

International Conference on Yoga

SECTION 4 : OTHER APPLICATIONS OF YOGA

4.1 KEYNOTE ADDRESS

ACCELERATING THE APPLICATION OF YOGA FOR ANANDA

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ABSTRACT

There is a big gap between the potential of the yoga sastras to benefit humanity, and their actual application. In recent years, there is a worldwide renewal of interest in yoga. The address notes the underlying driving forces for this trend. It goes to explore how those forces could be further mobilised to accelerate the applications of yoga.

More specifically, we examine the scope for better understanding and practice of four types of yoga. Depending on their prakriti, nature; vasanas, tendencies; and needs, people may take up one or more of these yogas sooner. For example, in the western world, there has been more interest in Raja Yoga, especially in asanas, postures. There is also growing interest in dhyana, meditation. In India, there appears to be a rediscovery of bhakti yoga, in a less apologetic and more confident manner. Leaders in politics, administration, industry and NGOs can bone-fit themselves and society by becoming more of karma yogis. They as well as the bulk of the population, caught in the may a, delusion, of excessive materialism and consumerism, need to tread the path ofjnana yoga, to find a better balance in life. The address concludes with ideas for action by individuals, organisations, governments and facilitators.

A core principle of the Hindu philosophy, culture and civilisation, which gave birth to all the yogas, shared with all of humanity, is not negation, but affirmation, balanced enjoyment and transcendence of life. The aim is Ananda (joy), from birth; nay, even conception; to death; and rebirth and continuity, in many possible forms. However, alas, the full potential of yogaas for global ananda is far from being realised. This keynote address attempts to see ways in which their application can be accelerated.

1. Yoga Asanas (= Postures) : One component of the vast treasure of yoga, which seems to have spread most is the simplest one of physical postures.

- i. The post-war prosperity led Americans to search for alternative life styles. Yoga was adopted by the social rebels, as part of the counter culture,
- ii. With the spread of Indian music, food and other elements of Indian culture, celebrities in the film, art and intellectual worlds took to yoga, which increased its popular acceptance,
- iii. Modern technology of videos, films and audio cassettes has enabled self and group learning of yoga postures,
- iv. As has happened in some other areas, yoga is finding renewed interest in India, following western acceptance.

2. Dhyana (=Meditation) : The next most popular element of yoga has been meditation.

- i. The stress of life in industrial society, has led people to seek methods for calming an agitated mind,
- ii. Indian gurus and teachers have packaged and offered meditation in acceptable doses. Transcendental Meditation, in particular, seems to have spread worldwide,
- iii. Foreigners and affluent Indians visiting and staying with gurus have been exposed to group meditation.
- iv. It is being adopted by corporates, schools and government departments.
- v. It has entered popular lore through newspaper and magazine articles; radio and TV talk shows.

3. Pranayama (= Aware Breathing) : While this is relatively less practised, it is getting better understood.

- i. The need for stress management has brought about a better understanding of psychological and physiological causes, as well as consequences of breathing.
- ii. The higher incidence of cardiovascular exercises has led to better appreciation of the preventive and curative aspects of aware breathing.
- iii. Rise in urban pollution has further contributed to the realisation of restoring at least part of the health of the lungs by guided breathing techniques.

4. Raja Yoga : All the above three elements are part of the broader maarga, path, of the Raja Yoga, the science of total physical and mental fitness. Sage Patanjali, in his Yoga Sutra, codifies the Astanga Yoga, the eight parts of yoga. It includes the following five additional elements other than the three referred above:

- a. Yama (= good conduct) b. Niyama (= control) c. Pratyahara (= direction) d. Dharana (= focus) e. Samadhi (= bliss)

These are understandably, less widely practised. They require more time and dedication for intensive practice. They may be more relevant and feasible for the following kinds of persons :

- i. External Yoga Trainers, located in Asramas and Institutes, many of whose aspirants may graduate, in addition to the first three, into the next few, perhaps all the five elements.
- ii. Even some of the internal yoga trainers, in large organisations, at least some of whose participants may develop further interest.

5. Bhakti Yoga (= Devotion) : The advance of capitalism, technology and markets is drawing most people into Rajasic, feverishly hyperactive behaviour, a. Many in more Tamasic, indolent states are being drawn by advertising and demonstration effect into working for consumption. They are goaded by their family, friends and neighbours into more consumption, b. Even those who may have normally been in a Satvik state, a state of refined frictionless energy, are getting reluctantly pushed into Consumerism by the prevailing social environment and forces.

Consequently, more people experience stress, tension, disappointments, conflicts. There is a greater incidence of psychosomatic diseases. More serious illnesses such as Blood Pressure, Diabetes and Heart Ailments strike people at a younger age. Some of these afflicted are drawn to Bhakti. Most of them do so rather reluctantly. The reluctance stems from many reasons. It may be felt by the person, and seen by others near him, as a sign of failure, weakness or irrationality. The problems, often, need to be serious before the modern mind resorts to Bhakti. Nevertheless, this yoga is coming gradually under more application.

- a. Medical researchers have been measuring and documenting the benefits of Prarthana, prayer in coping with treatment, convalescence and stabilisation.
- b. Doctors are less dismissive of prayer and Satsang, in coping with pain, cure, relapse, and later prevention.
- c. A growing number of gurus and ashrams are providing the atmosphere and facilities for group prayers. These are accommodated to suit the convenience of office and facilities for group prayers. These are accommodated to suit the convenience of office and factory hours. They are held in

mornings, evenings and weekends.

d. One hopeful feature is that more parents are now able to take their children to learn and sing prayers in variety of kendras, centres, such as Sringeri, Kanchi, Chinmaya, Sai, Ramakrishna Mission, Udipi, Radho Swami, Brahma Kumari, Ma Amritanandamayi, Shri Ravi Shankar, Shri Rishi Prabhakar, Pandurang Sastry Athavale and many others.

e. Many television channels bring Pravachans, discourses, to millions of people in their homes. This is in addition to the thousands who listen in person, and hopefully, share with many more.

f. Bhakti chants and songs are also becoming more accessible, through audio cassettes. Even when extremely pressed for time, people try to listen to these while commuting to work or social engagements.

All the above steps are only at the courtyard of Bhakti. But they are a good start. If each human being can implant and keep remembering his/her Ishta Devata (Chosen Deity) - whether Rama, Siva, Krisna, Ganesa, Kumara, Hanuman, the Buddha, Allah, Jesus or Isvara - it helps to bring out the divinity and Satva in that person.

Bhakti Yoga has potential to help even the agnostic, and, indeed, also the atheist. Some of them show their Bhakti to worthwhile causes, such as the preservation of our fragile ecology, and relief to the poor, physically and mentally challenged, and elderly persons. Devotion to any worthwhile cause, such as the cosmos, humanity, nation, society, community, organisation and family is a form of bhakti, helping the individual to transcend Ahankara (=ego) and Svartha (=self-interest); and move towards Paropakara (=help to others).

6. Karma Yoga: The contemporary life is dragging practically every one into karma for long hours, daily, and over weekends and holidays. Besides, many work well beyond normal retirement, practically until death or serious, incapacitating illness. But all this Karma does not seem to bring them commensurate Santi (Peace) and Ananda (Bliss). Why? What is the way out.

The term 'Karma' is often misunderstood. Many, especially, foreign students of Indian philosophy, in particular the critics, take Karma to mean that it refers to the burden of Purva Janma Karma, actions of past births, and the possible consequent, helplessness and fatalism of the individual. But, of course, Karma is a much more dynamic concept and force. Each individual has significant freedom and responsibility for his/her current and coming Karma, through which one can shape a positive future, as well as overcome any unfavourable effects of the past.

There seems to be some awakening even to the intellectually and psychologically demanding principles of Karma Yoga.

i. The core principle of Karma Yoga is Nishkama Karma, work without desire for rewards. This is intellectually very difficult for the modern market denizen to grasp. The world is seen as a bazaar, a market and not a human community. Relationships and interactions are tending to be transactional based on bargaining. After some experiences of mistrust and win-lose, some seem to understand that dedicated, unilateral performance of Karma is the optimal strategy. Competition itself is bringing concern for customer, her satisfaction and delight; and for the shareholders and wealth creation for them.

ii. There is also more enlightened self-interest. This leads to a stronger commitment to sharing the phalam, fruit of action, rather than focussing exclusively on one's own phalam.

iii. In industry, the increasing commitment to corporate governance, transparency, social responsibility, good citizenship and philanthropy, shows an approach towards purer Karma, with less negative internal residues and external fallouts.

iv. In civil society, the smaller NGOs bring out the idealism of committed young people, women in self-help groups and aware men towards Alpa Kama Karma, less selfish work. If not totally nishkama, selfless.

v. Even in the larger national and international NGOs, there is an element of Madhya Karma,

moderately selfish work.

- i. Defeats in elections and public feedback through the press and NGOs is forcing politicians also to understand the laws of Karma yoga slightly more.
 - ii. Setbacks in careers due to careerism, corruption, sycophancy and manipulation seem to be bringing awareness among civil servants, high and low, to perform more Satkarma (good work) and less Dushkarma (evil work).
 - iii. Another principle of Karma Yoga is Kausalam, excellence in all work. Yoga karmasu Kausalam. The rising expectations of all stakeholders, the customer and citizens, has led to a wider quality movement, including ISO 9000, Total Quality Management and Human Resource Development.
- K. A third principle of Karma yoga is Samatvam (Balance). Samatvam Yoga Uchyate. A combination of the need to prevent and reduce Stress, Conflicts and waste is leading to more balance in decisions, actions and responses. Complex issues of liberalisation, globalisation, privatisation, restructuring and social change are being dealt with more through dialogue and less escalation.

7. Jnana Yoga (=Realisation) : The most difficult yoga for all human beings is the achievement of true (Jnana) Realisation. The achievement of Jnana comes only through Prashnam (Questions); Pariprashnam (Counter questions); Pranipaten levaya (Service with Humility). These are difficult for the contemporary Buddhi (Intellectual). Even that term is to be questioned. Are we more 'Manajlvis', living by the mind, rather than by wisdom. Or, perhaps just Vidya Karmis, Knowledge Workers, with a fast obsolescing and limited kind of Vidya.

. More Para Vidya, bounded knowledge of the external world of objects; and

. Less Apra Vidya, boundless knowledge of Brahman and the Self. Even in the most challenging area of Jnana Yoga, some stirrings in awareness and application are visible.

