Ashtanga Yoga Ethics-Based Yoga Versus General Yoga on Anthropometric Indices, Trigunas, and Quality of Life in Abdominal Obesity: A Randomized Control Trial

Abstract

Introduction: The philosophical tenets of yoga such as Ashtanga yoga (AY) and Trigunas are seldom considered while designing yoga programs for chronic diseases. This randomized control trial explored the impact of AY principle-based yoga on the anthropometric indices, personality traits, and quality of life (QoL) in abdominal obesity (AO). Materials and Methods: Sixty-two participants with AO were randomized (n = 31 in each arm) into an AY arm or general yoga (GY) arm. For 12 weeks, both the AY and the GY received the same yoga protocol; however, the AY received an additional AY-based orientation session fortnightly. Changes in waist circumference, hip circumference (HC), height, weight, body mass index (BMI), waist–hip ratio, Vedic Personality Inventory for gunas, and World Health Organization QoL-BREF were measured at baseline and at the end of 12 weeks. Results: By the end of 12 weeks, the AY arm significantly differed from the GY arm in HC (P = 0.05) and BMI scores (P = 0.03). The AY arm has shown a significant increase in the sattva guna (P < 0.001) and reduction in the rajas (P < 0.001) and tamas gunas (P = 0.03). There was a significant improvement in the physical and social QoL domain, whereas the other variables examined remained insignificant. The increase in sattva guna was negatively correlated with waist circumference (r = −0.489) and BMI (r = −0.553). Conclusion: Exposing participants to progressive AY philosophy can change the personality traits which are further associated with melioration in the determiners of AO. Future yoga programs for chronic disorders may consider including AY philosophy for substantive outcomes.

Keywords: Abdominal obesity, Ashtanga yoga, obesity, Trigunas, waist circumference, yoga

Introduction

Abdominal obesity (AO) is reckoned as one of the primary risk factors associated with increasing incidence of diabetes, cardiovascular diseases, respiratory disease, and cancer.[1,2] AO is prevalent even among the population with a normal body mass index (BMI) and leads to metabolic deterioration by catalyzing systemic inflammation, insulin resistance and hyperlipidemia, etc., which predisposes to metabolic syndrome and associated complications.[2,3] Numerous interventions such as behavioral therapy, dietary advice, physical activity, yoga, and pharmacological interventions are proposed to prevent and treat AO.[4] Irrespective of these treatment options, an appropriate solution for AO is yet to be identified owing to its multidimensional etiology. A recent study reported that the global prevalence of central obesity was 41.5%, with higher prevalence reported among older individuals, females, urban residents, and participants with higher socioeconomic status.[5]

There are overwhelming literature available reporting the impact of yoga on obesity and/or AO which are suggestive of the positive impact of yoga on anthropometric variables related to obesity.[6,7] Most of these studies reporting the beneficial effect of yoga predominantly utilized yogic techniques such as asana, pranayama, and/or meditation techniques as a therapeutic tool. However, the real essence of yoga remains not just in physical practices but also in bringing the changes at a subtler level of a person which can have an influence on the physical health. There are earlier reports insisting the need for

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inculcating yoga ethics as described by Sage Patanjali into general yoga (GY) practice for drawing the higher benefits of yoga.\cite{10,11}

Yoga regards Trigunas (personality traits), namely sattva, rajas, and tamas, as the fundamental force that encompasses all actions and behavior in humans.\cite{12} Triguna comprehensively links psychological, physiological, spiritual, and personal virtues together which determines a person’s emotional and physical well-being.\cite{13} A recent study demonstrated that of all the gunas, sattva guna is associated with those emotional constructs that favor positivity and well-being.\cite{14} With growing evidence base suggesting the role of personality/emotional state in the etiopathogenesis of chronic diseases,\cite{15} it is inevitable for mind–body interventions like yoga to realign its delivery mode to include yoga ethics to rekindle the better personality traits.

This study hypothesized that an Ashtanga yoga (AY) ethics-based yoga program will have better impact on the anthropometric indices, Trigunas, and quality of life (QoL) of AO patients compared to GY protocol.

