ELECTRODERMAL ASSESSMENT OF SMET PROGRAM FOR BUSINESS EXECUTIVES

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Abstract

Yoga courses are becoming increasingly fashionable for large corporations and their business executives. No study has previously assessed and demonstrated Yoga's specialty, the ability to increase levels of subtle energy in course participants. This study evaluates the impact of a 5 day stress management programme (SMET) for managers as measured by AcuGraph3. Forty five volunteers (both female & male), employees from a large Indian corporation, aged between 30 and 50 years were selected for the study. A single group, pre-post assessment was applied and the subjects were assessed on day 1 (pre) and day 5 (post) of the intervention. AcuGraph 3 'Digital Meridian Imaging' system was applied to assess. Post energy levels were significantly improved compared to pre values after the SMET program for the subject ($p<0.001$). The 5 days SMET intervention increased overall pranic energy in the main acupuncture meridian channels. The results begin to explain why yoga practice is clinically effective.

Keywords: *SMET, IAYT, Acugraph, Jing-Well points, Pranic Energy Level*

The opening up of the Indian economy through liberalization, privatization, globalization and natural thrust towards information technology has made managers' lives increasingly demanding.[1] Challenges are multiplied when executives have to work in diverse cultural situations. Workforce diversity has not only adversely affected executives' emotional stability, but also leadership behaviour and effectiveness. The need for executives who are emotionally stable under adverse circumstances is increasing.[2]

India's increasingly recognized systems of traditional knowledge provide a simple, natural remedy for this situation. Yoga practices are increasingly popular, and many businesses take them seriously as a means of increasing employee well being, health and effectiveness, even in large corporations. [3] Yoga explains its power to achieve these aims in terms of traditional sciences. The Yoga perspective is that consciousness has five main coverings or 'sheaths', the *panchakoshas*. The manager's emotional stability is identified as belonging to the third of these, at the level of mind, the *manomaya kosha*, disturbances in which can impact lower levels, the *pranmayakosha*, and the physical body, or *annamaya kosha.* [4] Even a little Yoga practice can improve stability in the mind, particularly in the emotions that drive thoughts, and create problems for health. Swami Vivekananda Yoga Anusandhana Samsthana (SVYASA) holds programs to reduce executive tension and improve emotional balance in managers. [1] The main program, Self-Management of Executive Tension (SMET) [1, 5] trains executives to eliminate the effects of stress and maintain positive emotional balance. Using principles derived from the Upanishads[6], combined with modern and traditional stress management techniques, it trains executives to be self-sufficient in handling effects of professional stress. The effectiveness of these programs has been evaluated using various measures such as emotional competence. [1] These measures evaluate program efficacy in western terms, but they do not begin to explain why the programs are so effective – how they work. Recently, SVYASA has begun to measure the effect of its Yoga programs on the *pranamayokosha* by direct measurements of the level of pranic energy[7,8], as assessed by modern electronic instruments such as AcuGraph3[9], and even Gas Discharge Visualization (GDV). [10] Here we report increases in Pranic Energy in SMET program participants as assessed by AcuGraph3.

Self Management of Excessive Tension (Smet): SMET is a set of techniques and Yoga practices developed specifically for applications to business by SVYASA. [1,5] It includes conceptual inputs in the fields of stress, executive growth, group dynamics, and stress physiology, as well as Yoga-based practices known as 'Cyclic Meditation'[5]: *asanas* and 'instant relaxation', 'quick relaxation', and 'deep relaxation' techniques. Cyclic Meditation uses an alternation of stimulation and relaxation procedures, where relaxation periods last longer than stimulation periods. The practice is based upon two principles, depth of perception, and expansion of awareness. This study evaluated pre-post changes in pranic energy in business managers, participating in a SMET program. The experimental hypothesis was that the SMET intervention would significantly enhance the managers' pranic energy level.