There is an emerging field of research and discussion on the theme of "Spirituality at Work", two ideas, Spirituality, on the one hand and work on the other, which were considered antithetical.

i. Behavioural scientists and trainers are realising that beyond reaching the body, head, and heart of the employees, it is also necessary to reach their soul (Atman).

ii. Mid-career, Mid-life, Family and other crises bring in some Vivek (Discrimination); and Vairagya (Detachment).

v. A convergence between Advaita, Monism and the unified field theory of Quantum Mechanics; the history of time and the universe; the cycles of big bang and black hole; Srishti (Creation) and Pralaya (Deluge), are widening the vision of the Manajlvis, from their spiritual Kupastha Mandukam (frog in the well existence).

8. Action Agenda : The world will need Yoga even more in the coming years –namely, the third millennium of Christendom, the sixth millennium of China, and perhaps the fourteenth millennium of the Indian civilisation. The following actions need to be taken in a concerted manner by the individuals, parents, organisations, governments and Yoga Acaryas (Teachers).

i. Start the children early on Raja and Bhakti Yogas, through schools and Kendras in all locations.

ii. Supplement them in adult life with Karma and Jnana Yogas,

iii. Reinforce all the Catur Yogah (Four Yogas) in mid-life periodically.

iv. Research, retrieve, translate into all world languages, the core ideas and methodologies of all the four yogas and popularise them world-wide.

Governments and Corporations need to support this research and dissemination generously,

v. All formal organisations, commercial and non-profit, should encourage all their employees to learn and practice all the four yogas, and extend them to their families and local communities,

vi. Every global citizen should enrich herself/himself and their communities by integrating total yoga into a holistic life style, blending the four goals of Dharma (Ethics); Artha (Wealth); Kama (Enjoyment); and Moksha (Transcendence).

4.2 INVITED TALKS

APPLICATIONS OF YOGA

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ABSTRACT

Yoga, a magnificent inheritance commands a strong and benevolent presence in this world. Yoga is a way of life an integrated system of education for mind, body and spirit. This art was perfected and practiced in India thousands of years ago. Many have responded to the call of yoga in recent times and reaped diverse benefits in terms of enhancement of quality of life (physical & mental health). By persistent toning and relaxing the body, calming the breath and mind, one gets in touch with inner peace more and more as time progresses.

Yoga brings harmony of mind and body, preventive and rehabilitative benefits are unsurpassed, the traditional wisdom as encapsulated in yoga deals with prevention and control of diseases, incorporating the fundamental pillars of, positive health and prevention of disease, the therapeutic benefits have been well established in a number of disease states including psychosomatic disorders. Scientific studies and exciting developments in research methodologies establish the innumerable applications of yoga in various fields. Inclusion of yoga in 'Holistic Health Therapy', in 'Alternative Medicine' and as a 'Supportive Therapy' show that a multitude of potentials of yoga, an ancient Indian science, have been realised.

Yoga, a magnificent inherence, commands a strong and benevolent presence in this world. Yoga is a way of life, an integrated system of education for the mind, body and spirit. This art was perfected and practiced in India thousands of years ago. Many have responded to the call of yoga in recent times and reaped diverse benefits in terms of enhancement of quality of life (physical and mental health). Many are first attracted to yoga to keep oneself fit. Others join to get relief from ailments like backache, hypertension, diabetes etc. Secondly yogic postures initially look like physical postures bring subtle changes in one's approach to life. By persistent toning and relaxing the body, calming the breath and mind, one gets in touch with inner peace as time progresses. In today's fast life style, yoga has a multitude of applications. Firstly as it provides the much needed relaxation by releasing tension in muscles and strengthening the immune system. Secondly, yogic postures provide stretching and toning of muscles, maintain flexibility of joints and thereby improve fitness. Thirdly, yoga teaches correct breathing techniques to improve vitality and gain control over mental state by regulating the flow of Prana. Fourthly, yoga teaches proper attitudinal changes of appropriate restraints and disciplines and positive thinking and therein points to its role in education. Yoga brings harmony of mind and body. Fifthly, preventive and rehabilitative benefits are unsurpassed. The traditional wisdom as encapsulated in yoga deals with prevention and control of diseases, incorporating the fundamental pillars of positive health and prevention of disease. Sixthly, the therapeutic benefits have been well established in a number of disease states including psychosomatic disorders.

Scientific studies and exciting developments in research methodologies ranging from microelectrodes to Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET) and

Functional Magnetic Resonance Imaging (fMRI) have made it possible to probe secrets related to nearly billions of interconnected neurons of the brain and thereby establish the innumerable applications of yoga is a prime historical example of a science based on observation, projection of hypothesis and experimental testing. Yoga and meditation have been tested pragmatically and findings are based on similar individual & group experiences, effects reported from generation to generation and technological advances. Understanding applications of yoga has been possible by using appropriate methodology both theoretical & experimental. Theoretical is exploration of nature of human psyche by observation, analysis & evaluation of experience while experimental study involves stimulus input into various systems by yogic practices such as the CNS by relaxation and meditation, in sensory system like vision by eye exercises and visualization, audition by chants, and internal sounds, smell by essence, taste by food, touch by mudras, respiratory system by breathing, in CVS through breathing practices and asanas and the musculoskeletal system through asanas. Applications of yoga: broadly classified into promotive, preventive and therapeutic

Promotive	Preventive	Therapeutic
Physical fitness	Psychosomatic	Hypertension
Sports	Disorders	IHD
Education	Diabetes	Obesity
Personality	Obesity	Backache
StressManagement	CVSRisk	Asthma
Geriatrics	Pain	Rehabilitation
Psychiatry		
Interpersonal	Relationship	Orthopedic
Acclimatization	Migraine	

PROMOTIVE AND PREVENTIVE ROLE

Health is "swasthya" - a state of well being (bodily elements work in an integrated manner) and disease is "Vyadhi" - a state of disintegration. Need of the hour is promotive measure as drugs are costly, side effects are common & no cure for some ailments. Yoga has a significant role to play. General effects of yoga in conferring promotive health is due to its ability to establish stable autonomic balance, development of hypometabolic state, improvement of physical efficiency, improvement of thermoregulatory efficiency, increase in cardiopulmonary functions, improved immunological tolerance, a tranquil state of mind to combat stress. Reduction in cardiovascular risk is possible as yoga establishes a healthy metabolic profile. Evidences pointing to this effect is decrease in blood pressure, free fatty acids, LDL & VLDL cholesterol, increase in HDL cholesterol, decrease urinary excretion of adrenaline & non adrenaline, decrease in fasting blood glucose, decrease in DBH, in MAO cholinesterase, increase urinary 17 DH & 17 keto steroids (Selvamurthy et al) Preventive role in NIDDM and syndrome X is due to improved insulin kinetics reduction in insulin resistance and increase in glucose utilisation (Sahay). All the above changes point to autonomic shift to parasympathetic from sympathetic & healthy metabolic profile provides buffering function which of great significance in stress related disorders as one tackles stress in a more efficient manner and with reduced deleterious effects on the body (Malathi et al) Research in yoga have clearly shown reduction in anxiety, increase in GSR, increase alpha activity. The psychophysiological changes can

be attributed to inhibition of vHPA axis as evidenced by decrease in cortisol levels (Ray et al, Selvamurthy)

YOGA AND PHYSICAL FITNESS

Improvement in motor skills is due to the effects of yoga on improvement in dexterity, coordination, flexibility, improved steadiness, perception, improvement in muscle power (grip strength) (Malathi et al). Improved cardiorespiratory efficiency is well established as evidenced by lower heart rate response to exercise, reduced oxygen consumption per unit work, reduced minute volume, increase in breath holding time, improved respiratory endurance, increase in maximum breathing capacity. Thus all these findings point to economical energy expenditure. Body composition studies showed reduced skin fold thickness and increase in lean body mass. The increase in endurance time could be due to alternate recruitment of motor units, onset of fatigue delayed, decrease in pyruvate and lactate levels, increase in aerobic power and postponement of anaerobic threshold. The above benefits point to the important role of yoga in sports (Ray et al). National health policy on education (1986) has recommended the inclusion of yoga in sports which aims at physical fitness and emotional stability. An integrated yogic schedule aims at autonomic balance, calm mind with increased awareness and concentration (Schmidt et al, Madanmohan et al)

YOGA AND EDUCATION

There is need of yoga for teachers as the job is tiring, as one needs to keep students attentive, verbose because one has to be heard for long duration. Voice modulation, concentration are also essential. Yoga provides an opportunity to teacher to understand child's nature. The benefits of yoga for students is well established as there is improvement in attentivity which is essential learning and for memory. Also memory is enhanced in a relaxed atmosphere. Research evidences point to decrease in anxiety particularly during exams as shown by increase in GSR, improved performance, memory especially spatial memory is facilitated (Naveen et al). Further yoga taught at younger age provides reduction in asymmetry of shoulders, abdominal muscle toning and improved fitness. An important benefit derived is improved concentration in terms of balance time, reduced distractibility and error scores. Studies on relaxation and yoga in community home children showed a relaxed nature with reduced respiratory rate & regular breathing (Shirley et al).

YOGA AND INTERPERSONAL RELATIONSHIP

Need has arisen due to increase in violence, fear and insecurity, family break ups, physical and sexual abuse, suspicion between people etc. We live in association with other people, friends, colleagues, family members which determines the quality of life. In Yoga, definition of healthy relation is "self development, trying to understand ourselves and to continually make efforts to change in order to reach highest potential as human beings" (Nespor).