**Materials and Methods**

**Study setting and ethical considerations**

This study was conducted at Sant Hirdaram Medical College of Naturopathy and Yogic Sciences for Women, Bhopal, India, during November 2021 through February 2022. The study protocol was approved by the Institutional Ethical Committee of the college via F.No: 12/SHMCNYS-IEC/P41/2020-2021, and written consent was obtained from all the study participants before enrollment. The study was registered as a clinical trial in the Clinical Trials Registry of India (CTRI/2021/11/038054).

**Study participants**

The participants were the residents of Sant Hirdaram Nagar who were invited to participate in this trial on an outpatient basis by open invitations through social media, flyers, and billboards. Both males and females aged between 25 and 45 years with AO (waist circumference exceeding 80 cm in females and 90 cm in males) whose physical activity category was either inactive or moderately active as per the International Physical Activity Questionnaire Short Form\cite{16} were included in this study. The exclusion criteria for the trial were as follows: (i) any participant who has a history of yoga practice within the past 6 months; (ii) physical or medical history that limits the participant from doing yoga; (iii) those participants who are regular practitioners of gym and aerobics; (iv) under psychiatric medications; (v) involvement in any dietary programs for obesity; (vi) secondary obesity due to hormonal imbalance; (vii) participants with any co-morbidities such as cardiovascular disease, type 2 diabetes mellitus, or hypertension; and (viii) pregnant and lactating mothers.

The sample size was calculated using Cohen’s formula for an effect size of 0.79 derived from the mean and SD values of a previous study on AO and yoga\cite{17} which reported a significant change in the waist circumference after 12 weeks of yoga practice. Using G*Power software, for a level of significance ($\alpha$) 0.05 and power (1−$\beta$) of 0.90, the total sample size required was calculated as $n = 56$. However, considering a dropout of 10%, the final sample size required for the study was $n = 62$.

**Study design**

This was an open-label parallel randomized control trial with two arms, AY arm and GY arm, with 31 participants in each group ($n = 62$). The participants were randomized using computer-based randomization software (www. www.randomizer.org) at a ratio of 1:1. The trial profile is depicted in Figure 1.

**Interventions**

Both the AY arm and GY arm received yoga interventions that included prayer (AUM chanting), asanas (postures), and pranayamas (breathing practices) for 45 min daily for 5 days a week for a period of 3 months. The detailed yoga protocol is tabulated in Supplementary Tables 1 and 2. In addition to the GY protocol which was common for both the arms, the AY arm received special orientation sessions on AY teachings which included yama (abstinences), niyama (observances), asana (yoga postures), pranayama (breath control), pratyahara (withdrawal of the senses), dharana (concentration), dhyana (meditation), and samadhi (absorption).\cite{18} This session was designed for 1 h repeated fortnightly for 3 months discussing the progressive approach of AY principles and its relevance in health and disease. The AY arm participants were counseled to try and adopt these principles in their day-to-day life.

**Outcome measures**

All the outcome measures were collected at the baseline, i.e., before the initiation of interventions and at the end 3 months after the interventions.

**Anthropometric measurements**

The primary outcome measure was a change in the waist circumference of the study participants. Besides this, other anthropometric measures such as hip circumference (HC), height, weight, BMI, and waist–hip ratio were also measured in both the groups.

**Vedic Personality Inventory**

A Hindi version of VPI was used to assess the “gunas” of the study participants, which are the spiritual personality traits classified in yoga namely sattva (happiness), rajas (passion), and tamas (dullness). VPI has demonstrated adequate reliability and validity which has a Cronbach’s $\alpha$ ranging from 0.69 to 0.91.\cite{19} The VPI consists of
56 questions which are subdivided into 15 items for the sattva guna, 19 for rajas guna, and 22 for tamas guna.

**World Health Organization Quality of Life-BREF**

The World Health Organization QoL-BREF (WHOQOL-BREF) Hindi version was used to assess the change in QoL before and after the yoga interventions. The WHOQOL-BREF quantifies the subjective QoL in four domains, namely physical, psychological, social, and environmental health.\[20\]

In addition, we utilized a weekly food recall questionnaire specifically validated for North Indian populations\[21\] to assess the food and fluid intake of the study participants. The participants were asked to indicate the quantity of food items consumed with predetermined types of utensils (i.e., a bowl, cup, glass, and spoon). The investigators recorded the data and nutrient calculations for the standard recipes were used for calculating the total calorie intake. The dietary intake was assessed at the baseline and at the end of 3 months.