Prana and Chi – Electrodermal Assessment of Prana: SVYASA has been developing a program to evaluate pranic energy by measuring effects on conductivity at the end points of the acupuncture meridians.[11] Comparison of the ancient Chinese and Indian systems indicates that meridians in traditional Chinese medicine (TCM) correspond to 'Nadis' in the Vedic system, channels through which the pranic energy is said to move.[8,12] Traditionally, health is associated with strong energy and balance of energy between the various acu-meridians; imbalance in Chi energy flows is said to be due to blockages in meridians[13], and to lead to pathology. [13, 14] TCM holds that the solution is to bring Chi back into balance.[13] Studies have shown that Chi

can be increased strongly and balanced by practicing Qigong (China) or pranayama (India). [15]

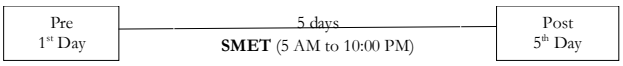
Electrodermal measurements depend on measuring the electrical conductivity of specific acupuncture or energy points on the skin. The several hundred such points on the human body are generally located along the meridians described in TCM, each associated with specific functions in the body, and named for a particular organ. Such electrical conductivity measurements provide information about the balance of Chi between the meridians and are used to diagnose the condition of the corresponding organs. Treatment correspondingly aims to correct health problems by improving the flow and uniformity of distribution of Chi. Electrodermal screening has been described as an indispensable tool for measuring biologic energies that no 21st century physician should be without. [16] Numerous factors complicate electrodermal readings and present challenges to studies of acupuncture point and meridian. Commercial electro-diagnostic devices are sometimes thought inadequate and that improved methods may be needed to pursue this research more rigorously. [17]

Despite this, electrodermal testing of acupuncture meridians has become popular in recent years due to ease of use of available instruments. One study using electrodermal measurements of weekend course participants suggested that the immediate effect of qigong practice improves balance of chi energy in the body, and correspondingly improves health.[18]

Acugraph: This study used the conveniently simple Acugraph3 Digital Meridian Imaging system, developed by Miridia Technologies in Meridian, Idaho, which has the following components: probe, ground bar, connector cable, software CD, user manual[9], and computer. Readings are based on the 0–200 scale of Dr Nakatani's original system. [19] It measures impedance with a voltage divider circuit comparing a known reference resistance, and gives transformed resistance at specific acupuncture points in normalized conductance (1/resistance) units; it works on very low voltages and currents (0-40 ìA), far below most people's threshold of sensitivity. [9] An AcuGraph operator can take about one reading every 3 seconds, or about 10 measurements per minute. AcuGraph use is precluded for those with implanted electronic devices such as pacemakers or defibrillators. Its use is also to be avoided near skin rashes, lesions, or wounds. Every effort must be made to reduce variations. Major sources of variability include: the instrument itself (device, electrodes and skin probe interface); operators; and physiological variability of persons being measured. Operators must be properly trained to reduce errors in readings, but even so high variability from this source can remain.[20] Physiological variability can be reduced, to some extent, by keeping time of measurements fixed; averaging readings smoothes out fluctuations. With these provisos, Acugraph provides information about chi energy level in each meridian of potential importance in diagnosis. Chi energy in a particular meridian is considered 'normal' if conductance values of both left and right meridians are within 10 points of the overall average for the subject. If both values are more than ten points above the average, the meridian is considered to have excess energy, 'High', while if both values are more than ten points below it is considered deficient in energy, 'Low'.[9] If Left and Right values of a meridian fall on either side of either the High (+15 points), or Low (-15 points) energy levels, its energy is considered 'split'. Acugraph presents a subject's meridians as a bar-graph, consisting of a pair of bars for each meridian. Each pair is coded in one of four colors: 'normal' in green, 'high' in red, 'low' in blue, and 'split' in pink, as these are considered important for individual diagnosis. [9] The average energy for each subject is depicted by a middle line in green with the value given. The Acugraph software also calculates derivative variables: overall Yin Balance, Yang Balance, Personal Integral Energy (PIE), Energy Level (EL), Energy Stability (ES), Left /Right Balance (L_R), Upper/Lower Balance (U_L) Yin/Yang Balance (Y_Y). Electro-dermal screening of this kind is now increasingly popular throughout the world for diagnosis and to monitor efficacy of treatments. SVYASA selected Acugraph3 as a possible instrument to assess its Yoga programs. Reliability testing concluded that meridian color readings were not sufficiently reproducible for diagnostic accuracy, but that it could be used to assess groups. [21] Here, we report changes in pranic energy levels in SMET course participants assessed using Acugraph3 measures on a limited number of acupuncture points – the Jing-Well points at the end of each meridian, the easiest to locate.