YOGA AND REHABILITATION

Rehabilitation is the process of restoring functional and mental abilities and attempt to reverse risk factors that contributed to the events wherever possible. In mentally handicapped role of pranayama, suryanamaskar, asanas and meditation have shown improved motor coordinations, improved social adjustment, improved mental ability. Restoration to some degree of functional

ability has been shown in physically handicapped wherein role of asanas in causing repeated muscle stretching has been proved beneficial. Loosening exercises in rheumatoid arthritis help to regain function of grasping. Studies in visually handicapped have shown role of asanas, breathing practices in decreasing anxiety levels, improved motor skills, dexterity and similarly in socially disadvantaged the benefits yoga is shown in decrease in anxiety, breath rate, increase GSR, improvement in sleep and in well being (Shirley et al). Further in coronary artery disease the benefits asanas, breathing practices, visualization, life style modifications are well demonstrated in increase in exercise tolerance, increase net change in left ventricular ejection from rest to maximum exercise of + 6.4% and 20.5% decrease in plasma cholesterol (Manchanda et al, Mahajan et al) Patients of substance abuse practicing asanas, pranayama, meditation have shown active cooperation, reduction in depression, anxiety, and improved mental resolve,. Addition is a disease that afflicts body, mind and soul. Simple gentle stretching and then postures - tadasana, virasana, trikonasana, breathing and meditation to bring awareness to disregarded parts of body, relaxation to achieve harmony of mind and body, pratyahara - for withdrawal, mantra allows sense of well being to percolate into one's mind, body & almost into every cell. In HIV patients yogic postures to honor the body, to improve quality of life has been advocated with good results. Yoga sets the dialogue between nervous system, endocrines and immune system improving immunological competence (Nespor)

YOGA AND MEDICAL APPLICATION

The therapeutic benefits of yoga has been well established in hypertension asthma, obesity, diabetes, orthopedic problems, sleep loss related problem, coronary artery disease, psychiatric problems. In essential hypertension baroreceptor sensitivity is decreased as shown by sluggish response to orthostatic, increased CPR response. Decrease in blood pressure, improved tilt response, improved cold pressor response, decrease in catecholamines, decrease in plasma renin activity have been seen following yogic practices indicative of attenuation of sympathoadrenal and renin angiotensin activity and improved baroreceptor sensitivity (Selvamurthy et al) The erythrocyte lipid peroxidation levels are increase while reduced Na KATPasc levels in essential hypertension. Following yogic practices there is an reduction in lipid peroxidation and increase in Na KATPase levels (Talukdar et al). Sudarshan kriya practice has shown significant anti depressant effects while relaxation in adjustment disorder and depression showed decrease in self reported anxiety, restlessness, and cortisol levels (Satyanarayana, Naga Venkatesh Murthy et al) Epileptic patients practicing meditation by word repetition showed decrease in seizure frequency, in duration intensity of seizure (Deepak et al). Sahaja yoga in epilepsy showed increase in GSR pointing to reduction in anxiety, reduction in blood lactate & urinary VMA, Inference that can be drawn from this is that Sahaja yoga practice is beneficial to patients with high anxiety level & psychosocial problems. Mechanism of action may be acts by conditioning of limbic system which in turn regulates ANS & HPA (Usha Panjwani et al). In multiple sclerosis an improved positive attitude of life was seen.

Studies in diabetics have shown decrease in blood sugar, drug score and improved insulin kinetics (Sahay). The role of yoga in pain management can be attributed to self awareness, relaxation, self acceptance. Yoga has philosophical dimensions which plays a role in promoting independence & self confidence of people suffering as evidenced by 33% pain reduction (Melzack's scale) in 65% of patients along with decrease in mood disturbance and psychiatric symptomatology. The mechanism may be attentional stance towards proprioception called "detached observation". It

could cause "uncoupling" of the sensory dimension of pain experience from the affective alarm reaction and reduce experience of pain through cognitive reappraisal (Nespor K). Yoga has both preventive and curative role in orthopedic problems. Anxiety paralysis activity and increases muscle spasms and reduces flexibility. Poor postures, lack of exercise aggravate the condition. We have stopped responding to signals of bad posture. Yoga reestablishes tone, improves coping mechanisms of stress, improves flexibility, awareness of posture. Sleep wakefulness is a behavioral phenomenon. Altered state mind (anxiety/depression), fever, environmental factors, hypertension, altered blood gas levels lead to reduced sleep. Sleep loss is associated with fatigue, confusion, decrease in concentration, memory, increase in aggressiveness, irritability and raised nor epinephrine levels, Yoga, which is known to reduce norepinephrine, could provide beneficial effects in sleep loss related disorders as well.

YOGA AND ACCLIMATIZATION

In stressful environment maintenance of stable autonomic equilibrium is essential. Studies have revealed beneficial effects of yoga in cold conditions as shown by improvement in thermoregulatory efficiency, reduction in cold induced vasoconstriction, non-shivering thermogenesis, quicker rewarming, magnitude of fall in oral temp is less. Findings point to economical heat production wherein hormonal mechanisms could be responsible. Keeping physically and mentally fit even in stressful environments (soldiers) is of great concern. Studies have revealed the benefits of yoga particularly with respect to increased alpha index, decreased anxiety and stable cognitive functions in subjects exposed to such stressful situations (Selvamurthy). Thus with the multitude of application of yoga, the inclusion of yoga in Holistic health Therapy, in "alternative medicine" and as a "supportive therapy" show that varied potentials of yoga, an ancient Indian science have been realised. Yoga may be the answer for various inherent problems of modern, urban society as it offers avenues for promotive, preventive and therapeutic benefits.

VEDIC AND YOGIC ORIGINS: A NEW SOURCE

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ABSTRACT

More than 2000 seals have been unearthed during the extensive excavations conducted at the ancient sites of Harappa and Mahanjodaro. The study of these seals throw light on our ancient scripts and epics like Vedas, Ramayana and others. It also opens the new chapter of the ancient literature, Veda. We come across the references to the presently non-existent river Saraswati. It sheds light on Vedanta. The greatness of Rama has been portrayed and his character has been very well acclaimed through pictorial representation found on these seals. The script found and deciphered on Harappan seals indicates that it corresponds to Old Brahmi. Harappan civilization overlapped with the Sutra period of the Vedic age. This means that Patanjali of Yoga Sutra fame must date to 2000 B.C and quite different from the grammarian Patanjali of Mahabhasya.

In our recently published book, *The Deciphered Indus Script*, N. Jha and I present deciphered readings of well over five hundred texts with Vedic references and explanations. Since many of the messages are repeated on different seals, they probably cover between 1500 and 2000 seals, or about half the known corpus. We have read more that are not included in our book for reasons mainly of logistics. These can now serve as new invaluable source for the study of the closely related fields of Veda, Vedanta and Yoga. The main conclusion to follow from our work is that the Harappan Civilization, of which the seals are a product, belonged to the latter part of the Vedic Age. It has close connections with Vedantic works like the Sutras and the Upanisads. The style of writing reflects the short aphorisms found in Sutra works. The imagery and symbolism are strongly Vedic. The vocabulary depends heavily on the Vedic glossary Nighantu and its commentary by Yaska known as the Nirukta. There are references to Vedic kings and sages as well place names. Of particular interest are reference to Plaksarga - the birthplace of the Sarasvati River, and Sapta Apah or the Land of the Seven Rivers. Subsequently, I myself deciphered what was billed as the 'world's oldest writing' (c. 3500 - 3300 BC), showing it to be a reference to 'Ilavarta', which, according to the Rigveda, is the land bounded by the Sarasvati and the Drsadvati rivers. This means that the Rigveda must already have been quite ancient by the time of the Harappan Civilization. Since the Harappan Civilization was known to be flourishing in the 3100 - 1900 BC period, the Rigveda must have been in existence by 4000 BC. This now receives archaeological support following R.S. Bisht's investigation of the great Harappan city of Dholavaria. Bisht (and other archaeologists) have concluded that the Vedic Aryans of the Sarasvati heartland were the people who created the Harappan cities and the civilization associated with it. Our deciphered readings tell us the same thing. This has particular relevance to the origins of Yoga - both in principles and chronology. Until recently, the Harappan Civilization was thought to be unrelated to Yoga. There is now both direct and indirect evidence suggesting otherwise. Many clay figures illustrating Yogic postures have been found at sites like Harappa and Mohenjodaro, dating to before 2500 BC. Further, technical terms from Yoga are found on several deciphered seals. It is now beyond dispute that the Harappan Civilization (c. 3100 - 1900 BC) overlapped with the Sutra period of the Vedic Age. This means that Patanjali of the Yogasutra fame must date to before 2000 BC, and quite different from the grammarian Patanjali of Mahabhashya. The rest of the article summarizes the findings following the decipherment.

MESSAGE OF THE HARAPPAN SEALS

I will not present the decipherment here which both Jha and I have discussed in detail at other places. I will only note that the script is a highly complex hybrid • that includes (1) an alphabetical subset; (2) a large number of composite signs; and (3) numerous pictorial symbols. The language of the Harappan texts is Vedic Sanskrit, and the script itself is strongly influenced by the rules of Sanskrit grammar and phonetics. It is clear that the later Brahmi script is a derivative of the Harappan that evolved by borrowing heavily from its alphabetical subset. In fact, there exist examples of writing that combine features of both. It is therefore reasonable to call the Harappan script Old Brahmi or Proto Brahmi. Its decipherment was the result of more than twenty years of research by Jha - a Vedic scholar and paleographer of considerable distinction. As previously observed, Jha and I have read close to 2000 seals; for most of these we have also found references in the Vedic literature, particularly the Nighantu and the Nirukta of Yaska. With this body of material, we are now in a position to take a broad look at what these seals have to say about the people who created them. The language of the seals is Vedic Sanskrit, with close links to Vedantic works like the Upanisads. For instance, we have found and deciphered a seal which contains the word sadagama (sat agama) - a reference to the six schools Vedantic knowledge. This shows that they must already

have been in existence before 2000 BC. (Most of the seals were created in the 3100 - 1900 BC period.)



Proto types of some seals from the ancient site Mohanjodaro

Our fairly extensive readings indicate that the seals contain little in the way of history. To begin with, the writings on the seals are brief, with an average length of five to six characters. This makes them unsuitable for recording historical details. Whatever historical information we do find is incidental. There are occasional references to Vedic kings like Sudasa, Yadu and Puru, and to sages like Kutsa and Paila. We find also references to ancient places like Plaksagra (birth place of the Sarasvati river), Sapta-Apah or the Land of the Severn Rivers referred to in the Vedic literature. But such 'historical' seals are few and far between; they probably do not exceed five percent of the total. Other historical information has to be inferred from indirect messages like the one about the six schools of Vedanta mentioned earlier.

REFERENCES TO RAMA

We do find references to Rama, both in India and West Asia. (A few Harappan seals have been found in West Asia.) These seals speak of 'Kanta-rama' or 'Beloved Rama' and 'Kanta-Atma-Rama' or 'Beloved Soul Rama'. One seal in particular speaks of samatvi sa ha rama meaning 'Rama treated all with equality.' All this finds echo in the Valmiki Ramayana as 'arya sarva samascaiva sadaivapriyadarsanah', or Arya to whom all were equal and was dear to everyone.' There is also a reference to Rama performing a successful fire ritual (or launching a fire missile) which again is mentioned in the Ramayana. There is another reference to Rama's successful crossing of the sea which again touches on the Ramayana. Of particular interest is the presence of 'Rama' in at least one West Asiatic seal from pre Sargon layer in sothern Mesopotamia. We know from Zoroastrian scripture that Rama was well known in ancient West Asia. The readings suggest that this goes back to a period long before 2500 BC. What is interesting in all this is that Rama is treated as an ideal man and ruler loved by everyone; nowhere have we found anything to suggest that he was regarded as divine. All this suggests that history books are in need of major revision. The Aryan invasion stands shattered, the Proto Dravidians are found to be a myth, and the cradle of civilization - assuming there was such a thing - is not Mesopotamia but Vedic India. Also, a version of the story of Rama existed five thousand years ago, and known both in India and West

Asia. And the Samskrit language - at least the Vedic version of it - is of untold antiquity; it was certainly not brought to India by invading nomads in the second millennium.

