

Effects of yoga practice on acumeridian energies: Variance reduction implies benefits for regulation

Niharika Nagilla, Alex Hankey¹, HR Nagendra²

Swami Vivekananda Yoga Anusandana Samsthana (S-VYASA),¹Professor of Yoga and Physical Science, ²Vice-Chancellor, S-VYASA, 19 Gavipuram Circle, Bangalore, India

Address for correspondence: Dr. Alex Hankey, S-VYASA, Eknath Bhavan, 19 Gavipuram Circle, KG Nagar, Bengaluru 19, India. E-mail: alexhankey@gmail.com

ABSTRACT

Background and Objective: This paper concerns mechanisms responsible for the efficacy of yoga medicine, traditionally attributed to the enlivenment of prana. Our strategy was to investigate levels of Qi in acupuncture meridians, since Qi is usually considered equivalent to prana.

Materials and Methods: Electrodermal measurements at acumeridian endpoints (Tsing points) were made on 32 healthy individuals, pre and post 3 weeks yoga lifestyle program using AcuGraph 3 (an instrument in wide use). A previous study found that inherent errors prevent AcuGraph from precisely evaluating Qi energies in single meridians, so group results are reported: (a) Energy levels, (b) energy stability, and (c) energy balance between (i) Yin/Yang meridians, (ii) upper and lower, and (iii) left and right regions of the body.

Results: Significant improvements were observed in all but energy stability, supporting the ideas that yoga enlivens prana, and that balance in meridians constitutes health. For balance variables, the study observed shifts toward normal at both ends of variable distributions, reducing standard deviations: post-intervention percentages of subjects with values in the 'healthy' range increased.

Conclusion: Yoga improved regulation of Qi levels in acumeridian meridians as well as increasing them.

Key words: Prana; yoga; acumeridians; balance.

INTRODUCTION

The ancient medical practices of both India and China are well-known, but much of their procedures are not yet precisely understood in scientific terms. Comparisons between the two have revealed certain similarities, suggesting that comparisons between the two are worth undertaking. The Indian Systems of Medicine (ISM) are based on Ayurveda^[1] and Siddha,^[2] while yoga is accepted as playing an important role in both physical and mental health.^[3] Traditional Chinese Medicine^[4] largely focuses on the Chinese concept of life energy, or 'Qi',^[5] which is said to flow through the body in various channels, or meridians, each connected to one of the major organs. Health is said to depend on maintaining both level of energy in different meridians, and balance of energy levels between them.

The role of practitioners of Traditional Chinese Medicine is to restore balance in prescribed ways, increasing or decreasing energy levels where appropriate.^[6]

It is generally agreed that the TCM concept of Qi corresponds in Indian systems to 'prana',^[7,8] which has two forms, prana and shakti, corresponding to the two forms recognized by the Chinese system: Yang Qi and Yin Qi.^[4] Yogis sometimes simply call it prana shakti. As long as prana shakti exists in the body, prana works, the lungs breathe, the heart beats, and the whole organism is kept alive.^[3] Prana shakti is held to be the main principle supporting all life, and controls the functioning of the body's organs and organ systems. The pathways for the movement of prana shakti are known as 'nadis'. Through these the prana shakti travels. The nadis thus appear to have the same function as the meridians of the Chinese system.^[7,8]

A preliminary exploration of this relationship has been carried out by Meenakshy^[9] who also explored the repeatability of electrodermal measurements using the AcuGraph 3 system,^[10] obtaining self-consistent estimates of variances caused by various sources of error. Among her findings, Meenakshy observed^[9] that the SD's for AcuGraph

Access this article online

Website:
www.ijoy.org.in

DOI:
10.4103/0973-6131.105948

Quick Response Code



are such that reliability can only be attributed to group averages and not to individual readings. For that reason, this paper only reports analyses of means and SD's for the entire experimental group.

