

## Influence of Yoga & Ayurveda on self-rated sleep in a geriatric population

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**Background & objectives:** Sleep in older persons is characterized by decreased ability to stay asleep, resulting in fragmented sleep and reduced daytime alertness. Pharmacological treatment of insomnia in older persons is associated with hazardous side effects. Hence, the present study was designed to compare the effects of Yoga and Ayurveda on the self-rated sleep in a geriatric population.

**Methods:** Of the 120 residents from a home for the aged, 69 were stratified based on age (five-year intervals) and randomly allocated to three groups *i.e.*, Yoga (physical postures, relaxation techniques, voluntarily regulated breathing and lectures on yoga philosophy), Ayurveda (a herbal preparation), and Wait-list control (no intervention). The groups were evaluated for self-assessment of sleep over a one week period at baseline, and after three and six months of the respective interventions.

**Results:** The Yoga group showed a significant decrease in the time taken to fall asleep (approximate group average decrease: 10 min,  $P < 0.05$ ), an increase in the total number of hours slept (approximate group average increase: 60 min,  $P < 0.05$ ) and in the feeling of being rested in the morning based on a rating scale ( $P < 0.05$ ) after six months. The other groups showed no significant change.

**Interpretation & conclusion:** Yoga practice improved different aspects of sleep in a geriatric population.

**Key words** Ayurveda - geriatric population - self-rated sleep - yoga

Older adults spend more time in bed relative to time spent asleep<sup>1</sup>. This is due to longer time taken to fall asleep, more periods of wakefulness during the night, and time spent lying awake before rising in the morning. It is well recognized that the function of sleep

in everyday life is crucial to an individual's sense of wellbeing, with a strong relationship between the quality of sleep and psychological symptoms<sup>2</sup>. Hence, it is also desirable for older persons to get an adequate sleep at night, though the expectations should be based

on realistic ideas of the sleep requirement and inevitable age-related changes in the sleep structure<sup>3</sup>.

Pharmacological treatment of insomnia in older persons has been found to be associated with hazardous side effects such as states of confusion, psychomotor performance deficits, nocturnal falls, dysphoric mood, impaired intellectual functioning, and daytime sleepiness<sup>4</sup>. During the last two decades, a number of well documented behavioural principles for good sleep have been described and particular forms of short-term behavioural and psychological therapies have become available<sup>5</sup>. Clinical interest in the possible effectiveness of such approaches has been stimulated by the fact of high co-morbidity between insomnia and other conditions which respond to psychological approaches. These therapeutic approaches can be mainly classified into three categories: behaviour based educative methods (*e.g.*, avoiding large amounts of coffee or heavy food just before bedtime)<sup>6</sup>; relaxation techniques (*e.g.*, progressive muscular relaxation, briefer forms of autogenic training, and various forms of self-hypnosis); and formal psychotherapy.

Yoga is an ancient Indian science and way of life which brings about relaxation and also induces a balanced mental state<sup>7</sup>. Yoga techniques include physical postures (*asanas*), voluntarily regulated breathing (*pranayamas*), meditation, and philosophical principles which help to reach a balanced mental state. A closely related ancient Indian discipline, *Ayurveda* (the 'Science of Life', in Sanskrit), provides comprehensive knowledge about diverse aspects of health<sup>8,9</sup>. Wide ranges of health measures are covered including massage and herbal preparations. The latter are used for healthy persons ('rejuvenating preparations' or *rasayanas*) and for therapy. In the present study on persons over the age of 60 yr we compared the effects of yoga with those of an ayurveda herbal preparation (intended to promote positive health in aged persons) on different aspects of sleep, based on their self-assessment. This comparison of the effects of two related disciplines was planned to understand their effects individually, so as to use them with better efficiency as complementary systems, which is how these have been traditionally described<sup>8</sup>.

## Material & Methods

**Subjects:** The subjects were persons of both sexes, over the age of 60 yr in a residential home for the aged in Bangalore city, south India. The total number of residents was 120; 30 of them were ill or bed-ridden. The remaining 90 persons were told about the trial. All of them expressed their willingness to participate in the trial. The protocol was approved by the ethical committee of the institution and the signed informed consent of each subject was taken. They were screened using the electrocardiogram (all leads), fasting blood glucose, and blood pressure measurements, as well as a detailed clinical examination.