**Data analysis**

All the data were analyzed using Jeffreys’s Amazing Statistics Program version 0.16. Shapiro–Wilk test was used to test the normality of the data. Normally distributed variables were analyzed using independent *t*-test for between-group analysis and paired *t*-test for within-group analysis. Similarly, nonnormally distributed variables were analyzed using Mann–Whitney *U*-test for between-group analysis and Wilcoxon signed-rank test for within-group analysis. In addition, analysis of covariance was conducted to correct for the baseline difference between the groups across the outcome variables studied.\[22\] Partial eta squared ($\eta^2_p$) values were computed to reflect the amount of variance attributed to intervention across the outcome variables. Pearson’s and Spearman’s correlation tests were used to analyze the correlation between the variables.

**Results**

All the 62 participants completed the study, and none of them reported any adverse events during the trial. The
detailed baseline characteristics of the participants are tabulated in Table 1. Although the study intended to have both males and females, all the participants enrolled were only females. On an average, the AY arm participants consumed 1427.43 K/Cal per week whereas the consumption in the GY group was 1324 K/Cal per week.

**Changes in anthropometric measurements**

Compared to the baseline, both the AY and GY arms have shown a significant reduction in all the anthropometric measures such as weight, waist circumference, HC, and BMI except waist–hip ratio. The AY arm has a shown significant reduction in the waist circumference ($P = 0.03$) and BMI ($P = 0.01$) compared to the GY arm [Table 2]. However, it was found that after correcting for baseline differences, except HC ($P = 0.05$) and BMI scores, the other anthropometric measurements were not significant, indicating that the effect of intervention (AY) is significant on HC and BMI but not on other anthropometric variables. The postintervention differences after correcting the baseline differences are outlined in Table 3.

**Changes in the personality traits**

The personality traits measured by VPI have shown a significant increase in the satvik personality trait scores among the participants and a significant reduction in the rajas and tamasik trait scores among the AY arm. These changes were not significant in the GY arm [Table 2]. The results are depicted in Figure 2. Compared to the GY arm, the changes of personality traits in the AY arm were statistically significant even after correcting for the baseline differences between the groups [Table 3].

**Changes in quality of life scores**

The QoL measured by the WHO-QoL-BREF has shown a significant improvement in both the arms. There was no significant difference between the changes in QoL domains when compared between the AY and GY arms except for the social QoL domain [Table 2]. However, after correcting for the baseline differences, a significant improvement in QoL was observed in physical and social domains of the AY arm compared to the GY arm [Table 3].

**Correlation between satva guna, waist circumference, and body mass index**

Besides this, a Spearman’s correlation has shown a moderate negative correlation between satva guna and waist circumference ($P = -0.489$, $P < 0.001$). Similarly, a Pearson’s correlation has shown a strong negative correlation between satva guna and BMI ($r = -0.553$, $P < 0.001$). The correlations are depicted in Figure 3.

**Discussion**

This is the first trial to explore if ethics-based (AY principles) yoga practice is superior compared to GY (focused on asana, pranayama, and meditation).

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**Table 1: Baseline characteristics of study participants**

| Variables                  | AY arm (n=31) (%) | GY (n=31) (%) |
|----------------------------|-------------------|---------------|
| Age (years)                | 38.069±5.91       | 36.931±6.245  |
| Height (cm)                | 157.241±5.396     | 154.69±6.804  |
| Education                  |                   |               |
| <10th grade                | 32.2              | 12.9          |
| Up to 12th grade           | 19.3              | 22.5          |
| Graduation                 | 32.2              | 22.5          |
| Postgraduation             | 6.4               | 35.4          |
| Socioeconomic status       |                   |               |
| Lower class (≤70,069)      | 6.4               | 3.2           |
| Lower-middleclass (70,137-273,039) | 45.1           | 58            |
| Upper-middleclass (2,773,167-845,955) | 35.4          | 32.2          |
| Upper class (≥846,023)     | 3.2               | -             |

AY=Ashtanga yoga, GY=General yoga, INR=International normalized ratio
in modulating the anthropometric indices, personality traits, and quality of life among participants with AO. The results indicate a significant decrease in the HC and BMI following 12-week Ashtanga principle-based yoga intervention. Further, there exists a positive change in the personality traits (gunas) among the AY arm participants compared to the GY arm. Similarly, the AY arm has shown a marked increase in the social and physical quality of life compared to the controls.