Traditionally, there are said to be 72,000 nadis supplying vital energy to every cell in the body. ISM particularly name three nadis in the spine, said to be the main nadis in the whole body: the Ida on the right, the Pingala on the left, and the Sushumna in the centre.^[9] The Ida controls aspects of the body related to the moon, the Pingala controls aspects related to the sun, while the Sushumna functions best when the two are fully enlivened and in balance. This system was widely recognized in ancient times, giving rise to the snake symbols found even today throughout India. The well-known symbol for balanced spinal energies consists of two snakes intertwined round a central column represents perfect health, and is still widely used and worshipped. In western systems, it is called the Caduceus, and was the symbol of health for the system of medicine propagated by Hippocrates—the 'Hippocratic symbol'.

In relating ISM to Traditional Chinese Medicine, it is tempting to hypothesize the equivalence of Yin and Yang Qi with energies in the Ida as feminine and Pingala as masculine, respectively. This hypothesis will be treated in a later paper.^[10] Balancing Yin and Yang energies is one of the main means of maintaining health.^[4] Acupuncture thus deals with maintaining the equilibrium of 'Qi'. Sometimes the Moon is said to connect more to the mind, while the Sun is said to connect more to the body. Traditional Indian and Chinese systems thus treat body and mind implicitly in an integrated fashion when restoring a patient to normal health.

In the Siddha system of medicine,^[2] many more individual nadis are named, including the left and right pairs connected to 12 major organs referred to earlier. The Indian and Chinese systems thus seem to be in correspondence. It is therefore pertinent to take machines developed to measure energies in acupuncture meridians, and see if the changes they measure correspond to predicted changes in prana/shakti levels in Indian systems of medicine.

One such machine is AcuGraph 3,^[11] developed to make specific skin-resistance measurements at the final acupuncture points (Tsing points) of the 24 acupuncture meridians. Supposedly, AcuGraph can measure the energy level in each meridian, but previous research suggests that its measurements are better used to assess changes in groups of subjects.^[12,13] The study reported here therefore took a group of subjects, made a fundamental hypothesis about the prana concept used in Yoga, and attempted to verify it by measuring acupuncture meridian energies using AcuGraph 3. Such a study has a two-fold purpose: first to test whether predicted changes can be observed,

and second to see whether the hypothesized translation between Indian and Chinese systems holds good. The design of the experiment is given in the 'Methods' section below, with results, discussion, and conclusions thereafter.

MATERIALS AND METHODS

Subjects: 35 healthy volunteers of both sexes (17 m, 18 f) attending a Yoga Instructor Course (YIC) at the rural campus of Swami Vivekananda Yoga Anusandhana Samsthana (SVYASA), Yoga University, Bangalore, Karnataka, India. Of these, post course readings were obtained from 33.

Inclusion criteria

For inclusion in the study, subjects had to be: participating in the YIC; willing to volunteer for the trial; between 18 and 50 years old; completed 12 years education to the end of High School; and able to understand instructions given in English.

Exclusion criteria

Presence of cognitive, psychiatric or neurological disorders, or possessing other physical disabilities and for ladies: pregnancy, or menstruation on days of measurement.

Yoga intervention

This consisted of the 3-week YIC, an intense yoga lifestyle program, incorporating the following: specified times of rising (4.30 am) and going to bed (9.00 pm), vegetarian diet, singing (*bhajans*), and theory lectures; specific yoga practices, including a graded course in *yogasanas* (yoga postures), and *pranayamas* (breathing techniques), *yogakriyas* (purification practices) and yogic games; IAYT specific relaxation and stress management techniques, including various meditation practices [Table 1].

Assessments

Assessments were made using the AcuGraph "Digital Meridian Imaging" System, a computerized tool used to measure and analyze energy levels of acupuncture meridians. AcuGraph is a computerized device used to test galvanic skin response at points on traditional acupuncture meridians, and so assess meridian stress.

Procedure for AcuGraph measurements^[11]

Subjects sit easily on a chair, with feet on a mat, rather than the floor. A damp cotton ball is used to improve the conductivity of a small, circular, electrical probe, which is then applied to each acupuncture 'Tsing' point at the extremities of acupuncture meridians on the hands and

feet, in the order specified by the computer, while an iron 'ground bar' is held in the hand on the opposite side. The computer records readings at the specified left and right measuring points on all major acupuncture meridians; 6 on each hand 6 on each foot, corresponding to the left and right meridians for the 12 major organs in the body: lung, pericardium, heart, small intestine, triple warmer, large intestine, liver, spleen, kidney, bladder, gallbladder, and stomach. An excellent pictorial account has been given.^[13]

RESULTS

Inspection of the data revealed five subjects for whom readings were exceptionally high, with several pre or post readings being over 190 or reaching the maximum limit of 200. This is generally due to excessive moisture on the skin. Previous observations^[9] have noted that such subjects have difficulty slowing down and relaxing, and may be considered hyperactive. Because of this fundamental difference between these subjects and others in the study, they were analyzed in a separate group.