Subjects with the following health problems were excluded from the study: uncontrolled diabetes (seven participants), uncontrolled hypertension (four), neurological disorders (three), dementia (one), hearing impairment (five), and a detected case of non-infective Hansen's disease. Sixty nine subjects were included for the study after this screening.

**Randomization:** The 69 subjects were stratified according to age [five-year intervals, between 60 and 65 yr (lower limit), and between 90 and 95 yr (upper limit)]. Within a particular five-year age range, subjects of each gender separately, were randomized as three groups (groups 1, 2 and 3) using a standard random number table. Allocation of a group to a particular intervention was carried out by the lottery method, as follows: The three interventions 'Yoga', 'Ayurveda' or 'Wait-list control' were written on three similar pieces of paper which were folded. A person who had no other part in the trial, picked up and opened the folded papers. The first intervention to be picked up was assigned to group 1, and accordingly for groups 2 and 3. Following stratified sampling and random allocation, there were 23 subjects in each group (including seven males in the Yoga group and six males each in Ayurveda and Wait-list control groups) with average ages ( $\pm$  SD) of  $70.1 \pm 8.3$ ,  $72.1 \pm 9.0$ , and  $72.3 \pm 7.4$  yr, respectively.

The Ayurveda group was selected so as to independently evaluate the effects of a system of treatment (and of lifestyle) which is complimentary to Yoga. The idea was to evolve a comprehensive

programme with some aspects each from Yoga and Ayurveda, for a geriatric population. The Wait-list control group was selected to study the retest effect (as assessments were made thrice) on subjects who were equally motivated to receive Yoga or Ayurveda if the interventions were allocated to them.

*Study protocol:* All three groups were assessed for self rating of specific aspects of sleep at baseline, and after three and six months of the interventions (Yoga, Ayurveda, or Wait-list control) using a sleep rating questionnaire. There were seven questions, which subjects were asked to answer based on their experience during the week prior to assessment. Asking them to recall their quality and amount of sleep in the week prior to assessment was important, as recall over longer periods is especially likely to be influenced by anamnesis in older persons<sup>10</sup>. The questionnaire consisted of seven questions. The questions were either dichotomous (*i.e.*, two options: yes/no; Questions 5 and 6) or open questions (*i.e.*, Questions 1, 2, 3, 4 and 7).

The questions were:

1. Approximately how long (in min) does it take you to fall asleep?
2. How many hours do you sleep each night?
3. How many times (if any) do you wake up during the night?
4. What are the usual reasons for waking up, if you do so?
5. Do you feel rested in the morning (yes/no)?
6. Do you sleep in the day time (yes/no)?
7. If your answer to Question 6 was 'yes', for how long do your day time naps last (in min)?

The sleep rating questionnaire has been evaluated for its reliability and validity based on standard criteria. Reliability was ascertained based on (i) temporal stability, and (ii) internal consistency. To assess temporal stability the correlation coefficients were calculated using the data of the 'no intervention', Wait-list control group with two correlations being made, *viz.*: (i) baseline with three months, and (ii)

baseline with six months. Of the five variables for which the correlations were made, the temporal stability was demonstrated for four (Table I). In order to evaluate internal consistency the correlation between two variables, which assessed an equivalent aspect of sleep, was calculated. The two variables were the number of hours slept each night and the feeling of being rested in the morning. The values for the three groups were as follows: Yoga ( $r = 0.643$ ), Ayurveda ( $r = 0.578$ ) and Wait-list control ( $r = 0.699$ ). Validity was inferred based on the content and indirectly based on the test for internal consistency described above.

To eliminate the possibility of bias the examiner was kept unaware of the group to which the subject belonged.