There was a significant reduction in the waist circumference among the AY arm compared to the GY arm after intervention; however, after correcting for the baseline differences, this remained insignificant. Nevertheless, a correlation analysis suggests an inverse relationship between sattvik guna, waist circumference, and BMI. This suggests a role of guna in assuaging the determinants of AO. Studies in psychology also link personality traits to be closely associated with incidence of chronic diseases including obesity. Therefore, mind–body interventions like yoga targeting obesity should not be merely focusing on weight loss rather it should also utilize the progressive philosophical approach of yoga that can influence the personality traits.

After correcting for the baseline difference, a significant reduction was observed in HC of the AY arm compared to the GY arm. A reduction in HC is considered protective against cardiovascular and metabolic disorders including AO. There were no differences observed between the groups in the other anthropometric measures and QoL domains except physical and social domains. The AY group

| Variables studied          | Within-group analysis (mean±SD) | Effect size (mean change: AY‑GY) | P‑value in between-group analysis |
|----------------------------|---------------------------------|----------------------------------|----------------------------------|
|                            | Pre AY | Post AY | Pre GY | Post GY | Mean difference (95% CI) | Partial eta squared (η²) | F      | P      |
| Weight (kg)                | 70.160 (69.790-70.530) | 70.290 (69.920-70.660) | 0.130 (−0.650-0.400) | 0.004 | 0.226 | 0.63 |
| BMI (kg/m²)                | 92.610 (91.940-93.280) | 93.670 (93.000-94.330) | 1.060 (−2.010-0.100) | 0.082 | 4.919 | 0.03 |
| Waist circumference        | 102.580 (101.880-103.270) | 102.840 (102.150-103.530) | 0.260 (−1.260-0.730) | 0.005 | 0.287 | 0.59 |
| HC                         | 28.780 (28.620-28.930) | 28.300 (28.840-29.160) | 0.221 (−0.450-0.01) | 0.063 | 3.715 | 0.05 |
| WIR                        | 0.902 (0.895-0.910) | 0.906 (0.899-0.914) | 0.004 (−0.015-0.007) | 0.010 | 0.574 | 0.45 |
| VPI_Sattwa                 | 45.780 (44.255-47.305) | 39.530 (38.005-41.056) | 6.249 (4.04-8.458) | 0.369 | 32.143 | 0.00 |
| VPI_Rajas                  | 29.030 (27.624-30.435) | 33.039 (31.634-34.445) | 4.010 (−6.014-2.005) | 0.226 | 16.069 | 0.00 |
| VPI_Tamas                  | 22.388 (21.194-23.583) | 24.267 (23.072-25.462) | 1.878 (−3.580-0.176) | 0.082 | 4.891 | 0.03 |
| Physical_QoL               | 71.228 (67.335-75.122) | 65.461 (61.568-69.355) | 5.767 (0.260-11.273) | 0.074 | 4.405 | 0.04 |
| Psychological_QoL          | 71.005 (67.021-74.999) | 66.788 (62.803-70.772) | 4.218 (−1.450-9.885) | 0.039 | 2.224 | 0.14 |
| Social_QoL                 | 77.155 (72.773-69.845) | 69.845 (65.463-72.247) | 7.309 (1.068-13.550) | 0.091 | 5.509 | 0.02 |
| Environment_QoL            | 75.806 (71.213-80.399) | 76.539 (71.946-81.132) | 0.733 (−7.345-5.969) | 0.007 | 0.048 | 0.82 |

*The comparison of postintervention differences between AY and GY groups was made across the dependent variables after correcting for the baseline differences in each of the dependent variables studied. AY=Ashtanga yoga, GY=General yoga, CI=Confidence interval, VPI=Vedic Personality Inventory, QoL=Quality of life, BMI=Body mass index, HC=Hip circumference, WHR=Waist-hip ratio

Table 2: Comparison of changes between the Ashtanga yoga arm and general yoga arm after 12 weeks of interventions (before baseline adjustment)