Tables 2a and 2b therefore present results for the two groups of 28 and 5 subjects, separately: group averages for

important overall combinations of meridians indicating overall energy level (EL), energy stability (ES), personal integrated energy (PIE), and balance between Yin meridians and Yang meridians (Yin-Yang balance), those on the hands and feet (upper-lower balance), and those on left and right sides of the body (left-right balance).

Table 1a shows that, as hypothesized, the overall Qi (prana) energy, EL, was significantly increased, $P < 0.047$, but that energy stability did not change significantly $P > 0.05$. However for changes in energy balance between Upper and Lower meridians and between left and right meridians, there were significant effects: a considerable decrease in standard deviation, indicating a narrowing of the range of the variable. Values of Mean \pm 2 SD's for the post data were between the same values for the pre-data, showing that the distribution 95% confidence intervals had greatly improved.

One way to see this in more detail is to analyze correlations between the pre-post difference in the variable and the initial values of the same variable [Tables 3a, 3b]. The very significant negative 'r' values indicate that high initial values decrease, whereas low initial values increase – a narrowing of the distribution, as shown by the observed

Table 1: Components of a 3-week intensive yoga module

Yogasanas (yoga postures)	Suryanamaskara, tadasana, ardhakatichakrasana, vajrasana, ushtrasana, hamasana, mayurasana, janusirasana, paschimottanasana, sarvangasana, padmasana, matsyasana, ardhmatsyendrasana, bhujangasana, shalabhasana, dhanurasana, chakrasana, padahasthasana, shavasana etc.
Yoga pranayamas (breathing techniques)	Dog, rabbit, tiger breathing exercises, bhastrika, brahmari nadisudhi, anuloma-viloma pranayamas
Yogakriyas (purification practices)	Kapalabhati, jala and sutra neti, nauli, vamana dhouti, laghu shankarprakashalan
Yogic games	Egg and spoon race, leader-leader change, ramshyam
IAYT specific relaxation techniques	Instant relaxation technique (IRT) Quick relaxation technique (QRT) Deep relaxation technique (DRT)
IAYT specific stress management techniques	Self management of excess tension (SMET)
Various IAYT Meditation practices	Omkara meditation Cyclic meditation

Table 2a: Results of AcuGraph pre and post tests on variable averages for 28 normal subjects

Variable	EL	ES	PIE	Yin/Yang	Upper/lower	Left/right
Pre (M \pm SD)	60.61 \pm 18.40	67.64 \pm 12.87	59.11 \pm 15.83	8.00 \pm 6.69	25.79 \pm 16.06	9.32 \pm 6.57
Mean \pm 2SDs	97.4 23.8	93.4 41.9	90.8 28.4	21.4 0.00	57.9 0.00	22.5 0.00
Post (M \pm SD)	87.82 \pm 22.62	61.29 \pm 13.09	50.07 \pm 17.78	12.75 \pm 9.26	23.04 \pm 12.83	6.32 \pm 6.66
Mean \pm 2SDs	132.9 43.7	87.5 35.1	85.6 14.5	31.3 0.00	48.7 0.00	18.6 0.00
Pre/post difference	+27.2	-6.4	-9.0	+4.75	-2.7	-3.0
't'/P values	$P < 0.0001$	$P = 0.073$	$P = 0.05$	$P = 0.032$	ns	$P = 0.09$
SD change	+4.2	+0.22	+1.95	+2.57	-3.23	+0.09

Table 2b: Results of AcuGraph pre and post tests on variable averages for 5 hyperactive subjects