### Interventions

*Ayurveda* - The Ayurveda group received a herbal preparation *i.e.*, a 'rejuvenating tonic' (*Rasayana Kalpa* in Sanskrit). The participants were given 10 g (1 tablespoon, approximately) of *Rasayana Kalpa*, twice a day, once in the morning (0600) and again in the evening (1800). After both doses they were asked to drink 200 ml of skimmed milk, as is prescribed in Ayurveda texts<sup>8</sup>. Though the prescribed dose was 48 g per day<sup>11</sup>, the present dose was suggested by Ayurveda experts who were consultants for the project. This preparation (10 g) consisted of the following herbs (the Sanskrit names are given in parenthesis): *Withania somnifera* (ashwagandha roots, 2 g), *Emblica officinalis* (amalaki, 1 g), *Sida cordifolia* (bala, 0.25 g), *Terminalia arjuna* (arjuna, 0.25 g), *Piper longum* (pippali, 0.5 g). The other contents were: sugar (4 g), honey (2 g), water and clarified butter (ghee) in the amount required to get the correct semi-solid consistency.

*Yoga training:* The Yoga session was planned to include: physical activity, relaxation, regulated breathing and philosophical aspects. This was an integrated approach of yoga, derived from principles in ancient texts which emphasize that yoga should promote health at all levels<sup>12</sup>. The session was for sixty minutes daily, for six days a week. Subjects practiced breathing exercises (10 min), loosening exercises (*shithilakarana vyayama*, 5 min), physical postures

**Table I.** Correlation coefficient for temporal stability in Wait-list control group

Variable studied	Comparisons			
	Baseline versus 3 months		Baseline versus 6 months	
	Correlation coefficient	P value (two tailed)	Correlation coefficient	P value (two tailed)
Time taken to fall asleep	0.495	.027	0.561	.010
Number of hours slept each night	0.455	.001	0.361	.001
Feeling of being rested in the morning	0.204	.388	0.167	.482
Number of awakenings in the night	0.781	.001	0.645	.002
Number of minutes slept each afternoon	0.851	.001	0.744	.001

(20 min) [*i.e.*, *tadasana* (mountain posture), *padahasthasana* (hand-to-foot posture), *ardhakatichakrasana* (lateral arc posture), *ardhachakrasana* (half wheel posture), *viparithakarani* (half shoulder stand posture), *matsyasana* (fish posture), *bhujangasana* (cobra posture), *shalabhasana* (locust posture), *makarasana* (crocodile posture), *vakrasana* (sitting sideward twist posture), *paschimothanasana* (back-stretching posture), *ushtrasana* (camel posture), *shashankasana* (moon posture), *vajrasana* (diamond posture), (*ardha padmasana* (half lotus posture), *shavasana* (corpse posture)], voluntarily regulated breathing (*pranayama*, 10 min) such as: *nadishudhi* (alternate nostril breathing), *brahmari* (bumble bee breathing), *surya anuloma viloma* (right nostril yoga breathing), and *chandra anuloma viloma* (left nostril yoga breathing) and yoga-based guided relaxation (15 min), which has been described elsewhere<sup>13</sup>. There was an additional session in the evening which consisted of devotional songs (*bhajans*, 15 min) and lectures on theory and philosophy of yoga alternating with 'cyclic meditation'. The last technique is derived from another ancient Indian text (the *Mandukya Upanishad*) and involves alternating cycles of physical postures and supine rest<sup>14</sup>.

**Statistical analysis:** Data were analyzed using the statistical package (SPSS Version 10.0). The data at baseline, and at three and six months of all three groups were assessed with tests for normality

distribution using both graphic presentations (box plot and stem and leaf plot) as well as Kolmogorov-Smirnov test.

Repeated measures Analysis of Variance (ANOVA) was used to test for (i) significant differences between the assessments (baseline, three and six months) of all three groups *i.e.*, within-subjects factor, and (ii) differences between the groups (Ayurveda, Yoga and Wait-list control) *i.e.*, between-subjects factor. The 't' test for paired data was used to compare data at three and six months with those at baseline for each group, separately. These parametric tests were used even though the data were found to be not normally distributed as it has been shown that analyses of variance and t tests are usually robust enough to perform well even if the data deviate somewhat from the requirements of normality and homoscedasticity<sup>15</sup>.

Since the 'feeling of being rested in the morning' was dichotomously scored, the data were binary. Hence, a nonparametric statistical test, McNemar test was used to compare data at three and six months with those at baseline for each group, separately.