Table 3: The postintervention differences in Ashtanga yoga and general yoga after correcting for baseline differences

| Dependent variable*          | Postintervention, mean (95% CI) | Mean difference (95% CI) | Partial eta squared (η²) | F      | P      |
|------------------------------|---------------------------------|-------------------------|--------------------------|--------|--------|
| AY                           |                                |                         |                          |        |        |
| Weight (kg)                  | 70.160 (69.790-70.530)         | 0.130 (−0.650-0.400)    | 0.004                    | 0.226  | 0.63   |
| BMI (kg/m²)                  | 92.610 (91.940-93.280)         | 1.060 (−2.010-0.100)    | 0.082                    | 4.919  | 0.03   |
| Waist circumference          | 102.580 (101.880-103.270)      | 0.260 (−1.260-0.730)    | 0.005                    | 0.287  | 0.59   |
| HC                           | 28.780 (28.620-28.930)         | 0.221 (−0.450-0.01)     | 0.063                    | 3.715  | 0.05   |
| WIR                          | 0.902 (0.895-0.910)            | 0.004 (−0.015-0.007)    | 0.010                    | 0.574  | 0.45   |
| VPI_Sattwa                   | 45.780 (44.255-47.305)         | 6.249 (4.04-8.458)      | 0.369                    | 32.143 | 0.00   |
| VPI_Rajas                    | 29.030 (27.624-30.435)         | 4.010 (−6.014-2.005)    | 0.226                    | 16.069 | 0.00   |
| VPI_Tamas                    | 22.388 (21.194-23.583)         | 1.878 (−3.580-0.176)    | 0.082                    | 4.891  | 0.03   |
| Physical_QoL                 | 71.228 (67.335-75.122)         | 5.767 (0.260-11.273)    | 0.074                    | 4.405  | 0.04   |
| Psychological_QoL            | 71.005 (67.021-74.999)         | 4.218 (−1.450-9.885)    | 0.039                    | 2.224  | 0.14   |
| Social_QoL                   | 77.155 (72.773-69.845)         | 7.309 (1.068-13.550)    | 0.091                    | 5.509  | 0.02   |
| Environment_QoL              | 75.806 (71.213-80.399)         | 0.733 (−7.345-5.969)    | 0.007                    | 0.048  | 0.82   |

*Significant change (P<0.05) compared to baseline, Independent t-test, Mann-Whitney U-test. VPI=Vedic Personality Inventory, QoL=Quality of life, AY=Ashtanga yoga, GY=General yoga, SD=Standard deviation, BMI=Body mass index, HC=Hip circumference, WHR=Waist-hip ratio

Therefore, mind–body interventions like yoga targeting obesity should not be merely focusing on weight loss rather it should also utilize the progressive philosophical approach of yoga that can influence the personality traits.
had shown a significant improvement in the social domain which may be indicative of AY principles influencing the social and interpersonal relationships compared to GY. An earlier study also has reported yoga to improve the QoL and interpersonal relationship.\textsuperscript{[27]} Similarly, AY has shown superior physical QoL compared to their controls. There are no controlled studies till date that compared the difference between AY principle-based yoga program and GY program. Our results indicate that AY principles may be inculcated into existing yoga programs for pronounced benefits. Barring few studies,\textsuperscript{[18,28,29]} the research till date has tended its focus on mechanistic yoga that only includes postures, breathing, or meditation rather than focusing on the crux of yoga.

There is growing interest among the yoga researchers to elucidate a balance between the underlying mechanisms of yoga with their psychophysiological correlates.\textsuperscript{[30]} Critical reviews discussing the functional gravity of yoga reports that, yoga should move beyond just being an intervention to be a way of intervention – a way to look inside.\textsuperscript{[31]} The experimental work presented here provides one of the first investigations into how yoga can influence personality traits and its role in influencing outcomes related to AO. There was a significant increase in the percentage of \textit{sattva guna} and a reduction in the \textit{rajasik} and \textit{tamasik gunas} among the AY arm compared to the GY arm.