FLOODS MARITIME ACTIVITY

To return to the seals and their contents, such 'historical' seals are exceptional. A great majority of the seals are different in character and content. Often their texts can be quite mundane. We find a reference to a craftsman by name Ravi whose products last twice as long as those made by other craftsman (dvi-ayuh). One inscription speaks of a short-tempered mother-in-law; there is even mention of relieving fever with the help of water from a saligrama (fossil stone) - a remedy still followed in many Indian households. We find numerous references to rivers (apah) and 'flows' (retah), suggesting the existence of an extensive systems of waterways. We have texts like a madra retah (flow to the Madra country), and a vatsa retah (flow to the Vatsa country) indicating their presence. The Vedic Civilization was of course largely a maritime one, as indeed was the Harappan - a fact noted by David Frawley. The seals confirm it. There is recent archaeological evidence indicating the presence of Indian cotton in Mexico and Peru dating to 2500 BC and earlier (Rajaram and Frawley 1997), which again suggests maritime activity. As noted earlier, archaeological evidence also supports the fact that the Vedic people (and the Harappans) engaged in maritime activity. References to floods are common, and can sometimes be quite vivid. There is a particularly dramatic inscription, which speaks of workers labouring all night by lire, trying to stem the floods. The readings suggest that the floods were due to the encroachment of seawater and not necessarily the rivers. These messages should be of interest to archaeologists who have noted the damage to sites due to floods and resulting salinity. The great Harappan city of Dholavira in Gujarat is a striking example.

VEDIC SYMBOLISM

What should be of particular interest to students of Yoga are references to Vedic and Vedantic texts and their symbolism. The influence of Sankhya Yoga on the seals is pervasive. While historical references are rare, and many seals contain much mundane material, a substantial number of seals have messages reflecting Vedic symbolism. This symbolism can be quite profound, and one has to dig deep into the Vedic and Vedantic literature in trying to interpret them. But once understood, it helps to explain the symbolism of the images on the seals also. This can be illustrated with the help of the famous Pasupati seal - containing Isvara seated in Yogic posture - alongside its deciphered text. The seal contains a mediating horned deity -surrounded by five animals. The animals are - elephant, musk deer, buffalo, tiger and rhinoceros. These five animals are often identified with the five senses, and the five associated elements - fire, water, space, wind and earth (or soil). These elements that go to make up the material universe are known in the Vedic literature as panca maha-bhutas or the five great elements. The reading on the seal is Isadyatah mar ah. Mara is the force opposed to creation - one that causes the destruction of the universe. The seal message means: Mara is controlled by Isvara. The seated deity is of course a representation of Isvara. Hindu cosmology holds that both the creation and the destructions of the universe result from the action of the five great elements. So Mara, the destructive force, is also composed of the five great elements. With this background, the deciphered message Isadyatah marah allows us to interpret

the symbolism of the famous Pashupati seal. It expresses the profound idea, that, in every cosmic cycle, both the creation and the destruction of the universe are caused by the action of the panca maha-bhutas (Five Great Elements) under the control of Isvara. This remarkable interpretation was decoded and brought to my notice by Jha. We find numerous such seals with close links to the Vedic and Vedantic literature; our book includes several such interpretations. The written messages are brief in the form known as 'sutras' to Samskrit scholars. These are short formula - like aphorisms made famous by such works as Panini's grammar, and Patanjali's celebrated Yogasutra. They invariably need elaboration. An example is the message Isadyatah marah just described; it is a sutra that needs to be expanded and explained. The seals are products of the same cultural, and no doubt, historical milieu. Thus they confirm the earlier findings of Sethna and this writer that the Harappan Civilization overlapped with the Sutra period. This is what Frawley and I in our book have called the 'Sutra-Harappa-Sumeria equation'. (Jha and I have also found mathematical formulas on a few seals). All this provides a window on the Harappan world, and calls for a complete revision of Vedic history and chronology.

CONCLUSION

In summary, one may say that the deciphered seals, while they may not contain much in the way of history, they do provide a clear historical context for the Harappans by establishing a firm link between Harappan archaeology and the Vedic literature. Thanks to the deciphered seals, the Harappans, who until now had been left dangling like the legendary king Trishanku, find at last a place in history - in Vedic India. The Harappans were the Vedic Harappans. The Rigveda therefore must go back into the fifth millennium. If there was a cradle of civilization, Vedic India, not Sumeria, has the strongest claim. This recognition is bound to bring about a revolution in our understanding of history.

REFERENCES

1. Jha, N.(1996) Vedic Glossary on Indus Seals. Ganga-Kaveri Publishing House, Varanasi.
2. Jha, N. and N.S.Rajaram (2000) The Deciphered Indus Script: Methodology, Readings, Interpretations. Aditya Prakashan, Delhi.
3. Rajaram, N.S. (1996) "Jha's Decipherment of the Indus Script", in the Quarterly Journal of the Mythic Society (October-December 1996).
4. Rajaram, N.S. and David Frawley (1997) Vedic Aryans and the Origins of Civilization: A Literary and Scientific Perspective, 2nd edition. Voice of India, New Delhi.

SOCIAL DIMENSION OF SPIRITUALITY

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ABSTRACT

Attractive slogans such as 'globalization', 'global village - or in reality turning entire world in to a mere global market. The terrible consequences of this system for the mankind are there for all to see: ever increasing disruption of 'family 'life, violence, murders, suicides, sexual orgy, nervous

disorders, psychosomatic diseases, crimes against women, chasm between rich and the poor, unemployment, mechanization of human life, environmental destruction etc. The human development of council of UN has in its reports expressed its grave concern over these developments. One has to understand, under the above circumstance, the duties, responsibilities and obligations of individuals towards society that is 'samaj'.

The word for 'society' in Sanskrit is 'Samaj', which means, that which is born from a common source. It is clear, taking birth is a phenomenon of living beings and therefore society is a living entity. The Hindu concept of life does not stop at that stage also. It encompasses the entire creation, both moving and non-moving-caracara Srshti, as a single living entity - though it appears to be replete with a bewildering variety of external forms and qualities. This is precisely what Sir Jagadish Chandra Basu explained to the scientists of the British Royal Society long back at London. After demonstrating that even the metallic lead exhibits a spark of the same spirit as a human being, he said, 'Our ancient sages meditating on the banks of Ganga over two thousand years ago had declared that he alone truly knows who realises the underlying unity amidst all the wondrous diversity of creation. I have only, in a very small way, demonstrated the same truth in the laboratory'. It is also obvious that such an all-encompassing unifying life-impulse cannot be produced by any man-made law - whether it is social, economical or political. Nor can it be imposed by the fiat of a government. On the contrary, the sole criterion for making any such law should be to uphold, preserve and protect that supreme life-impulse. Then only will the society be able to live on and develop in all fields of its activity just as any healthy living being. This last aspect needs to be emphasised once again. Such an all-suffusing impulse cannot be expected to play just a part - role in the life-process of a society. On the other hand, it is the guiding force for every single function of every one of its organs. This is just as in a living body, whose life-impulse energises every one of its millions of cells. It is this principle - this supreme Life-Spirit or 'spirituality'- which makes for the lubricant and harmonious working of a society which would be capable of effacing any challenge - external or internal - to its existence or growth. Many experiments have been carried out in the West so far, but without this life-principle, for bringing about an enduring happy and peaceful life for the people. To start with, the Papal autocracy in Europe and England which had ushered in a life of utter misery for the commoners, was overthrown by the kings; but their dynastic rule too ended in bloody revolution with the cry of 'liberty, equality and fraternity'. However, unprecedented economic serfdom and misery resulting from the accompanying industrial boom gave birth to a violent revolt in the form of communism in countries like Russia. That too, after its seven decades of experimentation of brutalisation of man not only died but dismembered its mother - countries which had nurtured it. And now, Capitalism and free-market economy have come to rule the roost under the garb of democracy.

Attractive slogans such as 'globalisation', 'global village' - are in reality turning the entire world into a mere global market. The terrible consequences of this system for the mankind are there for all to see: ever-increasing disruption of 'family' life, violence, murders, suicides, sexual orgy, nervous disorders, psychosomatic diseases, crimes against women, chasm between the rich and the poor, unemployment, mechanisation of human life, environmental destruction, etc. The Human Development Council of U. N. too has, in its report, expressed its grave concern over these developments and painfully remarked that this aspect of all-round human misery is more severe in affluent societies. And all this, apart from the never-ending bloody conflicts between and within countries because of both economic and fundamentalist factors, the looming nuclear disaster, etc. All these developments have forced leading sociologists, scientists, historians, thinkers, ecologists and jurists of the world to administer the stern warning that humanity is doomed to total

destruction unless the entire approach to human welfare is reversed. They have also in their own ways emphasised the need for adopting a holistic, spiritual view of solving the many critical challenges facing the humanity. But it is no use merely propounding the obvious truth that unless spiritually is incorporated as the warp and woof of the social fabric, its ordered, happy life will soon get disrupted and destroyed. What is of supreme moment is to evolve a served day-to-day practical code of conduct for every individual in the society commensurate with his/her station in life. Further, mere formulation of such a life-style will also not suffice unless the individuals are inspired with the vision of a harmonious and happy life for himself/herself both at the personal and social levels.

This is precisely the concept and role of Dharma as had been preached and practised successfully by the Hindus for thousands of years in the past. This has been acclaimed by not only the Hindu savants but most eloquently by the non-Hindu thinkers, historians, spiritual luminaries across the world. In fact, the acme of the fulfilment of human endeavour is epitomised in the famous dictum: Atmano mokshartham, jagad hitayaca - the highest state of bliss for the individual coupled with the total welfare not only of mankind but of all living beings. And Dharma itself is defined as that principle which sustains and nourishes the society at all levels Dharanat dharmamityahu, dharmo dharayati prajah. The root of the word 'Dharma' is 'dhri' - means the principle of joining and sustaining. A little reflection will show that the entire physical universe also is a product of joining together of several entities in a well ordered manner. This principle of joining - Dharma - starting at the level of individual with the family, finally extends to that of the humanity, all creation and ultimately that Supreme Reality - God, out of whom all this wonderful variety of creation has been evolved. At the family level, Dharma takes such forms as that towards one's mother and father as Putradharma (one's duty as a son towards the mother and father), towards one's children as Matru Dharma or Pitru Dharma (as the mother or father towards one's children), towards one's spouse as Patnti Dharma or Pati Dharma (as the wife towards the husband and vice versa) . In the same way, the family as a whole has a duty towards its neighbours, towards the village and so on until it extends to cover the entire society, humanity, creation and God. It will be observed from the above holistic style of life, that 'duty' takes the place of 'rights', spirit of service and self-sacrifice in place of exploitation, co-operation in place of competition, harmony in place of conflict, peace and happiness in place of tension and misery, and ultimately a sense of fulfilment of one's sojourn on earth in place of frustration and meaningless existence.