## Results

The 69 were older persons were staying in an institution for the aged. At the beginning of the study, most of them reported sleep difficulties. These were: (i) difficulty in falling asleep (55 out of 69), (ii) periods

**Table II.** Self-rated sleep assessment scores at baseline and after three and six months for all three groups (Yoga, Ayurveda and Wait-list control)

	Yoga			Ayurveda			Wait-list control		
	Baseline (n = 23)	Three months (n = 20)	Six months (n = 18)	Baseline (n = 23)	Three months (n = 15)	Six months (n = 12)	Baseline (n = 23)	Three months (n = 20)	Six months (n = 20)
Time taken to fall asleep (min)	36.30 ± 11.00	29.00* ± 12.30	25.83** ± 11.70	39.40 ± 21.70	39.60 ± 25.50	28.30 ± 15.60	36.70 ± 22.10	39.70 ± 18.40	40.70 ± 23.10
Duration of sleep each night (h)	5.78 ± 0.95	6.25 ± 0.78	6.88* ± 0.96	6.13 ± 1.05	6.13 ± 1.55	6.50 ± 1.24	6.43 ± 1.16	6.30 ± 0.86	6.45 ± 1.09
Number of awakenings in the night (number of times)	2.50 ± 0.90	2.00 ± 0.70	2.00 ± 0.70	2.30 ± 1.20	1.90 ± 1.10	2.00 ± 1.00	2.30 ± 1.20	2.30 ± 1.20	2.40 ± 1.20
Feeling of being rested in the morning (0=not rested, 1 = well rested)	0.26 ± 0.04	0.45 ± 0.51	0.66† ± 0.48	0.48 ± 0.50	0.53 ± 0.51	0.50 ± 0.52	0.61 ± 0.5	0.50 ± 0.51	0.57 ± 0.5
sleep in the afternoon (min)	35.80 ± 27.70	28.50 ± 21.70	31.60 ± 22.30	22.20 ± 18.00	22.00 ± 20.30	23.70 ± 16.20	31.30 ± 20.60	30.00 ± 19.40	27.70 ± 21.30

\* $P<0.05$ , \*\* $P<0.01$ , t-test for paired data comparing the values at three or six months versus baseline; † $P<0.05$ , McNemar test, comparing the values at six months versus baseline  
Values are mean±SD

of wakefulness during the night (58 out of 69), and (iii) reduced number of hours slept each night (42 out of 69).

The data of baseline, three and six months of all three groups were found to be not normally distributed based on the Kolmogorov-Smirnov test. In the Yoga group the time taken to fall asleep was reduced significantly at three ( $P<0.05$ ) and six months ( $P<0.01$ ), and duration of sleep each night increased significantly at six months ( $P<0.05$ ). Other groups showed no significant change (Table II).

The repeated measures ANOVA showed that there was a significant interaction between the factors (Assessments and Groups;  $P<0.05$ ) for the 'time taken to fall asleep', while other variables showed no significant difference (Table III).

The paired 't' test showed that there was a significant decrease in the time taken to fall asleep in the Yoga group at both three months ( $P<0.05$ ) and

six months ( $P<0.01$ ) when compared with the baseline values. Also, there was a significant increase in the total number of hours slept each night in the Yoga group for the comparisons made between the values at six months with (i) those at baseline ( $P<0.05$ ) and (ii) at three months ( $P<0.05$ ).

The McNemar test for the "feeling of being rested in the morning" showed that there was a significant increase in the 'feeling of being rested in the morning' in the Yoga group at six months ( $N=18$ ,  $P<0.05$ ) compared with the baseline values, while other groups showed no significant change.

## Discussion

Problems with sleep organization in the elderly include difficulty in falling asleep, less time spent in the deeper stages of sleep, early morning awakening, and less total sleep time<sup>16</sup>. A variety of factors may influence the sleep in older persons, such as acute and chronic illnesses, medication effects, psychiatric

**Table III.** Analysis of variance for "time taken to fall asleep"

Source	df	MS	F	P value (two tailed)
Within subjects factor (Assessments)	1.785	510.7	3.02	0.060
Between subjects factor (Groups)	2	1060.958	1.334	0.273
Interaction (assessments subjects)*	3.569	455.5	2.694	0.042
Error (Within subjects factor)	83.876	169.08		
Error (Between subjects factor)	47	795.576		

\*Greenhouse-Geisser epsilon = 0.892, hence df, MS, F and P values are noted taking Greenhouse-Geisser epsilon into account

disorders and primary sleep disorders<sup>17,18</sup>. However, the subjects studied here were screened to exclude these factors. Hence any sleep disorganization observed in them may be attributed to psychological factors associated with 'assorted life changes such as loss of loved ones, leaving a familiar home to live in a more supervised setting'<sup>16</sup>, as well as financial strain<sup>19</sup>.

