

# Effect of integral yoga on psychological and health variables and their correlations

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## ABSTRACT

**Objective:** Certain psychological and health variables are commonly measured in India. This study evaluates the effects of integral yoga practices on these variables and also the consistency of correlations observed between them.

**Materials and Methods:** The study was a pre-post intervention study. The variables were measured at the beginning and the end of a one-month yoga course. There was no control group. The study was carried out at Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA) University, in its rural campus south of Bangalore. Based on health criteria, 108 subjects were selected out of 198 volunteers to form the experimental yoga group. Ages ranged from 17 to 63 years. The yogasanas (postures), pranayama (breathing exercises), relaxation techniques, meditation, chanting and lectures were the components of yoga intervention. The variables measured were sustained attention, emotional intelligence – EQ, general health – GHQ, guna personality – *sattva*, *rajas* and *tamas*.

**Results:** Significant pre-post changes were found in all variables. Significant correlations were found between the following pairs: The two sustained attention variables; emotional intelligence and general health; GHQ and *tamas*; *sattva* and *tamas*; and *rajas* and *tamas*.

**Conclusion:** The study shows that there were significant changes in all variables ( $P < 0.001$ ) except in *sattva*. It also confirms that EQ and general health variables correlate significantly with each other and negatively with *tamas*. EQ and *tamas* form positive and negative predictors of health respectively. *Sattva* correlates positively with EQ suggesting that a *sattvic* personality indicates better self-control. This suggests that, by improving guna personality, long-term yoga practice may stabilize EQ.

**Key words:** Emotional intelligence; *gunas*; psychological; yoga.

## INTRODUCTION

Yoga is widely practiced for its benefits to body and mind. Yoga therapeutics is an increasingly appreciated discipline, particularly in India where it is overseen by the Ministry of Health and Family Welfare's Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy (AYUSH). Not many studies have assessed the influence of integral yoga practices on psychological

and health variables, establishing many possible benefits. This study apart from establishing the benefits of internal yoga investigates the relationships between the variables themselves. Up till now, this correlation aspect has not been much investigated, since this requires simultaneous measuring of many variables for a large group, and then to correlate. The aim of the present study is to begin to remedy this deficiency. It measured many variables on a group of volunteers large enough to identify significant correlations between variables. Specifically it evaluated correlations between measures of sustained attention, emotional intelligence, general health and *guna* personality before and after a one-month Yoga instructor's course.

Sustained attention is the capacity to attend to a task for a required period of time. The ability may be related to steadiness of focus, which in turn is a sign of mental

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stability. Sustained attention may thus depend on emotionality.

A self-controlled study on 20 male volunteers measured immediate effects of three yoga-breathing techniques on performance of a letter cancellation task (LCT).<sup>[1]</sup> Practice of alternate nostril yoga breathing (*Nadi suddhi pranayama*) and right nostril yoga breathing (*Surya anuloma pranayama*) improved task performance. No significant change was observed following left nostril breathing, or simple breath awareness. The authors concluded that anxiety-reducing effects of *pranayama* might have contributed to better LCT performance, since this requires selective attention.

Patil and Telles<sup>[2]</sup> measured the effects of two yoga-based relaxation techniques on six letter cancellation (SLC) test performance, a task requiring selective attention, concentration, visual scanning abilities and repetitive motor response. Cyclic meditation brought about a greater improvement than supine rest again suggesting anxiety reduction.

Khemka et al.<sup>[3,4]</sup> in a two separate control studies measured immediate effects of two relaxation techniques and immediate effect of *Kapalbhati* and breath awareness on healthy volunteers on performance of SLC task and digit letter substitution (DLS) task and found significant increase in both task performances of attention in all four interventions of two studies.

Emotional intelligence has been variously defined as “the ability to control one’s own and other’s feelings and emotions, to discriminate amongst them, and to use this information to guide one’s thinking and actions”,<sup>[5]</sup> “... the capacity for recognizing our own feelings and those of others, for motivating ourselves, and for managing emotions well in ourselves and in relationships.”<sup>[6]</sup> Goleman claims that about 80% of a person’s success in life depends on emotional competencies as measured by EQ.<sup>[7]</sup>

A controlled study of 170 subjects by Kumari et al.<sup>[8,9]</sup> assessed the effects of a six week part-time self management of excessive tension (SMET) program for managers on their emotional well-being. EQ scores increased significantly on four of the five subscales.