YOGA AND PHYSIOLOGY

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ABSTRACT

Yoga is our ancient Indian cult, a way of life. During the initial phase Yoga and Ayurveda were together, later spiritual minded saints took to Yoga, Health biased individuals took Ayurveda. Ayurveda took care of healthy living. So, ancient scholars developed understanding of the physiological principles in the background of yogic culture. Yoga and Ayurveda were complementary to each other. This article is a review of the physiological basis of effects due to yogic practice. It shows the reader as to how the yogic practice has tremendous physiological and psychological

effects even on a common man. Yoga not only improves physical capability but also improves mental faculties like concentration, memory, learning efficiency, perceptual speed and so on.

Yoga is our ancient Indian cult and way of life which is claimed to endow perfect physical and mental health to its practitioner. During the initial phase of its inception perhaps Yoga and Ayurveda (a system of medicine in India) were together. Later it bifurcated to separate disciplines with spiritual minded saints taking to yoga and the health biased individuals taking to Ayurveda. Ayurveda takes care of healthy living which should be free from diseases and if there be any disease its treatment by various means has also been formulated by Ayurveda. So, ancient scholars had to develop the understanding of the physiological principles in the background of yogic culture and both were complementary to each other. In this article a review of the physiological basis of the effects due to yogic practice based on our years of experimental work in this field has been given. It will show the reader how the yogic practice has tremendous physiological and psychological effects even on a common man, who are not yogis in the advanced stage of spiritual practice. There has been a steady flow of information input in this area since seventies. Our own series of research programmes have contributed significantly to illustrate the physiological, biochemical and psychological effects. The autonomic nervous system controls most of the involuntary functions of the body and its sympathetic component (excitatory) gets dominant under stressful conditions. Prolonged stressful conditions lead to various psychosomatic disorders. The practice of yogic asanas and pranayama helps to alleviate various psychosomatic disorders. Our study (1) showed that the practice of yogic asanas and pranayama for six months lead to a state of reduced sympathetic activity shifting the autonomic balance. Autonomic indices, reflecting the sympathetic/parasympathetic activity, such as heart rate and blood pressure start showing a gradual decline during 6 months of yoga practice. The control subjects who performed regular physical exercises of army PT programme did not show such decline. Pulmonary ventilation, oxygen consumption, mean skin temperature, blood catecholamines, cortisol (stress hormones) reveal a stable autonomic equilibrium with a trend of gradual shift towards parasympathetic dominance. More stable autonomic nervous responses point to a possible delay in wear and tear in physiological systems as the anabolic activity predominates in these individuals, while the stress-induced disturbances in autonomic balance is restored to normalcy faster, minimising the ill effects of stress. Cardiovascular regulation to orthostasis (blood pooling in lower parts of the body) improves by yogic practices. This is relevant to those who are involved in occupations demanding prolonged standing like sentries, factory workers etc.

Thermoregulation involving the balance between heat loss and heat gain through hypothalamic thermostat mechanism and through the autonomic neural and metabolic pathways improves by regular practice of selected asanas and pranayama for six months. This has been reflected in the quicker rewarming of the hand in the yoga group of subjects after it is taken out from immersion in cold water at 10° C for 2 minutes. Probably due to better thermoregulation the sadhus and saints live with minimal clothing in extreme cold conditions prevailing over the mountains in Himalayan ranges. In another study by exposing the human volunteers in a 10° C cold chamber it was found that tolerance to cold by yogic exercises is being achieved by heat production mechanism rather than by heat conservation by the physiological system. There is a possibility of this heat production being achieved by non-shivering (metabolic) thermogenesis, which is more effective and economical. Yoga helps to achieve a state of mental tranquillity to its practitioners. Scientific basis for this has been demonstrated in our study which reveals increase in alpha index of electroencephalogram (indication of mental tranquility) after six months of regular yogic practice. But in state of deep meditation theta frequency dominates. Yogic practices help to improve even

the exercise performance at submaximal level. The physiological responses to submaximal (50% of maximal) and maximal level of exercise on a bicycle ergometer were assessed by monitoring heart rate, pulmonary ventilation, oxygen consumption and blood lactic acid. After six months of yoga training the same subjects could perform the submaximal exercise in a more economical way by lesser increase in heart rate and oxygen consumption. The net mechanical efficiency also increases. This will be useful to increase the productivity in general. We have also shown enhancement of muscular efficiency by increasing the endurance time as well as by alternate recruitment of motor units. During the sustained muscular effort, if the burden is shared by groups of muscle units participating alternately, the endurance can be prolonged. Yogic practice helps to achieve exactly this as reflected in lower build up in EMG voltage and concurrent increase in endurance time. Body flexibility forms an integral part of physical fitness among other factors. Flexibility is known to decline with aging process leading to several disorders of skeletomuscular system. Regular yogic practice helps to improve the body flexibility at all the important joints and regions even in the middle aged men. The beneficial effect of yoga can find some application in competitive sports to improve the performance of the participants. We conducted a controlled study on the effect of selected yogic exercises in the control and management of essential hypertension. Blood pressure showed a gradual, decline towards normal values after 4-6 weeks of yogic practice. It was achieved by restoring the sensitivity of Baroreceptors which act like sentinel keeping a close watch on the blood pressura.

With the alteration in physiological functions biochemical changes also takes place due to yogic exercises. The blood glucose, cholesterol and dopamine beta hydroxylase were decreased while monoamine oxides, lactic dehydrogenase, plasma cholinesterase and urinary excretion of 17 hydroxy and 17 keto steroids showed significant increase after six months of yogic practice. Even the glucose tolerance test shows improvement after 3-4 months of yogic practice. This opens up a new vista for treatment of mild cases of diabetes. Our studies have revealed some beneficial effects of yoga on even acclimatization at high altitude. We were inquisitive to know the alterations if any in the physiology of men who are present in the environment where Agnihotra is being performed. The GSR and skin temperature showed mild increase along with EEG showing increase in alpha activity and suppression of delta activity indicating a state of relative tranquility of mind and body. According to WHO, health is not mere absence of disease but the physical and, 'mental well being of an individual to make him creative and productive. Yoga not only improves physical performance capacity but also improves mental faculties like concentration, memory, learning efficiency, perceptual speed, psycho-motor performance which are useful for success in any profession. Information available in the literature and our own study shows that yoga is just not meant only for the Yogis who are in higher spiritual level but more for the good of the common man. So, to fulfil the goal of balanced physical and mental health of common people which is badly needed at present and for the next millenium the message of yogic culture has to be taken to them as progress of society and civilisation depends on their welfare.

NEUROCOGNITIVE ASPECTS OF CONSCIOUSNESS

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ABSTRACT

Awareness is considered the most important aspect of consciousness. Neuroimaging and brain lesion studies have investigated the neurocognitive aspects of awareness. Findings of metabolic, electrophysiological and behavioural changes can be integrated to develop heuristic understanding of consciousness. Neuroimaging studies have shown that verbal encoding and transcoding are unique functions of the left prefrontal cortex and provide basis for thinking. Semantic and sequential relationships of auditory and visual inputs of language material are encoded by this system, which is also engaged in verbal transcoding of nonverbal input. The network provides the natural basis for talking, thinking and listening function in the brain. Listening to one's own thoughts is proposed to provide the basis for verbal awareness. Verbal awareness serving as a monitoring process of thinking helps to regulate thinking and actions generated as a sequence. Awareness is therefore, the core of intention to act, which may be regulated (selection and inhibition), based on anticipated consequences. Evidence suggest that awareness is associated with voluntary selection and control of motor outcome rather than its initiation. Considering this role of awareness on thinking, it is suggested that awareness selects and inhibits thought production. Withdrawing awareness and shifting focus will further help in the regulation of production of thoughts. Verbal encoding and transcoding help to generate a world of thoughts, which may or may not confirm to reality. The effect of such regulation is discussed in the light of electrophysiological and clinical data. The paper briefly probes the scope of Yoga in controlling awareness and related motor programming and execution.

Panel Discussion

Theme: Other Applications of Yoga

Chair Person: Dr Ponna Wighnaraja Advisor, UNO, Srilanka

Panelists: Sri Mujralidhar Rao, Dr Malathi, Prof EGG Sudarshan, Sri H V Seshadri, Sri Venakteswara Rao, Dr. Bijlani, Dr Ann DeBaldo

Q: Whether V K YOGAS has to recommend for introduction of yoga in education system?

A: (by Dr A Malathi): Yes it is extremely important that VK YOGAS should evolve make recommendations at the level of WHO. This being an international conference would have a say at higher level. Finally whether the decision taken may not be of what we can about. But sincere attempt from our side is extremely important.

Raghavendran, a participant added: It is in this context that chief minister of Andhra Pradesh is very dynamic and he has introduced yoga for the MLA'S and ministers. He has assured that yoga would be introduced and would be made part of the school curriculam.

Reaction from Maharashtra delegate: Maharashtra Govt has added yoga education to school children in 1974. Govt. of Maharashtra has designed from 5th standard to 10th standard. Unfortunately that has not been implemented. It so happens that rules are formed but not followed.

It can be suggested that all the physical education teachers can be made to attempt the yoga shibirs/camps so that at least at some places, once a week, they can start the yoga education. Why should it come from the ministry? Why not start at the individual level for betterment of society. After all we are giving right direction?

Q: What is the exact role of a yoga student towards society?

A: (by Dr Ponna Wighnaraja) Do not try to change the world or society, first change yourself. Now really there are two kinds of questions.

1) Process of change from within, 2) then think of society to take up yoga. If you are learning yoga your first indispensable step is to make this paradigm shift. Paradigm shift from purely technocratic approach to spiritual value based approach. Once you plant your plan then not only you set yourself on the path you change an individual intellectually, physically and emotionally but you will also gradually develop a concern for the society. That concern for the society is being fulfilled by many of you all by going and becoming yoga teachers. But today this revolution we are talking about requires you all to be multifaceted that means we cannot just say I am a yoga teacher but also have to learn how to influence people, how to manage, how to multiply some of the success stories, how to treat with the poor and so on. It is a major challenge, and there is no easy way. So the question you have to answer is if you are serious about helping in the process of bringing about social change, then you have to be able to challenge yourself.

Dr Venkateshwara Rao added: For doing a job we need three components 1) what to do is a knowledge 2) how to do is skill. Both are available 3) why to do is attitude, so yoga will bring about a change in the attitude of a person to use his production capacity as productivity. So it is necessary to use yoga for productivity. Next point is whether society can be changed? Yes, 'Jesus tried, he was crucified. Gandhiji tried and he was shot dead. There is a cost for change. If you are prepared to pay the cost you can try to change the society or else you fit into the society and use your production capacity to the fullest extent by having yoga as an in put.