In the present study the improvement in sleep following yoga was in agreement with earlier reports<sup>20</sup>. The practice of yoga has been shown to reduce signs of physiological arousal in normal volunteers based on measurements of autonomic and respiratory variables and oxygen consumption<sup>13,14</sup>, as well as a decrease in plasma catecholamine levels<sup>21</sup>. A similar benefit of reduced physiological arousal following yoga was also seen in persons with higher than usual arousal to begin with, related to their social circumstances<sup>22</sup> or to physical impediments<sup>23</sup>.

While the above studies have shown that the practice of yoga decreases psychophysiological arousal, it has also been shown that subjects who practiced yoga breathing (*pranayama*) for a two-year period could achieve higher work rates with reduced oxygen consumption per unit work and without an increase in blood lactate levels<sup>24</sup>. In addition, yoga practice was shown to help in adapting to unusual environmental demands<sup>25</sup> and to bring about a shift in

balance, in cases of abnormal functioning as evidenced by changes in the electroencephalograph frequencies in epileptics following six months of *Sahaja yoga*<sup>26</sup>.

Hence, yoga may have reduced the time taken to fall asleep and increased the total sleep time by reducing physiological arousal, manifestations of anxiety and improving the ability to physiologically adapt in this group of institutionalized, older persons. Difficulty in falling asleep has been found to be higher in groups with physiologic and somatoform disorders<sup>27</sup>. Also, complaints of nocturnal awakening were higher in persons with anxiety and physiologic disorders. In the present study, most often the participants woke up because of nycturia, occasional cough, and non-specific aches.

*Rasayana Kalpa* has been believed to promote positive health in older persons and contains, among other constituents, the roots of *Withania somnifera* (*aswagandha*)<sup>8</sup>. The roots of *Withania somnifera* are traditionally used to promote physical and mental health, to provide defence against disease and adverse environmental factors and to arrest aging. *Withania somnifera* is also used to stabilize the mood in persons with behavioural disturbances. The anxiolytic and antidepressive effects of the bioactive glycowithanolides isolated from *Withania somnifera* roots were compared with those of the benzodiazepine, lorazepam and the tricyclic antidepressant, imipramine, respectively, in rats<sup>28</sup>. The herbal preparation exhibited an antidepressant effect comparable with that induced by imipramine, supporting the use of this preparation as a mood stabilizer.

The absence of change in the Ayurveda group may be related to the fact that the number of subjects at six months was reduced to 12, versus 18 in the Yoga group. The main reason was that the preparation was followed by milk (as prescribed in Ayurveda texts), hence, they chose to give up their customary intake of coffee. This was not a required restriction but though the participants chose to give it up, they were uncomfortable about it.

Sleep disorders have been shown to be related to depressive symptoms, poor physical activity,

medication and bad self-rated health<sup>29</sup>. As already described, yoga is known to reduce anxiety while physical activity is increased<sup>23</sup>. In addition, the philosophical aspects of yoga may have been important to reduce depressive symptoms in these institutionalized older persons<sup>30</sup>. The subjective assessment of the participants was that singing devotional songs was the most enjoyable part of the yoga programme. This devotion was “*bhakti yoga*” or the science of emotion culture<sup>31</sup>. Hence an integrated approach of yoga including the mental and philosophical aspects in addition to the physical, was especially useful.

The present results suggest that yoga practice, which includes physical activity, relaxation with awareness, and inputs about philosophical and emotional stability<sup>33</sup>, improved the sleep and increased the feeling of being refreshed on awakening in institutionalized older persons. Since it is known that changes in sleep are inevitable as age advances<sup>34</sup>, any intervention, which makes this process free from difficulties, is a useful addition to the routine of older persons. Since the assessments were done using a questionnaire, which was subjective in nature, the findings of the study should be regarded as a preliminary observation rather than a substantiated view. In order to objectively understand the changes in sleep architecture underlying these improvements, further research with polysomnographic recordings would be required.

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