Methods

Study Design: was a pre-post, self-as-control study, assessed on 1st (pre) and 5th (post) day of the intervention. There was no separate control group.



Subjects: consisted of 45 executives of both sexes (39 males, 6 females) middle and top class ONGC employees, age range from 30 to 50 years.

Inclusion Criteria

Taking Self Management of Excessive Tension (SMET) program at SVYASA

Willing to participate in the study

Aged between 30 and 50 years.

Exclusion Criteria

Any cut, scar or mole on the surface of Jing well points.

Pregnancy or menstruation for ladies.

Chronic, contagious, infectious disease, e.g. active tuberculosis, Hepatitis B or C, or HIV.

Disseminated cancer, severe osteoporosis.

Missing any finger or toe.

Intervention: was a 5 day residential SMET program, a Yoga lifestyle intervention consisting of intensive anti-stress Yoga training from 4:30 am to 9 pm, incorporating the following: specified times of rising and going to bed,

vegetarian diet; group meetings and Yoga practices: yoga *asana* (yoga postures), *pranayama* (breathing techniques), relaxation techniques, stress management techniques, meditation, Yoga purification practices (kriyas), *bhajans* (singing), lectures, and yogic games.

Assessment: was done on 1st day and 5th day of the training program using the Acugraph3

Digital Meridian Imaging system measuring skin conductance at acumeridian end points.

Procedure for AcuGraph measurements: [9] Subjects sit comfortably on a chair, feet on a mat, and are first asked for personal information, which is entered in Acugraph soft: First / Last Name, ID number, age, gender etc. The subject's hands are checked for excessive wetness or dryness, which is adjusted using a towel or damp cotton ball (used to improve the conductivity of the electrical probe) applied to each acupuncture point. The subject then holds a ground bar with a medium grip in one hand, while successive acupoints on the opposite side ('Jing Well' point at the extremities of acupuncture meridians on the hands and feet), are measured in the order which the computer specifies, and for which it records readings at the specified left and right measuring points on all major acupuncture meridians; 6 on each hand and 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, and Large Intestine, (Hand) and Spleen, Liver, Kidney, Bladder, Gall Bladder, and Stomach (Foot). Care was taken to collect pre post data for each subject at exactly the same time of day from 9: 30 am to 1:00 pm by a trained and skilled operator not involved in design or intervention, who managed pressure points, and location and alignment at the Jing-Well points.

Data Analysis: SPSS 19 statistical software was used to analyze the data. One Sample t-tests were used for each meridian.

Results

Results are given in Table 1. In the pre-data, mean energy level was very low, 24.38 ± 8.24, but much of the variance was due to upper-lower imbalance of 22.62 ± 14.30. The average for the upper meridians was 26.0 ± 11.24, while that for the lower meridians was 23.51 ± 12.35. This shows that the executives' normal energy levels were very low.

Comparing the pre data with the post data showed general improvements in the overall values of meridian energy. Only two meridians did not improve significantly on average, KI_L ($p = 0.277$) and HT_L ($p = 0.090$), though the latter showed a good trend. All other meridians improved in energy with $p < 0.05$, confirming previous findings that low pranic energy levels are rectified by IAYT Yoga lifestyle intervention. [7, 22, 23] With regard to the average variables, overall energy level EL improved, and its components of Yin meridian mean energy and Yang meridian mean energy also did so.

A striking feature of these results is the extremely low average energy level of 24.38, EL. The same operator previously obtained a mean energy level of 86.05 for a group of 37 diabetics.[20] Normally, pathology tends to decrease EL values, but here, despite being apparently healthy, subjects had overall energy levels only 28% of the diabetic patients. The operator (MKB) also reported that, when taking the pre-data, the low energy levels made many readings hard to obtain; even achieving initial electrical contact at an acupoints presented a challenge. The low EL value presented a contrast, however, to the number of balanced meridians: The subjects had an average of 10.96 out of 12 meridians in balance in the pre data, remaining much the same at 10.71 in the post data. In contrast, the group of diabetics averaged many more meridians out of balance. So in balance out of balance appears to be a more reliable estimate of pathology, as the manual suggests.