Variable	EL	ES	PIE	Yin/Yang	Upper/lower	Left/right
Pre (M \pm SD)	125.4 \pm 47.11	59.4 \pm 19.42	63.8 \pm 42.56	10.8 \pm 7.40	12 \pm 8.37	3.25 \pm 3.95
Mean \pm 2SDs	200 31.2	98.2 20.6	148.9 0.00	25.6 0.00	28.7 0.00	10.2 0.00
Post (M \pm SD)	138.6 \pm 53.22	71.4 \pm 17.36	67.2 \pm 33.90	4.6 \pm 7.50	9.25 \pm 7.27	2.25 \pm 2.63
Mean \pm 2SDs	200 32.2	105.6 37.2	135 0.00	19.6 0.00	23.8 0.00	7.5 0.00
Pre/post difference	+13.2	+12.0	+3.4	-6.2	-2.75	-1.0
't'/P values	ns	ns	ns	Ns	ns	ns
SD change	+6.1	-2.06	-8.66	+0.10	-1.10	-1.32

Tables 1a and 1b give pre and post intervention means and standard deviations for EL - Energy level; ES - Energy stability; PIE - Personal integrated energy; Yin-Yang balance, Upper-lower balance and Left-right balance for the 28 normal and 5 hyperactive subjects, respectively

Table 3a: Pearson correlation tests on upper/lower balance variables

Variable	Upper/lower balance-pre	Upper/lower balance pre-post difference
Upper/lower balance-pre	$r=1.000$	$r=-0.762$ $P<0.001$
Upper/lower balance	$r=-0.762$	$r=1.000$
Pre-post difference	$P<0.001$	

Table 3b: Pearson correlation tests on left/right balance variables

Variable	Left/right balance-pre	Left/right balance pre-post difference
Left/right balance-pre	$r=1.000$	$r=-0.716$ $P<0.001$
Left/right balance	$r=-0.716$	$r=1.000$
Pre-post difference	$P<0.001$	

Tables 2a and 2b give correlation r values and significance P values for correlations between pre values and pre-post differences for upper/lower balance and left/right balance respectively. Since the data were not normally distributed, Pearson's correlation test was used. The negative value of r indicates that while the highest values decrease between pre and post, the lowest values increase—suggesting a systematic decrease in width of distribution i.e. standard deviation. Note that this test reaches significance, when the corresponding F tests in Figure 1 could not

reduction in standard deviation in both variables, from 27 to 17 for U/L Balance, and from 9 to 7 for L/R balance. The P values for these correlations are $P < 0.001$ for U/L Balance, and $P < 0.001$ for L/R balance. The significance of these P values suggests that these results are repeatable, and that this 'narrowing of distribution' effect is real.

DISCUSSION

The data upheld the experimental hypothesis that yoga life-style interventions will increase energy levels: the mean increase in meridian energies was 10.5 for the 28 normal subjects and a similar amount for the five hyperactive subjects. However the fact that the increase was uniform across a large range of initial values suggests that a deeper analysis is needed in the future: was the increase 5 hyperactive subjects unhealthy, as the AcuGraph manual suggests, or were the hyperactive subjects deriving some as yet unidentified benefit? This would require measuring such subjects for changes in hyperactivity and associated causative variables as well as AcuGraph.

Energy stability decreased though the change was not significant. On the other hand, the PIE percentage decreased, presumably because the decrease in stability was associated with a decrease in the number of balanced meridians and here, the decrease was significant. This observation requires reassessing with larger amounts of data, to see if this apparently negative effect is repeated.

The balance variables on the other hand gave very interesting results. Normally, expected improvements as a result of medical interventions consist of shifts in values of variable distributions toward values indicative of health. This kind of change is expected of scientifically designed

interventions: the ideal value of a variable is known, and, if a patient has a deviation in a particular direction, treatment is designed to bring it back in the direction of normal. In general, treatments are designed to shift a variable in a particular direction; if a shift in the opposite direction is required, a different treatment is given. Treatments shift variable values in particular directions.