Q: (to Dr Ponna Wighnaraja) may I expect your contribution to the world by advising the UNO to pass a compulsory resolution to introduce yoga to all schools of all countries? What the Panel suggests in this direction of education? In what way you can try to help?

A: I am only an individual, but an individual who has been on the advocacy compagin for the last 20 to 25 years through publications etc. There is still a fragile pressure particularly in relation to yoga. We did have one in New Delhi. In certain areas preventive health measures should be a major part by WHO. Currently WHO's priority is malaria and AIDS. Nothing about yoga. But this does not mean that we should give up our thought concerning yoga. But to be able to advocate in the UN system first, we should know UN system is intergovernmental system. So we have to start advocating pressure groups in our own ministeries and government. For this we need a lot of pressure groups and like minded eminent personalities to pour pressure on the government to do so.

Q: (by Priyadarshini) Sir, So far we have heard about about what others should do to improve the society. But I personally feel the change should come from within. When you change automatically the environment around changes. I would like to share my feelings with delegates here.

A: (by Ponna Wighnaraja) This is excellent. Unless you try to group together you may not be able to make any advancement in social forces. So there has to be a critical mass of individuals getting together to be able to build a socially transformed society.

CONCLUDING REMARKS (by Ponna Wighnaraja)

I think that may people from the audiance despite their commitment, despite their willingness to learn, despite their willingness to do something there is a missing element. I do not think that they

have taken trouble of reading this tremendous well documented literature that is available on yoga. Having looked at it you also have to digest it and should be able to answer some of the questions that are raised. Internalisation of all this does not go on, we will not know about what we can do about to bring up better society. This is the home work all of us need to do.

4.3 ORAL PRESENTATIONS

APPLICATIONS OF YOGA IN ALL STAGES OF LIFE AND AREAS

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ABSTRACT

In this paper we wish to present various fields of applications of yoga for all age groups and also target groups which we assessed through self-reports, feedback forms and enrolment for regular yoga training which proved to be quite effective. In the area of Yoga for personal effectiveness (height increasing, obesity eradication) we had a total of 34 camps. All these camps were of one month duration which were attended by a total of 1661 persons. For professional groups (Doctors, Fire brigade personnel, Police) 10 camps were conducted, attended by 439 persons. For target population with ailments such as Asthma, Heart ailments, Blood pressure, Stomach problems and Thyroid problems we had 11 camps attended by 278 persons. There were 109 camps for 22,541 students for memory enhancement and camps for senior citizens also. All the camp material was developed and tailor-made according to the needs of the target groups after consulting the experts in respective fields wherever necessary.

People think that Yoga means only a few Asanas, some Pranayamas and Dharana-Dhyana only. But yoga has many other practical applications too. Regular and proper yogic practices help solve many problems. Therefore, the time has come to project and work out the 'tailor-made' Yoga than 'ready-made'one.

'Tailor-made' means to suit the requirements of common man. Paramahansa Satyananda Saraswati of Bihar School of Yoga, Munger (Bihar) once said -Toga is our heritage of yesterday, need of today and culture of tomorrow'. 'Why yoga is a need of today' requires no clarification. In order to meet the needs of common man and also to make the yoga movement socially relevant, we planned different projects and successfully worked them out under my guidance. The following figures will definitely throw some light on this 'Applied Yoga'.

SI. No.	Particulars	No. of Camps Shibirs.	No. of Participants.
1.	Height increasing camps	27	1,375
2.	Memory increasing camps(Medha Samskar)	102	20,628
3.	Asthama camps	3	46
4.	Fire brigade operators of Thane Muncipal Corporation	4	230

5.	Blood Pressure camps	5	137
6.	Yoga for Senior Citizens	12	400
7.	Yoga for Physically Handicapped	1	10
8.	Obesity eradication camps	6	236
9.	Yoga for Badminton Players	1	50
10.	Yoga for Doctors only	4	84
11.	Yoga for Jail Inmates(13 persons became qualifiedYoga Teachers)	6	378
12.	Yoga for Adivasi students(Tribal Area)	3	104
13.	Ananda Dhyana Sibir	7	832
14.	Ananda Pranayama Sibir	7	880
15.	Ananda Sadhana sibir	12	2,422
16.	Trataka Sibir	1	130
17.	Relaxation Sibir (Savasana)	16	976
18.	Yoga for Stomach Problems	1	10
19.	Yoga for Thyroid Problems	1	63
20.	Yoga for Pollution(Nav Sanjeevan Yoga)	4	250
21.	Yoga for Mentally Retarded	1	28
22.	Gayatri Mantrasadhana Sibir	3	900
23.	Yoga for Heart Patients	1	22
24.	Yoga for Police	2	125
25.	Yoga for Beauty	to be implimented	

The above figures are given to the end of June 1999. There will be upward revision in the near future.

A STUDY OF ELECTROENCEPHALOGRAM IN MEDITATORS

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ABSTRACT

Stress and strain of modern life can be reduced either by relaxation or meditation. Complete mental and physical relaxation is possible by ancient procedures like Yogic Meditation (YM) and Transcendental Meditation. Earlier studies on EEG during meditation, have shown dominant alpha pattern which is recorded symmetrically all over the cerebral hemispheres.

The study was conducted and the result showed the Alpha frequency and oltage were significantly higher in metitators. Beta waves were significantly higher control group. In either of the grouds Theta waves were not found. On Photic Stimulation no difference was observed in meditators and control group in EEG. There was a significant decrease in respiratory rate in meditators. In conclusion we found that meditation enhances self confidence, sense of well being and empathy; improves cognitive functions as esider.ced by increased Alpha wave activity and its synchronisation. It also increases mental concentration and reduces susceptibility to stress and straw. Thus meditation promotes complete health and well being in an individual.

During meditation, EEG shows dominant alpha pattern which is recorded symmetrically all over the cerebral hemispheres. In our country, reports of EEG studies in meditation are meager. An attempt has been made in this center to evaluate EEG findings in meditation.

MATERIAL AND METHODS

Subjects: The study was conducted on men 40 (17-66 years) of which 30 subjects practiced meditation at Gita Bhawan Center, Indore. All cases were divided into two groups:

Group (I) Meditator Group : (a) 15 men practice (TM) and (b) 15 men practicing Yoga Meditation (YM)

Group (II) Control Group : Comprised of 10 healthy men who had not meditated at any time. Both the groups were taking vegetarian diet only. All meditators were doing their practice for a period of 3 months.

Assessments : The present study was performed in meditators as follows:

In-Group (I), EEG was recorded before, during and after meditation. Where as in control group EEG was taken before, during and after an eye closed Relaxation session.

The other examination included (1) Pulse rate (2) Respiratory rate and (3) Blood pressure. (4) Electroencephalograms (EEG) were recorded with Grass instrument Co. Electroencephalograph model 6. The EEG traces were recorded with ampex corporation recorder FR-1300. The skin electrodes were placed according to international 10-20 system at F1 T3 P3 O1 O2 and A2. Grass Instrument Company plated cup electrodes and EEG electrode cream was employed. Recording was bipolar.

The EEG, was analysed for alpha frequency, alpha voltage, alpha percentage, alpha coherence and hemisphere symmetry in both control and meditative subjects. EEG was studied by two different persons who were unaware of the subjects.

TECHNIQUE OF MEDITATION

Transcendental Meditation: This technique was taught by the trained teachers. It comprised of sitting in eye closed position for 20 minutes and repeating a word given by teacher called as "Mantra". It was done for 20 minutes twice a day, morning and evening, but never after meals.

Yogic Meditation: This was done by focussing one's attention on a point midway between two eye brows. Subsequently one's attention merges into meditation. This was done for 20 minutes and twice a day, morning and evening.

RESULTS

1) The alpha frequency and voltage was significantly higher in meditators as compared to controls. There was a significant difference in alpha percentage, which was higher in meditators as compared to controls. In meditators alpha wave percentage in frontal area was higher as compared to controls.

2) Control group had significantly higher beta waves percentage.

3) In this study there was no evidence of theta waves, either in meditator group or in control group.

4) Eye opening response - Meditators showed persistence of alpha waves after eye opening in 28.9% of cases, as compared to mean alpha wave 12.4% in control.

5) Coherence - In meditators, good coherence was recorded during meditation. The interhemispheric time difference in alpha frequency was 121.79 ± 8.33 milliseconds indicating good coherence.

6) Hemispherical symmetry - Right and left voltage ratio which was 0.844 before meditation became 0.876 during meditation. Which suggested good coherence in both hemisphere.

- 7) On Photic Stimulation, difference was observed in meditators and control group in EEG.
(8) There was a significant decrease in respiratory rate in meditators.

DISCUSSION

The alpha waves are suggestive of increased relaxed state of mind. Alpha voltage is inversely related to mental activity. Increase in voltage is accompanied by decrease in the frequency, which occurs due to decrease in brain activity. Desirajul postulated that slowing of alpha frequency is due to decreased energy metabolism of brain. In our study alpha activity was significantly higher in meditators. These results are similar to those reported by Banquet et al^{2,3}

EEG pattern, which characterized sleep (High voltage slow wave pattern 12-14 cycles/ sec.), sleep spindles and low voltage mixed frequency with or without rapid eye movements were not seen during meditation. After 6 to 7 hours of sleep high voltage slow wave activity was seen. Where as only 5 to 10 minutes of meditation alpha waves activity predominated in the electro-encephalogram.

Alpha activity is produced in meditators by activation of diaphragmatic breathing than thoracic breathing. The breath becomes the object of awareness in most methods of meditation.⁴

Wallace et al⁵ found that those persons who practiced meditation can continue to exhibit alpha and theta waves after meditation period had ended. Our group also showed persistence of alpha waves after meditation.

The cortex of brain consists of two halves the left and right hemisphere. Speech, logical thinking, analysis and sense of time are thought to function in left hemisphere, while ability to recognize faces and comprehend maps and intuitive function is thought to function in right hemisphere. Right hemisphere is connected, with motor skills & spatial awareness⁵.

Meditation leads to development of right hemisphere associated abilities⁶. This has been further verified by several researches and they found that EEG alpha and theta wave coherence is most marked in right hemisphere during meditation⁷.

Our study also revealed good coherence in both hemisphere which is in accordance with above authors. A good coherence between two hemispheres represents the synchronization of logical with initiative functions of brain⁷. A significant finding that emerged from Banquet's researches was that brain wave patterns tend to synchronize during deep meditation to this phenomena of marked uniformity of frequency and amplitude in electrical activity from all areas of brain, Banquet gave the name of "Hypersynchrony" According to him this may have something to do with feeling of pure awareness of consciousness².