General health is not just absence of disease, but is well being on physical, mental and social levels.<sup>[10]</sup> Many studies have found improvements due to yoga practice. A small randomized control trial of *sahaja yoga*<sup>[11]</sup> evaluated effects on depressive disorders. Anxiety and depression scores reduced more in the yoga group. In a study of Yoga’s effects on distress symptoms in survivors of the 2005 tsunami,<sup>[12]</sup> self-rated fear, anxiety, sadness

and disturbed sleep decreased significantly along with heart and breathing rates for indigenous people. A review of *Sudarshan Kriya Yoga* for stress, anxiety, and depression concluded that the technique enhances well being, mood, attention, mental focus and stress tolerance,<sup>[13]</sup> and seems beneficial as a low risk, low cost adjunct to treatment of many conditions, and for criminal rehabilitation. A study of *hatha yoga*’s effects in 107 healthy adults found improved physical and mental health and well-being.<sup>[14]</sup>

A controlled pilot study evaluating a comprehensive yogic breathing program observed reduced anxiety, depression and stress, and increased optimism in the experimental group.<sup>[15]</sup> An RCT comparing meditation stress-management and education programs as adjuncts to pharmacotherapy for anxiety disorder found reduced anxiety and depression.<sup>[16]</sup> These results consistently find that professionally administered yoga programs improve many health variables.

*Guna* personality variables are three Vedic personality patterns named *sattva*, *rajas* and *tamas*: *Sattva* brings calmness, lightness, illumination, control, and the beginning of selflessness, all triggering constructive action; *rajas* is a more compulsive tendency to action and selfishness, producing pain, and a restless mind; *tamas* manifests as lethargy, drowsiness or sleepiness, blocks, and stagnation. According to Vedic psychology, these *gunas* constantly control a person’s tendencies: “Everyone is helplessly driven to action by the *gunas*”.<sup>[17]</sup>

An evaluation of yoga’s impact on the *gunas*, and on self-ideal disparity<sup>[18]</sup> found significant correlations between self and ideal self for the yoga group, but not for controls. *Tamas* was associated with disparity between self and ideal self. Another study<sup>[19]</sup> found that the Hare Krishna mantra increased *sattva* and decreased *rajas* and *tamas*. Generally, Yoga aims to improve *guna* quality, until *sattva* dominates all the time.<sup>[20]</sup>

Correlations between attention and *gunas*: *gunas* are related to cognitive characteristics,<sup>[21]</sup> perceptual acuity and field independence,<sup>[22]</sup> intelligence, memory, and attention-concentration.<sup>[23]</sup> Negative correlations are reported between *tamas* and field independence, short-term memory, intelligence and attention-concentration, and positive correlations between *sattva* and general intelligence, short-term memory and attention-concentration. Ability to focus attention correlates positively with *sattva*, and negatively with *tamas*.

Correlations between EQ and *gunas* have been studied by Kumari et al.<sup>[24]</sup> Finding none, they concluded that the two are distinct personality concepts.

Correlations between health and *gunas*: A study of *rajas* and *tamas* in psychological disturbance found the two predominant factors in the patient population,<sup>[25]</sup> suggesting that elevated levels of *rajas* and *tamas* give rise to mental ill health. It is generally agreed that predominance of *rajas* and *tamas* leads to psychological disturbance. *Sattva guna*, on the other hand, leads to positive mental health and optimal functioning. It embodies spiritual values, considered to take subjects beyond mental health problems. Similarly, a study of 100 cancer patients found that patients high in *rajas* or *tamas* are more prone to cancer.<sup>[26]</sup>

On the other hand, an RCT on *gunas* and health<sup>[27]</sup> found *sattva* improved more in the yoga group than in controls. *Rajas* reduced significantly in the physical exercise (control) group. General health status improved in both groups, consistent with the finding that, while *sattva* correlates positively with health, *rajas* correlates negatively. Based on previous studies on various variables and their correlations, we give below details of different tests by which these variables are measured.

### The tests

The SLC and DLS tests assess selective, focused and sustained attention, visual scanning and activation and inhibition of rapid responses. Psychomotor performance is a complex phenomenon. The tests identify major components of performance: Detection, perception, recognition, processing and integration. They have previously been used on the Indian population.