Literature suggests that an ideal healthy person will have dominance of \textit{sattva guna} and also proposes that diseases occur in those persons whose \textit{rajas} or \textit{tamas gunas} are dominant compared to \textit{sattva guna}.\textsuperscript{[32,33]} The present study results are identical with an earlier clinical trial that explored the impact of yoga on healthy volunteers which reported yoga to improve the \textit{sattva} status and reduce \textit{rajasik} and \textit{tamasik gunas}.\textsuperscript{[34]} Together, these studies provide important insights into the utilization of AY principles while designing a yoga program.

Although the current study has successfully demonstrated that exposing yoga participants to its underlying philosophies are beneficial, it has certain limitations in terms of the gender distribution, follow-up, etc. This study included only female participants as we could not get any male participant willing to participate in the study due to multiple reasons such as lack of comfort level due to increased number of female participants in the study and overlapping work schedules. This should be considered while planning future studies. Further, the investigators did not attempted for any follow-up and hence the sustainability of the change over time is unknown. Nevertheless, this study is providing compelling evidence on the importance of integrating yoga philosophy as a medium to bring forth meaningful change in the yoga participants.

**Conclusion**

Twelve weeks of Ashtanga principle-based yoga program has been found impactful over GY practice in improving the anthropometric indices, personality traits, and QoL. The findings of this study have a number of important implications for future practice as modulating the personality traits has been postulated to have a significant role to play in the etiopathogenesis of chronic diseases including AO.

**Ethics statement**

The study was approved by the Institutional Ethics Committee of Sant Hirdaram Medical College of Naturopathy and Yogic Sciences, Bhopal, India. (Approval Number: F.No: 12/ SHMCNYS-IEC/P41/2020-2021).

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**Conflicts of interest**

There are no conflicts of interest.

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Supplementary Table 1: Summary of yoga interventions in Ashtanga yoga and general yoga arm

| Practice                  | Duration |
|---------------------------|----------|
| Asanas                    |          |
| Tiryaktdasana (swaying palm tree pose) | 3 min    |
| Trikonasana (triangle pose)  | 3 min    |
| Konasana (angle pose)      | 3 min    |
| Padahastasana (hand to foot pose) | 1 min    |
| Ardha halasana (half plow pose) | 3 min    |
| Padavrttasana (cyclical leg pose) | 6 min    |
| Dwicakriasana (cycling pose) repetitive | 3 min    |
| Markatasana (monkey pose)  | 6 min    |
| Bhujangasana (cobra pose)  | 3 min    |
| Salabhasana (locust pose)  | 1 min    |
| Chakdhasana (mill churning pose) | 3 min   |
| Sthitta konaasana (static angle pose) | 3 min   |
| Sthitta konaasana (static angle pose) | 1 min   |
| Paschimottanasana (seated forward bend pose) | 1 min |
| Pranayamas                |          |
| Ujjayi (victorious breathing) | 3 min    |
| Anulom-vilom (alternative nostril breathing) | 6 min    |
| Brahmani (humming breath)  | 3 min    |
| Meditation                |          |
| Namunusandan (A-U-M chanting) | 30 min/once |
|                           | per week |
| Relaxation                |          |
| Guided relaxation technique | 3 min   |

Asanas are repeated 5-10 times within the stipulated duration with holding time of 10-15 s. Apart from these, the AY arm received an Ashtanga yoga-based orientation (eight limbs of yoga) which included discussions on Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana, and Samadhi. The investigators explained the role of each component of Ashtanga yoga in maintaining good health and live a meaningful life. AY=Ashtanga yoga

Supplementary Table 2: Overview of the points discussed in orientation program

| Limbs of yoga | Superficial meaning | Points discussed |
|---------------|----------------------|------------------|
| Yama          | Moral disciplines    | How to build self-discipline that will be beneficial to others around us and how that can help in calming/toning the mind |
| Niyama        | Positive observances | Discussed on the duties towards one’s self and how it will help in navigate in life |
| Asana         | Postures             | How to align the participants’ postures and win over the body |
| Pranayama     | Breathing techniques | How to achieve freedom over breath and regulate emotional breathing |
| Pratyahara    | Withdrawal of senses | The importance of control over breath to achieve higher state of mind |
| Dharana       | Focused concentration| How to utilize the first five limbs of yoga on building focus |
| Dhyana        | Absorption           | How to meditate on one-self and stay away from interruptions |
| Samadhi       | Bliss                | How to cultivate the habit of staying above likes, dislikes, hatred, love, and treat everything equally |