Meditator groups showed persistence of alpha waves after eye opening in 28.9% cases. Our observations are in conformity with Kras et al⁸ who found that meditators experienced calm and alert state of mind which is maintained even during dynamic activity and there was increase in alpha percentage in meditators even when eyes were open. In our study right and left hemispheric alpha voltage ratio which was 0.844 before meditation became 0.876 during meditation. Kiloh et al⁸ found decrease in alpha activity on left side during performance of mental arithmetic.

During act of meditation there occur inter-hemispheric symmetry in alpha rhythm. Which is found in our cases too.

In conclusion we found that meditation enhances greater self-confidence, sense of well being, empathy, improves cognitive function as evidenced by increased alpha wave activity and its synchronization. It also increases mental concentration and reduces susceptibility to stress and strain thus promotes complete health and well being in an individual.

REFERENCES

1. Desiraju T., Meli, B.L. & Kanchan, B.R. Neurophysiological correlates of yogic practices of

- meditation & pranayama unpublished paper presented at INDOCUSSR, Symposium on Neurophysiology Armenia 1983.
2. Banquet J.P. - EEG and meditation, *Electroencephalograph and clinical Neurophysiol*, 1972, 33:449
 3. Banquet J.P. - Spectra analysis of EEG in meditation, *Electroencephalography and clinical Neurophysiol*, 1973, 35:143-151.
 4. Tinnons, B., Salmay, J. Kaniya, J. - Abdominal, thoracic respiratory involvements and levels of arousal., *Psychonomic science* 1972, 27; 173-175.
 5. Wallace, R.K. Benson, H & Wilson A - A wakeful hypometabolic Physiological state *Atn. J. Physiol*, 1971, 221: 795-9
 6. Davidson J.M. - The physiology of meditation and mystical state of Consciousness *Perpectives Biol Med* 1976, 19: 345-79
 7. Gaylord, C, Orme - Johnson D. & Travies E. - The effect of Transcendental meditation technique and progressive Milderelaxation on EEG coherence and stress reactivity And mental Health in black adults, *Inter:J. Neuroscience*, 1989, 46: (1) 77-86.
 8. Kras, D.J. - Transcendental meditation and EEG alphas activity in Scientific Research on Transcendental meditation programme, *Collected paper vol 1, ed., ormejohnson and Forrow. Menu Press, West Germany* 1977, 175-181.
 9. Kiloh, L.G. & Osseleton, J.W. - "Clinical electroencephalography" 1981 4th edition, Butter worth, London.

EFFECT OF OMKAR CHANTING ON CONCENTRATION, MEMORY AND LEVEL OF FATIGUE

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ABSTRACT

Concentration is the measure of accuracy of work. Receiving power is the measure of understanding. Memory is a measure of ability to reproduce the knowledge that is known. The concentration, memory and the level of fatigue can be measured from the psychology based tests. Omkar recitation is an important yogic practice. The vibration due to Omkar meditation increases the efficiency of cells and the organs.

Omkar recitation is an important yogic practice. The vibrations due to Omkar recitation increases the efficiency of cells and the concerned organs. In the Omkar recitation, the first pronunciation A creates the vibrations, which effect on the spinalcord to increase it's efficiency. The second pronunciation U creates the vibrations in the throat and effects the Thyroid Glands, while the last pronunciation M, brings the vibrations to the brain, thereby activating the brain centres, as a result of which, the efficiency of brain increases. Therefore the effect of Omkar chanting increases the concentration, memory, receiving power of brain and ultimately decreases the level of fatigue. Concentration is a measure of accuracy of work and receiving power is a measure of understanding while memory is a measure of ability to reproduce the knowledge/ known things. Of course there are different opinions for the measurement of concentration, memory and receiving power. However, the concentration, memory and level of fatigue can be measured/understood from the

psychology based tests. Based on this hypothesis, the tests, were conducted the results are discussed.

MATERIALS AND METHODS

Studies were conducted on 24 female sadhaks in the age group of 20 to 50 years and 13 male sadhaks in the age group of 40 to 55 years. They were taught the Omkar chanting. One Orhkar in one exhalation of breath in 10 seconds. Before starting the Orhkar chanting class the Psychology based tests for measurement of concentration, memory and level of fatigue were conducted. The Orhkar chanting class was conducted between 2nd APR to 3rd May 99. Everyday in the morning between 6.00 am to 6.45 am. The following practices were performed.

1. Relaxation 4 min. 2. Pranayama 5 min. 3. Orhkar chanting 30min. 4. Prayer 5min. The tests for concentration, memory and level of fatigue were conducted after completing the Orhkar chanting class for one month. These tests can be described as follows.

1) Test for concentration: In this test, the sadhaks were asked to solve some multiplications (four digits by single figure) in 5 minutes. After completing the assignment, the multiplications were corrected. Results were tabulated as total attempted, correct problems and wrong problems. (Table No. 1) This test was conducted before Orhkar chanting class and after completing the Orhkar chanting class.

2) Memory Test: In this test, the different 25 items were kept on the table. All sadhaks were asked to observe for 1 minute. After this observation, they were asked to write the names of items within 5 minutes. The observations were tabulated as the number of items written and correct items written. (Table No.2)

3) Test for level of fatigue (Cancel action Test): In this test, a paper containing the English alphabets randomly printed was given to the sadhaks. The sadhaks were asked to cancel the T 'S' and 'G' letters within 5 minutes. They were asked to put vertical line after every minutes to know the number of words cancelled in every minute. The observations were tabulated as correct number of words cancelled (Table No.2).

RESULT AND DISCUSSION

1. The average number of problems solved before class were 20, out of which 17 were correct. But after the Orhkar chanting class, the average number of problems solved were 24, out of which 21 were correct.

Before Orhkar chanting Class, the average minimum 5 problems were solved by 2 sadhaks, but after the Orhkar chanting class, the average minimum 10 problems were solved by 2 sadhaks. Similarly before Orhkar chanting class, the average maximum number of problems solved were 20 by 11 sadhaks but after Orhkar chanting class, this average maximum number of problems solved were 25 by 16 sadhaks.

The improvement in ability/accuracy of solving the problems after Orhkar chanting class, indicates the increase in concentration.

From the observations, it can be seen that the concentration of 70% sadhaks has increased significantly.

The mean values for the problems attempted, correct problems solved, wrong problems and not attempted problems are given in Table No.I. From the above histograms, it is observed that after Omkar chanting the score for the respective tests increased significantly.

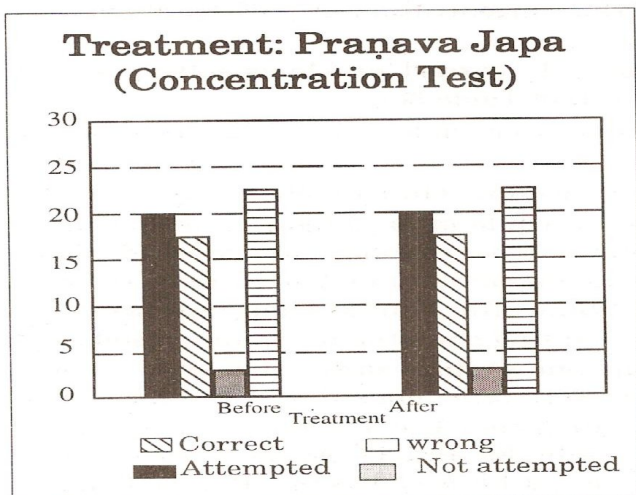
2. From the memory test, it is observed that, before Orhkar chanting class, the average number of items remembered were 15, while after Orhkar chanting class, the number increased up to 19. the minimum number of items remembered before and after Omkar chanting class was 8. But the maximum number of items remembered before Orhkar chanting class was 21. While after Orhkar chanting class, this number has increased to 24. Before Orhkar chanting class the maximum number of item 20 and 21 were remembered by only one sadhak each. But after Orhkar chanting class, the maximum of item (i.e. 24) were remembered by 4 sadhaks. The 20 items were remembered by 11 sadhaks and 18 items were remembered by 8 sadhaks. Before Orhkar chanting class, only 4 sadhaks have remembered maximum number of items, but after Orhkar chanting class 17 sadhaks have remembered the maximum number of items. Here, we assume that, the 4 sadhaks have remembered maximum number of items before Orhkar chanting class, they are having good memory. So excluding these 4 sadhaks, for remaining 23 sadhaks, the memory has increased significantly. This means, the ability to reproduce the known things i.e. memory has increased. It is concluded that, the memory has increased to 16% for 66% of sadhaks after the Orhkar chanting class. The mean values for items written and correct items for memory test and simply a score for cancellation test is given in Table No.2 and Graph No. 2. From the histograms cited here it is observed that after Orhkar chanting the score for the respective tests increases significantly.

Table 1: Effect of Pranava Japa on 'Concentration' (Multiplication test)

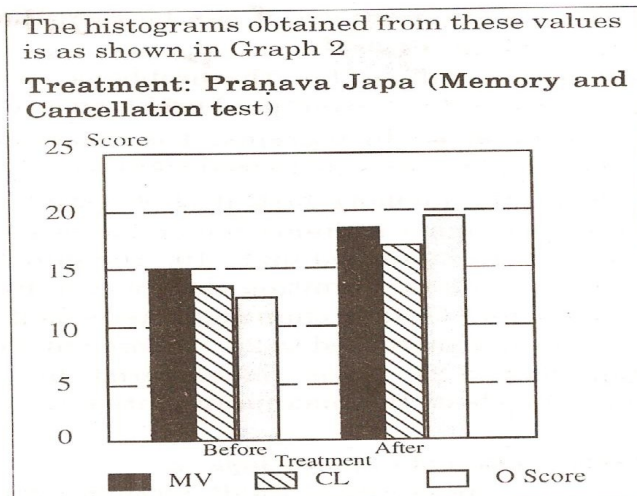
Treatment	Attempted	Correct	Wrong	Not attempted
Before				
Males	21.5	17.5	2.5	20.5
Females	19.9	17.5	4.0	22.1
Total	20.5	17.5	3.0	21.5
After				
Males	22.9	20.8	2.5	19.1
Females	25.5	20.9	4.6	16.5
Total	24	20.9	3.1	18.0

Table 2: Effect of Pranava Japa on memory and Level of Fatigue

Treatment	Items Written	Correct items	Score (Cancellation)
Before			
Males	14.6	13.5	9.7
Females	15.4	14.6	15.4
Total	15.1	14.2	13.5
After			
Males	16.7	15.5	15.1
Females	19.1	18.5	22.0
Total	18.2	17.2	19.5



Graph-1



Graph-2

3. The average number of marks (words cancelled) before Orhkar chanting class were 13, but after Orhkar chanting class the marks increased up to 20. The maximum number of marks before Orhkar chanting class were 25, but after the Omkar chanting class, the maximum number of marks was 32. From this, it can be concluded that, after Orhkar chanting class the marks in cancellation test were increased, indicating the decrease in level of fatigue. The effect of Orhkar chanting class was same in all age groups except the old age group. From memory and concentration test, it is seen that, the average and maximum number of marks obtained by female sadhaks is greater than that of male sadhaks. (See table 2, Graph 2) Omkar chanting test was applied for concentration test, memory test and cancellation test. In this case, null hypothesis to be tested is that there is no difference before and after the Omkar chanting against the alternative that Orhkar chanting is effective. The results are as shown in table 3. The differences are statistically significant. So the hypothesis, that the Orhkar chanting affects the concentration, memory and level of fatigue is accepted. The analysis was carried out by using software CST.