N. K. Chadha developed the adapted emotional intelligence (EQ) test in 2003 as discussed by Dalip Singh.<sup>[28]</sup> He compiled situations experienced by people in real life situations deemed neutral with regard to social desirability, and selected to avoid response bias.

The general health questionnaire (GHQ-28)<sup>[29]</sup> contains 28 items in four 7-item sub-scales: A-somatic symptoms, B-anxiety/insomnia, C-social dysfunction, and D-severe depression. The test examines recent mental status, identifying possible psychiatric disturbance.

The *guna*-based personality test<sup>[30]</sup> uses an inventory of 88 items, characteristic of *sattvic*, *rajasic* and *tamasic* personalities collected from the literature.<sup>[23]</sup>

No previous study has evaluated the effect of integral Yoga in a residential set up on healthy volunteers and consistency of correlations between these variables before and after a yoga intervention and hence this study was undertaken.

## MATERIALS AND METHODS

Subjects comprised 108 healthy volunteers (male and female, aged 17-63 years, mean  $31 \pm 10.75$ ) attending one-month, residential, Yoga Instructor's Courses at Swami Vivekananda Yoga Anusandhana Samsthana (SVYASA), Bangalore during August 2005 and February 2006.

### Inclusion criteria

Healthy student volunteers attending Yoga instructor courses.

### Exclusion criteria

Poor health as indicated by personal data, taking medication, or initial GHQ value over 5.

### Design

Subjects were assessed in a single group before and after the yoga practice.

### Intervention

An integrated approach to yoga therapy (IAYT) module includes *yogasanas*, *pranayama*, meditation, *kriyas*, lectures, singing, and yogic games. Each 45-60 min session was taught by qualified instructors and teachers. Lecture topics included the four paths of yoga, *pancha-koshas*, diet, and stress management.<sup>[31-33]</sup>

### Assessments

Subjects took the five tests named below in a single sitting at the same time of day immediately before and after the one-month yoga training period. They were not allowed to talk after receiving test sheets, and instructed to remain in place until everyone had finished, so as not to disturb others.

- Six letter cancellation (SLC) test.
- Digit letter substitution (DLS) test.
- Emotional intelligence (EQ) test.
- General health questionnaire (GHQ) test.
- *Guna* personality (*tamas*, *rajas*, *sattva*) test

The SLC test comprises a worksheet specifying six target letters to be cancelled from a working section of 22 rows by 14 columns randomly arranged letters of the alphabet. Subjects are asked to cancel as many target letters as possible in 90 s.

The DLS test consists of a similar test worksheet, containing a key, pairing digits 1-9 with letters of the alphabet. The working section displays 12 rows  $\times$  8 columns of randomized digits. Subjects are asked to substitute as

many target digits as possible in 90 s. A similar digit letter substitution task has been used on an Indian population confirming its validity to study immediate effects. The two tests are standard measures of attention span.

Chadha's EQ test consists of 15 questions, based on 15 socially neutral situations, offering five possible answers for each carrying scores 0-20. Total scores are converted into percentiles. Interpretation is as follows:

Score	Percentile	Interpretations
285 and above	P-90	Extremely high EQ
250 to 274	P-75	High EQ
200 to 249	P-50	Moderate EQ
150 to 199	P-40	Low EQ
149 and below	P-15	Try some other day

The test was standardized on broad populations in Indian society; hence it is used here. Retest reliability: 0.94; test validity 0.78.<sup>[28]</sup>

The GHQ 28 questionnaire provides individual diagnostic profile information: Four 7-item sub-scales are based on factor analysis, with factor structures consistent with the original studies.<sup>[34]</sup> Internal consistency, and reliability: Cronbach's alpha, 0.85, and validity, 0.76.<sup>[25,29]</sup>

It has no thresholds for individual sub-scales. Hence, the total of all sub-scales was used. All items have a 4 point scoring system: 'better than usual', 'same as usual', 'worse than usual', and 'much worse than usual', scored: 0-0-1-1.<sup>[35]</sup>

Pathak *et al.*<sup>[30]</sup> developed a *triguna*-based personality test, with items taken from *guna* depictions in *Sankhya Karika*.<sup>[36]</sup> It consists of 88 items: 24 *sattva*, 34 *rajas* and 30 *tamas*, scored on a five point scale ranging from 'not at all' to 'very much'. Low between scale correlations were reported. Test reliability coefficients were reported: *sattva*  $r = 0.62$ , *rajas*  $r = 0.83$  and *tamas*  $r = 0.70$ . Population norms, percentiles and categorizations were given.