Table 1 - 5-Day SMET Program Results

VARIABLE		MEAN ±SD	Change	't'	p Values
LU_L	PRE	30.04 ±12.70	8.22	3.33	0.00176
	POST	38.27 ±19.12			
LU_R	PRE	25.29 ±11.05	9.20	3.91	0.00031
	POST	34.49 ±18.03			
PC_L	PRE	28.00 ±10.76	7.78	3.71	0.00057
	POST	35.78±14.03			
PC_R	PRE	23.42±10.15	8.13	4.31	0.00008
	POST	31.56±11.12			
HT_L	PRE	27.42±15.81	4.40	1.73	0.090
	POST	31.82±16.52			
HT_R	PRE	20.89±8.54	8.36	5.74	8×10^{-7}
	POST	29.24±11.61			
SI_L	PRE	26.40±12.65	6.04	2.69	0.00999
	POST	32.44±16.60			
SI_R	PRE	26.00±10.26	6.53	3.23	0.00234
	POST	32.53±14.02			
TE_L	PRE	24.76±12.91	5.69	2.99	0.00459
	POST	30.44±13.29			
TE_R	PRE	22.58±8.67	6.76	3.74	0.00053
	POST	29.33±14.66			
LI_L	PRE	30.27±10.69	8.80	3.03	0.00402
	POST	39.07±18.52			
LI_R	PRE	26.93±10.71	7.91	3.47	0.00117
	POST	34.84±16.18			
SP_L	PRE	21.87±11.85	6.49	3.95	0.00027
	POST	28.36±11.97			
SP_R	PRE	19.47±9.66	10.00	4.98	0.00001
	POST	29.29±16.37			
LR_L	PRE	23.38±11.10	10.04	5.20	4×10^{-7}
	POST	33.42±15.43			
LR_R	PRE	22.76±13.08	9.16	4.50	0.00005
	POST	31.91±17.67			
KI_L	PRE	26.00±19.78	3.60	1.10	0.277
	POST	29.60±16.74			
KI_R	PRE	21.42±10.15	10.00	4.21	0.00012
	POST	31.02±17.54			
BL_L	PRE	21.91±10.14	14.49	5.35	0.0000029
	POST	36.40±20.60			
BL_R	PRE	23.96±11.67	12.89	5.47	0.0000020
	POST	36.84±20.04			
GB_L	PRE	23.60±11.27	11.29	4.36	0.000077
	POST	34.89±21.01			
GB_R	PRE	24.00±10.55	12.27	4.67	0.000028
	POST	36.27±21.89			
ST_L	PRE	27.11±15.15	11.07	3.95	0.00028
	POST	38.18±21.85			
ST_R	PRE	26.67±13.76	11.87	5.08	0.0000073
	POST	38.53±21.13			

VARIABLE		MEAN ±SD	Change	't'	p Values
LOW	PRE	10.67±7.71	+8.00	5.46	0.0000020
	POST	18.67±12.18			
MEDIUM	PRE	24.96±8.36	+8.15	5.47	0.0000020
	POST	33.11±12.63			
HIGH	PRE	38.71±9.69	+9.29	4.99	0.000010
	POST	48.00±12.62			
YIN	PRE	24.29±8.24	+7.8	5.44	0.0000020
	POST	32.09±11.48			
YANG	PRE	25.73±8.81	+9.29	5.55	0.0000015
	POST	35.02±14.30			
PIE	PRE	77.93±8.85	-3.46	1.71	0.095
	POST	74.47 ±11.16			
EL	PRE	24.38±8.24	+8.62	5.59	0.0000013
	POST	33.00±12.62			
ES	PRE	86.24±8.61	-2.68	1.55	0.127
	POST	83.56±7.87			
U_L_ BAL	PRE	22.62±14.30	+0.45	0.19	0.852
	POST	23.07±16.33			
L_R_BAL	PRE	10.80±8.85	-0.64	0.36	0.720
	POST	10.16±6.91			
YIN/YANG	PRE	10.53±9.65	-0.86	0.52	0.603
	POST	9.67±7.40			

Table 1: Pre-post changes in Acugraph parameters over a 5 day SMET program. The program significantly improved overall chi energy, but the data show exceptionally low readings. Most pre readings are below 30, one below 20. Other studies have found low energy levels in people working in stressful jobs, as here. Personal Integrated Energy (PIE), Chi energy stability (CES), Upper Lower Balance (ULB), Left Right Balance (LRB), Yin/Yang Balance did not change significantly.

