useful to face the stress more effectively (Malhotra et al., 1976; Selvamurthy et al., 1983).

Cardiovascular response to orthostasis also showed a significant improvement after yoga, because cardioacceleration to standing was significantly lower in the yoga group. On the other hand, these subjects maintained their systolic BP during orthostasis more effectively than their counterparts as revealed by Crampton's score. These observations suggest that yoga help to improve the cardiovascular efficiency and homeostatic control of the body. Pranayama, which is an integral part of yogic practices, is reported to improve breathing rate and ventilatory function of the lung (Makwana et al., 1988; Joshi et al., 1992). Significant improvement in FVC, FEV_1, FEV%, PEFR, and MVV in our study indicates that it may be caused by strengthening of respiratory musculature incidental to regular practice of pranayamic breathing. Similar ventilatory training even in elderly subjects (ages 60–75) has been shown to improve lung volumes and capacities (Belman et al., 1988). Lung inflation near to total lung capacity is a major physiologic stimulus for the release of lung surfactant (Hildebran et al., 1981) and prostaglandins into alveolar spaces (Smith et al.,

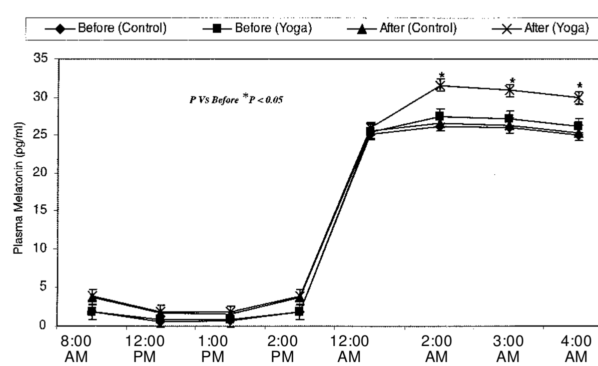

FIG. 1. Melatonin rhythmicity before and after 3 months of yoga and meditation.

1976), which increases lung compliance and decreases bronchiolar smooth muscle tone respectively.

Meditation, which is essentially a part of yogic schedule is characterized physiologically as a wakeful hypometabolic state of parasympathetic dominance. During meditation the practitioner remains awake and vigilant but the physical body goes into a state of deep muscle relaxation (Jevnig et al., 1992). Meditation also causes an increase in cerebral perfusion and alpha activity of EEG and skin resistance (Wallace and Benson, 1972) besides decreasing vascular resistance, blood levels of catecholamines, cortisol and lactate (Jevning et al., 1992; Young and Taylor, 1998). The most characteristic feature of all meditational techniques appears to be a decline in O_2 consumption and CO_2 elimination with decrease in respiratory rate and minute ventilation with no change in respiratory quotient (Wallace and Benson, 1972). The important significant difference is that the body appears to move into a state analogous to many, but not all aspects of sleep while subjects remain responsive and alert.

The exact significance and mechanisms responsible for increase in melatonin levels after yoga and meditation remains speculative. The higher melatonin levels during night after yoga and meditation showed a positive correlation with well-being. However, no such correlation was forthcoming between indices of cardiorespiratory function and melatonin indicating that yoga and meditation induced psychological elation might have been due to increased secretion of melatonin. In fact, the neurotransmitter serotonin has been well correlated with improvement in psychological profile (Bujatti and Rirderer, 1976). The increase in melatonin secretion after the yogic practices may either be caused by increased secretion of hormone by the pineal gland or decreased clearance from the circulation. Walton et al. (1995), have reported that yogic practices increase serotonin, which in turn might be acting as a precursor for increasing melatonin synthesis during yogic practices. Our observations on increase in nighttime melatonin after yoga and meditation are in consonance with the findings of Tooley et al. (2000) who have also reported an increase in melatonin following meditation.

Some of the properties of melatonin resemble those of hypnotic drugs especially in the induction of sleep (James et al., 1987), increase in theta wave activity and improvement of sleep quality (Waldhauser et al., 1990). In humans, alterations in melatonin circadian rhythmicity has been associated with sleep disturbances, anxiety states and psychosomatic disorders (Brown et al., 1987). Electrophysiologic recording has also demonstrated that the timing of the steepest increase in nocturnal sleepiness (the sleep gate) is related with rise in urinary excretion of 6-sulfatoxymelatonin (Tzischinsky et al., 1993). The low nighttime serum melatonin concentration has been reported in patients with depression (Brown et al., 1987). In view of the observations that melatonin counteracts sympathetic activity (Vishwanathan et al., 1986), improves quality of sleep (James et al., 1987), counteracts stress-induced disorders, resets the body's aging clock (Picrrefiche and Labonit, 1995; Poeggler et al., 1994), and elevates mood (Dawsan and Encel, 1993), it is possible that yoga- and meditation-induced improvement in autonomic balance and psychologic function might be mediated through an increase in secretion of melatonin from the pineal gland.

These observations suggest that regular practice of Hatha yoga and Omkar meditation can bring significant improvement in the autonomic balance, respiratory performance and well-being. It also facilitates secretion of melatonin from the pineal gland, which may be acting as a psychosensitive hormone. It is possible that if yoga and meditation are administered along with routine army exercises, both physical and mental performance can be improved.

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