Data analysis was carried out using SPSS-10.

## RESULTS

Data were first analyzed for normality using the Kolmogorov-Smirnov test. This found SLC, EQ, *tamas*, *rajas* and *sattva* pre-data to be normally distributed ( $P > 0.05$ ), while those of DLS, EQ, and GHQ were not normally distributed ( $P < 0.05$ ). The effect of integral yoga on each variable is shown in Table 1. Correlation coefficients and their significance are given in Tables 2 to 4 where results for each class of data are presented.

The effect of integral yoga practices shows significant improvement in all the variables but not much in *sattva*. Improvement in sustained attention, emotional intelligence, general health and *rajas* changes were at  $P < 0.001$  significant level while *tamas* at  $P < 0.01$  significant level and *sattva* at  $P < 0.447$  insignificant level after integral yoga practices as shown in Table 1.

Correlation coefficients range from -1.00 to +1.00, extreme values indicating a precise algebraic relationship. Similar measures are highly correlated – for the two measures of sustained attention, SLC and DLS: Positive ( $P < 0.001$ ) both before ( $r = 0.616$ ) and after ( $r = 0.55$ ) the intervention. Correlations between these and other variables were not correlated consistently before and after e.g. SLC was significantly correlated only before the intervention with EQ, *tamas* and *sattva* ( $P < 0.05$ ), while DLS was significantly correlated only after the intervention with EQ ( $P < 0.05$ ), a curious inconsistency.

Tables 2-4 list correlations among the other variables. Table 4 gives internal correlations of *gunas*. *Sattva* correlated negatively with *tamas* while *rajas* correlated consistently with *tamas* before and after yoga (see below, discussion section).

Finally, since pre and post intervention data are available, we present correlations between pre- and post-data for each variable in Table 5.

**Table 1: Pre-post mean, SD, % change and P value of each variable n=108**

Variable	Mean	SD	% Change	P<value
Sustained attention-SLC				
Pre	34.32	11.41		
Post	41.35	13.64	20.48	0.001
Sustained attention-DLS				
Pre	59.43	18.50		
Post	63.22	15.19	6.38	0.003
Emotional intelligence				
Pre	199.81	48.89		
Post	211.85	46.18	6.03	0.001
General health-GHQ				
Pre	1.78	1.90		
Post	1.17	1.54	-34.27	0.001
<i>Sattva</i>				
Pre	59.12	12.05		
Post	59.95	13.58	+1.40	0.442
<i>Rajas</i>				
Pre	63.36	16.23		
Post	57.68	14.28	- 8.96	0.000
<i>Tamas</i>				
Pre	39.26	16.51		
Post	36.54	16.13	-6.93	0.014

Table 1 presents pre-post differences between the different variables. Sustained attention, emotional intelligence and general health improved significantly. GHQ is scored according to negative health findings, so negative percentage value indicated tendencies to better health. Both *rajas* and *tamas* decreased significantly, but the change in *sattva* did not reach significance.

**Table 2: Correlations of emotional intelligence (EQ)**

n=108	r-value	P<value	Sign
<b>Correlation with</b>			
General health			
Pre-pre	-0.112	0.25	Not significant
Post-post	-0.224	0.02	Negative
<i>Sattva</i>			
Pre-pre	0.251	0.009	Positive
Post-post	0.339	0	Positive
<i>Rajas</i>			
Pre-pre	-0.076	0.437	Not significant
Post-post	-0.167	0.084	Not significant
<i>Tamas</i>			
Pre-pre	-0.284	0.003	Negative
Post-post	-0.241	0.012	Negative

Table 2 presents correlations for EQ, which correlated consistently with *sattva* (+ve) and *tamas* (-ve), but not consistently with GHQ