Discussion

Low energy levels indicate strain, and suggest susceptibility to disease. It is well known that pressurized work environments make employees disease prone and this data tends to corroborate that idea. In terms of pranic energy, one would say that the prana levels were low and that the pranamayakosha lacked resilience i.e. resistance to disease was compromised.

Despite low initial energy levels, the data upheld the experimental hypothesis that five days SMET program would increase energy levels: average increase was 8.77±2.72 points, and post readings were correspondingly easier to obtain. At the end of the course, however, 'Energy Levels' in most participants were still far lower than is desirable, suggesting that a longer intervention is needed for modern executives. The uniform increases observed over a range of initial values support this idea. Longer interventions might also show significant changes in the various combination variables that did not reach significance.

The strength of the study was that changes in individual meridian averages and overall Energy Level attained excellent p values. This was also seen in a previous study.[9, 22] we can therefore be certain that these results are reliable, and will repeat for similar courses / interventions in future. The weakness of the study was the short duration of the intervention, which, though usual for business courses, is shorter than SVYASA's normal medical IAYT Yoga life-style programs. Dependence of increases in energy level on different intervention durations needs to be investigated.

Similar studies have obtained related results: measures of Chinese practices also indicate increased chi energy. Sancier[15, 18] found increased levels of Chi following a weekend Qigong workshop. Another study of Tai Chi[24], showed greater reduction in salivary cortisol and improvement in mood than meditation and brisk walking Tai Chi involves slow body movements providing moderate aerobic exercise, but does not involve supine rest alternated with slow body movements as does cyclic meditation used in SMET.

The natural question is how Yoga achieves the observed increases. One hypothesis is that it does so directly, because Yoga practices aim to increase levels of pranic energy[7, 11] i.e. chi in the meridians. However, it could also be because energy consumption tends to be decreased by Yoga practices, and practitioners' physiology tends to function more economically, and should have 'energy' to spare. This seems to happen in Tai Chi. Lan[25] found reduction in subjects' oxygen consumption when breathing through an open circuit apparatus while practising Tai Chi.

A yoga study reported reduction in oxygen consumption (25.2%), and sympathetic activity after 10 minute practice of yoga-based guided relaxation in a supine posture. [26] Studies of Transcendental Meditation (TM) reported reductions in metabolic rate (and hence in need for oxygen) during TM reflected by an involuntary decrease in respiration rate and volume. [27] Greater reductions in oxygen consumption, respiratory rate, minute ventilation and tidal volume after CM[28], may have similar explanations. They suggest that the slow cyclic practice of yoga postures followed by rest in a supine posture induces deeper relaxation than supine rest alone. Indeed, the importance of alternating exercise with periods of rest has been independently described. [29] The yoga postures practiced in CM are physically activating compared to supine rest. One study of a guided relaxation technique combined with meditative stretching (body-mind training) found 31% reduction in electromyogram (EMG) of the frontalis muscle, and 22% reduction in state anxiety and fatigue[30], suggesting that meditative stretching combined with guided relaxation induces deeper muscular relaxation. Another showed that cyclic meditation[5], where slow body movements with sustained attention produce 'calming' and 'stimulating' effects with emphasis on awareness, improves performance on the six letter cancellation test better than supine rest. [31-33]

A study on effects of three different procedures, relaxation, visualization and yoga training, on perception of physical and mental energy and mood, demonstrated that relaxation and visualization made subjects sleepy and sluggish immediately after the practice, whereas the yoga training consisting of yogic stretch and breathing produced significantly greater increase in perception of mental and physical energy, feelings of alertness and enthusiasm. [34]

Conclusion

Our findings are consistent with previous studies of AcuGraph[35], that although Acugraph's information on individuals is not sufficiently accurate, analysis of data from groups can reduce variance enough for the information generated to be scientifically useful.

Group results supported the hypothesis that Chi energy would increase, both in individual meridians and overall.

Persistent low energy levels suggested that employees with workplace stress should attend longer Yoga courses, however. Failure to achieve significant improvements in average variables other than overall Energy Level (EL) i.e. Personal Integrated Energy (PIE), Chi energy stability (CES), Upper Lower Balance (ULB), Left Right Balance (LRB), and Yin/Yang Balance, also support this conclusion.

Conflict of Interest Statement: no author has any conflict of interest to declare.

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