Not all the effects of the yoga intervention given in Table 1 are of this type however, e.g. the changes in upper/lower, and left/right balance. In these cases a narrowing of distribution was observed: The significant changes were decreases in standard deviation. This is of great interest. Instead of almost uniform increase, as in mean acumeridian energies (EL), while the low ends of the distribution increased in value, the high end values decreased, a completely different kind of qualitative behaviour requiring a qualitatively and conceptually different kind of action on the system. Instead of directly affecting the variables themselves, *the yoga intervention seems to be acting on variable regulation.*

The implication that, yoga improves overall regulation of physiological systems, could be of considerable importance. It requires further testing in other experimental systems. Health or wholeness of system functioning requires balance, and this requires sensitive regulation. The more sensitive the regulation, the more accurately balance can be maintained, i.e. in some sense, the more robust the healthy state. From this perspective, optimal regulation will correspond to a state of optimal health. Through the recognition that heart rate variability is an essential component of health, this idea is already in the medical literature, because HRV is optimized when regulation is, in a precise sense, made most sensitive.

CONCLUSIONS

Our findings concerning AcuGraph seem largely consistent with those of Meenakshy^[9] and Mist *et al.*^[13] AcuGraph does not provide accurate enough information about individual meridians, but analysis of data from groups reduces standard deviation enough to make it a useful analytic tool for studying general effects of interventions on groups.

Based on this consideration, before and after measures of the three week yoga life-style intervention on 33 healthy young adults supported the hypothesis that overall Chi energy for the group would be increased. The fact that this increase showed no sign of leveling off for high starting EL values was a surprise. Further health research is required in this area: possibly, subjects with high initial AcuGraph energy level values should receive special training to prevent further increases to levels where they might become dangerous.

As regards the variables, upper-lower and left-right balance, AcuGraph averages strongly suggested that the standard deviations of distributions were significantly reduced, bringing subjects at both ends of the distributions back within the healthy range.

REFERENCES

1. Kaviratna AC, Sharma P. Journal of Alternative and Complementary Medicine. Charaka Samhita. Vols. 1-5. Delhi: Sri Satguru Publications; 1996.
2. Subramanian SV, Madhavan VR. Journal of Alternative and Complementary Medicine. Heritage of the Tamil's Siddha Medicine. Madras: International Institute of Tamil Studies; 1984.
3. Nagarathna R. Yoga in medicine. API Text book of medicine, 6th ed, India New Delhi: Association of Physicians; 2001.
4. Ni M. Journal of Alternative and Complementary Medicine. The Yellow Emperor's classic of medicine: a new translation of the Neijing Suwen with commentary. Boston: Shanbhala; 1995.
5. Liu Z, Liu L (Editors.). Essentials of Chinese Medicine. Vol. 1. Berlin: Springer; 2009.
6. Liu Z, Liu L (Editors.). Essentials of Chinese Medicine. Vol. 2. Berlin: Springer; 2011.
7. Patwardhan B, Warude D, Pushpangadan P, Bhatt N. Ayurveda and traditional Chinese medicine: A comparative overview. Evid Based Complement Alternat Med 2005;2:465-73.
8. Hankey A. CAM and the phenomenology of pain. Evid Based Complement Alternat Med 2006;3:139-41.
9. Meenakshy KB. Concept of Nadi/Meridian and Prana/Chi: a correlation. Master's Thesis. S-VYASA; 2009.
10. AcuGraph 3 Digital Meridian Imaging: User Manual. Meridian ID: Miridia Technology; 2008. www.miridiatech.com.
11. Satyananda SS. Journal of Alternative and Complementary Medicine. Four Chapters on Freedom. Munger:Yoga Publications Trust; 1976.
12. Singh HR. Comparison of Ida, Pingala, Sushumna and Yin, Yang according to ancient Indian scriptures and ancient Chinese scriptures. Master's Thesis. S-VYASA; 2009.
13. Mist SD, Aickin M, Kalnins P, Cleaver J, Batchelor R, Thorne T, *et al.* Reliability of AcuGraph system for measuring skin conductance at acupoints: Acupunct Med 2011;29:221-6.

How to cite this article: Nagilla N, Hankey A, Nagendra HR. Effects of yoga practice on acumeridian energies: Variance reduction implies benefits for regulation. Int J Yoga 2013;6:61-5.

Source of Support: Nil, **Conflict of Interest:** None declared