**Table 3: Correlations of general health (GHQ) and *gunas***

n=108	r-value	P value	Type of correlation
<b>Correlation with</b>			
<i>Sattva</i>			
Pre-pre	-0.068	0.487	No
Post-post	-0.097	0.319	No
<i>Rajas</i>			
Pre-pre	0.065	0.503	No
Post-post	0.097	0.316	No
<i>Tamas</i>			
Pre-pre	0.128	0.188	No
Post-post	0.276	0.004	Positive

Table 3 presents GHQ correlations with the *gunas*. None were consistent eg GHQ correlated significantly with *tamas* only after yoga ( $P < 0.05$ ). Note that, because biomedicine is a system of disease care, scores on general health were organized so that a larger positive score indicates negative health i.e. sickness (!), while smaller scores indicate positive health. As a result, all interpretations of GHQ correlations must be inverted: negative *r*-values indicate positive correlations with health, while positive *r*-values indicate negative correlations with health.

## DISCUSSION

The results of the effect of the integral yoga practices on psychological and health variables showed significant improvement in all measures except *sattva guna* where improvement did not reach significant level.

Deshpande *et al.*,<sup>[27]</sup> measured the same health variables (GHQ) and *guna* variables in a randomized control trial in normal healthy volunteers in Bangalore city and found significant improvement ( $P < 0.001$ ) on all the four domains in both Yoga and exercise groups while increase in *sattva* in both the groups and decrease of *rajas* and *tamas* in yoga and physical exercise group after the intervention in a non residential set up with daily 1 h classes for eight weeks.

GHQ is scored according to negative health findings and so negative percentage value indicated tendencies to better health. Both Deshpande *et al.*,<sup>[27]</sup> scores of GHQ and *gunas* were almost in line with the result of this study. Similarly sustained attention (SLC and DLS) scores of Khemka

**Table 4: Correlations between *gunas***

n=108	r-value	P value	Type of correlation
<b>Correlation of</b>			
<i>Sattva</i> with <i>Rajas</i>			
Pre-pre	-0.008	0.935	No
Post-post	-0.023	0.814	No
<i>Sattva</i> with <i>Tamas</i>			
Pre-pre	-0.224	0.020	Negative
Post-post	-0.274	0.004	Negative
<i>Rajas</i> with <i>Tamas</i>			
Pre-pre	0.468	0.001	Positive
Post-post	0.460	0.001	Positive

Table 4 presents internal correlations between *gunas* and *tamas* correlated negatively consistently with *sattva* as may be expected, and positively with *rajas*, which was surprising and may be a population-dependent result

**Table 5: Pre-post correlations *r* and *P* values for each variable**

Variable	r-value	P value
Sustained attention-SLC	0.650	0.001
Sustained attention-DLS	0.708	0.001
Emotional intelligence	0.674	0.001
General health	0.535	0.001
<i>Sattva</i>	0.601	0.001
<i>Rajas</i>	0.663	0.001
<i>Tamas</i>	0.787	0.001
GHQ components		
Physical / somatic symptoms	0.325	0.001
Emotional / anxiety, insomnia	0.235	0.014
Behavioral / social dysfunction	0.223	0.020
Self esteem / severe depression	0.394	0.001

Table 5 presents pre-post correlations on all variables. As might be expected, all were significantly correlated indicating good test-retest reliabilities for each of the seven variables and four sub-variables

*et al.*,<sup>[3,4]</sup> controlled studies of integral yoga practices on healthy volunteers were also in lines with the result of this study.

A controlled study of Kumari *et al.*<sup>[8,9]</sup> who assessed emotional intelligence (EQ) on corporate managers giving intervention of cyclic meditation found significant increase in EQ as in this study of integral yoga practices.

The results of all above studies on various psychological and health variables show beneficial effect of yoga practices in healthy volunteers. Therefore, one may conclude that yoga imparts significant benefits to healthy people also.

In correlation studies, pairs of variables are usually correlated if there is overlap between the various brain regions that each involves, even secondarily. Sustained attention variables, though well correlated with each other, do not correlate significantly with most other variables. The reason is probably that there is little overlap between the principal brain regions utilized. Sustained attention is primarily governed by cortical areas concerned with various stages of cognition.



In healthy subjects, cortical areas concerned with variables like EQ and health are only secondarily involved. Sustained attention is strongly dependent on *tamas* probably due to common influence of stress, anxiety or depression, on both task performance and personality. Cognitive processing is mostly cortical, but emotions and imbalances are more connected to mid-brain centers, which also modulate cortical function. Negative influence on these centers will have corresponding effects on cortical function. *Sattva* on the other hand may be postulated to be a state where modulation of cortical processing is optimal.

Common use of brain regions, which tends to correlate variables with each other as seen between EQ and guna personality, may be predicted from traditional guna analysis. Detailed characteristics of guna personality types identify *sattvic* people as having higher EQ, *rajasic* people as slightly negative, and *tamasic* people as low in EQ. Could this be due to insensitivity to mirror neuron functions? This sequence is reflected in pre-pre and post-post correlations between EQ and *sattva*, *rajas* and *tamas*: Positive for the first, a little negative for the second, and far more negative for the third. One way to understand Yoga's strong positive effect on EQ is that it first increases alertness (exemplified by increases in sustained attention); next it erases negative influences on personality (exemplified by decreases in *tamas*); and finally this leads to increased sensitivity to others' feelings and emotions (exemplified by increases in *sattva*).

Previous failure to observe the EQ-guna correlations identified here<sup>[24]</sup> may have been due to a more restricted sample: Industry managers, with a more limited range of personalities. Our observations of independence of *sattva* and *rajas* agree with previous results as do negative correlations between *sattva* and *tamas*. However, our study found high correlation between *rajas* and *tamas*, not seen previously.<sup>[24]</sup> These correlations may be due to a restricted range of subjects (healthy), manifesting less *tamas* than a general population. Kumari's result<sup>[24]</sup> suggests it is probably not due to inherent weakness in the questionnaire. This topic merits further investigation.

When these correlations are compared with each other, many offer self-consistent results; negative correlations between scores on the SLC test and *tamas*, and between *tamas* and *sattva* are consistent with positive correlations observed between SLC scores and *sattva*.

Remarkably, although the SLC and DLS tests are considered equivalent, they produced inconsistent correlations with the variables EQ, *tamas* and *sattva*. It is not clear whether these are chance results or if they effectively distinguish between SLC and DLS tests.

Of particular interest are the correlations between general health and other variables. GHQ is scored according to negative health findings, so high scores indicate susceptibility to disease, particularly psychic illness. Thus, positive *r*-value correlations with GHQ scores indicate a tendency to fall sick, while negative correlations indicate tendencies to better health. Here negative correlations between GHQ and EQ indicate improved health with improved EQ. Positive correlations with *tamas* confirm tendencies of high *tamas* people to disease.

The result that *tamas* correlate negatively with *sattva* confirms that the two oppose each other. Post-post correlations between GHQ and *tamas* increased, while correlations between GHQ and *sattva* and *rajas* remained similar. Yoga's improvements in these three variables did not alter their mutual correlations. The failure of *tamasic* personalities to improve in health increased the negative correlations between GHQ and *tamas*.

Correlations observed between the *gunas* themselves do not necessarily indicate poor choice of variables, as normally holds for tests of individual differences in personality. Rather, they tend to confirm that elevated levels of *tamas* (and to some extent *rajas*) prevent subjects from manifesting high levels of *sattva*. The observed negative correlations between *sattva* and *tamas* are therefore to be expected.

## CONCLUSIONS

A single month of integral yoga practices imparts significant benefits to healthy volunteers in all psychological and health variables. It improves sustained attention and EQ. It improves the personality of the healthy person by increasing *sattva* and decreasing *rajas* and *tamas*. It also improves all dimensions of general health.

Cognitive processes involved in sustained attention tests did not correlate with health and personality tests. This may be because the major brain regions involved in cognitive abilities were sufficiently different from those of personality for this group of healthy subjects. Enhancement in the functioning of one would not then seem to affect the other.

On the other hand, the impact of *sattvic* personality on both emotional intelligence and *tamas* was established. These significant results would not emerge by measuring single variables alone. It suggests that regular yoga practice benefits people for deeper reasons than immediate effects on the physical body. As Yoga practice transforms people's dominant *guna* making them more *sattvic*, their ability to spontaneously maintain high levels of health increases while not being affected by unhelpful emotions.

Thus, it is seen that integral yoga practices impart significant benefits and measuring correlations between different variables can yield significant information of potential importance that would not otherwise be available. Such studies should definitely be continued in future.

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