Test	n	Mean difference	t-value
Concentration	37	2.87	6.37**
Memory	37	2.91	5.68**
Cancellation	37	6.61	8.54**
Table 3		** Highly significant	

Acknowledgement: Authors are thankful to M B Kulkarni for his co-operation rendered in the statistical calculation.

REFERENCE:

1. Common Statistical Tests by M B Kulkarni, S B Ghatpande and S D Gore Satyjeet Prakashan

INFLUENCE OF YOGA ON MANUAL AND TWEEZER DEXTERITY IN CHILDREN

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ABSTRACT

The manual dexterity and tweezer dexterity was measured in two age-matched groups of girls whose ages ranged from 9 to 11.5 years, with 17 subjects in each group. After base line assessments one group received yoga training, while the other group carried on with their drill practice. Yoga practices included asanas, pranayama and meditation. The drill practice included sitting and standing exercise and practice with dumbbells. After 30 days, yoga group performed the dexterity tests within less time compared with day 1.

Dexterity is understood as quick, accurate and effective use of the hands in the manipulation of small objects. Yoga requires active participation of the subject by synchronizing physical movements with changes at the mental level. This is interesting to study with the possibility of yoga training or drill in schools. The present study was carried out to assess the performance in the manual dexterity and tweezer dexterity tests in two groups.

METHODS

Subjects: 34 healthy subjects were assigned to two groups of yoga and drill by randomization. They were between 9 to 11.5 years. Each group consisted of 17 subjects who were assessed on first day and end of 30 days during which they carried on with their routine activities. All subjects were right-hand dominant, based on their self-reports as well as on actual observation of the hand used by the subject.

Design: The two groups were assessed on the manual and tweezer dexterity tests, which were administered on the first day and the after thirty days.

Procedure: The assessment was modeled on the Minnesota manual dexterity and tweezer dexterity tests.

Simple Manual Dexterity: Subjects were instructed to insert all the blocks into the holes picking up the block nearest to them in the left-hand column and put in the hole nearest to it. Take next block in same column and put it in next nearest hole in same column. Go on and do the next in the same manner and so on until the board is filled.

Bimanual Dexterity: Here subjects have to pick up with right hand, twist the wrist and insert with left hand. Start with the hole farthest away and work right down the column. In the above tests subjects were told when to begin and after all pegs fit the board the time taken was recorded as the manual dexterity score.

Tweezer Dexterity: The subjects were instructed to pick up metal pins with a tweezer using the dominant hand and place them in holes in a metal plate as quickly as possible. They were told when do begin the test and after four minutes they were asked to stop. The number of pins placed was counted as the tweezer dexterity score.

Yoga Training: Yoga group received 30 days training in asanas, pranayama and meditation 30 minutes every morning and 45 minutes every evening.

Drill Practice: Drill group received drill practice for 30 days, which included sitting, standing exercises and dumbbells for 30 mts in morning and 45 nits every evening.

Table 1: Simple Dexterity Test

	Yoga	Drill
Pre	1.3041	1.2723
Post	1.1005**	1.1500*

*P <0.05, **P<0.05

Bimanual Dexterity Test

	Yoga	Drill
Pre	1.7847	1.8418
Post	1.2047** +	1.3218*

*P <0.05, **P<0.025, + P<.01

Tweezer Dexterity Test

	Yoga	Drill
Pre	22.2941	19.9411
Post	36**	30.2941*

*P <0.05, **P<0.01

Data Analysis

1. The data was analyzed using two-factor analysis of variance with assessments for the two groups.
2. Tukey test was used to test multiple comparisons for significant differences between means.
3. The dexterity score of 3 tests for the two groups obtained with assessments were compared for significant difference using paired t-test the Post Vs Pre assessments.
4. The Wilcoxon paired signed rank test was used to study percentage changes for yoga and drill group.

RESULTS

Tukey Test: There were significant reduction in the time taken in simple and bimanual dexterity tests and increase the tweezer dexterity score after 30 days of yoga practice. The groups mean values and significant changes are given in the Table-1

Wilcoxon Signed Rank Test : A significant change in percentage for both the group in the time taken on simple dexterity and bimanual dexterity test. A significant change in percentage for both yoga and drill group in tweezer dexterity score.

Paired-test: Simple and bimanual dexterity showed a decrease in time taken and increase in number of pins inserted in tweezer dexterity is shown in the Table 2:

Group	Manual Tweezer Pre	Manual Tweezer Post	Bimanual Pre	Bimanual Post	Pre	Post
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Yoga M	1.3041	1.1005**	1.7847	1.2047***	22.2941	36.00**
S.D	0.1197	0.0529	0.3488	0.092	7.7061	7.638
DrillM	1.2723	1.15*	1.8418	1.3218	19.9411	30.2941
S.D	0.0967	0.0643	0.3771	0.2218	7.8924	8.5733

*P< 0.05, **P< 0.0025, *** P< 0.001 paired 't' test, post compared to pre.

Table 2 : Mean and Standard Deviation of Three Dexterity Tests Before and After Yoga

CONCLUSION

The present study showed that after 30 days of yoga practice, there is decrease in time taken for bimanual and simple dexterity test and increases in tweezer dexterity scores than drill group. Yoga group performed faster with eye and hand co-ordination. Although drill group improved in the scores but not to extend of yoga group.

REFERENCE

1. Elliot M Waldron and Barry S Anton (1995) 'Effect of exercise on dexterity' Perceptual and Motor Skills, 80:883-889.
2. Michael Peters and Paul Campagnaro (1996) 'Do Women really excel over Men in Manual Dexterity ?' Human Perception and Performance 22(5): 107-112
3. NKManjunath and Shirley Telles(1999) 'Factors influencing changes in tweezer dexterity scores following Yoga Training' Indian J Physiol Pharmacol, 43 (2): 225-229
4. Krista Winter-Roberts and Jacobson 'Influence of Caffeine on selected manual manipulation skills' Perceptual and Motor skills, 1991, 721175-1181

YOGA REDUCES REACTION TIME

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ABSTRACT

Reaction time is the time period from the stimulus to the beginning of the response. This component seems strategic in distinguishing between outstanding, average and poor performers in many motor skills. The present study was carried out to assess whether general yoga practices would develop the performance of adults on reaction time.

The yoga practices consisted of asanas, pranayamas, meditation, devotional sessions, lectures and cleansing techniques. Assessments were taken on Day 1 and Day 28 of yoga training on reaction time to colored light cues. Each subject had 4 trials. The same sequence was followed for all subjects on pre and post assessments. The results show that yoga practices help in reducing the reaction time to colored light cues.

Reaction time is the time period from the stimulus to the beginning of the overt response. It improves during childhood, reaching a peak in the late teens or early twenties. The speed of reaction levels off and remains relatively unchanged until around the age of sixty. Where upon it gradually slows as one approaches feebleness. Several studies have shown that male have

significantly faster reaction times than females at all age levels. Some speculate these findings have been culturally influenced.

Yoga is an ancient Indian tradition, which through diverse physical and mental practices the practitioners strive to achieve a state of overall health. Yoga improves static motor performance following yogic training of school children (Telles, Hanumanthaiah, Nagarathna and Nagendra, 1993). This was thought to be related to improved attention and concentration.

The present study was carried out with the aim of assessing whether yogic training for one month would change reaction time in adult volunteers.

METHODS

Subjects : The present study was conducted on 33-volunteers between 17 - 43 years of age, who were attending a 30 day residential yoga training course. All the subjects were healthy, nonsmokers and took no drugs. They also had a uniform pattern of diet and activity during the stay here. The subjects were assessed before and after

28 days of yoga practice. All subjects were judged right hand dominant based on their self reports, information taken by us and actual observation of the hand used by them to perform the test.

Design : Recordings were made to assess the visual reaction time to colored light cues before and after 28 days of yoga practice.

Assessments : The subjects were told about the purpose of this study. They were interested and cooperated for the study, as they were assured that they would come to know the benefits of the one-month yoga practice.

When the student volunteers came for the residential course on the first day the assessments were taken. They were seated comfortably. The instrument, (Medicaid RTM 608, Chandigarh) was kept on the table at a comfortable distance so that their hands could reach the buttons. Their visual reaction times to the colored light cues were taken. Each subject was given 4 trials with a sequence of red, amber, green and red light. The procedure was kept the same for the post assessments.

Yoga Training : All the subjects received 30 days yoga training, which consisted of asanas 90 min, pranayamas 60 min, meditation 30 min, devotional sessions 60 min, guided relaxation 60 min, kriyas and lectures on the theory and philosophy of yoga 60 min every day.

Statistical Analysis : The values of reaction time in seconds obtained before and after yoga training were compared using the 't' test for paired data. The percentage changes were calculated.

Results : There were significant reductions in the visual reaction time to colored light cues after 28 days of yoga practice. The groups mean values SD as well as significant changes on paired 't' test are giving in the table -1.

Discussion: The present study shows after 30 days of Yoga training reaction time to colored light cues decreased significantly. Our results are in agreement with those of Malathi and Parulkar (1989) who have reported a significant ($p < 0.001$) decrease in visual and auditory reaction time after 6 weeks of Yoga training course. Our results are also similar to those of Madanmohan and colleagues (1992) who reported visual and auditory reaction time decreased significantly after 12 weeks of yoga practice.

The decrease in reaction time indicates an improved sensory performance and could be due to an enhanced processing ability of the central nervous system. The effect of yoga training and central nervous mechanism could be due to (i) Greater arousal and faster rate of information processing and (ii) improved concentration power and ability to ignore extraneous stimuli. Yoga practitioners are known to have better attention and less distractibility. It has been reported that yoga practice results in a decrease in mental fatigability and an increase in performance quotient. The present study suggests that yoga training lead to a significant reduction in visual reaction time. A further study could be made by adding a non-yoga (control) group to understand the retest effect.

	Red		Amber		Green		Red	
Before Yoga	0.45	0.15	0.41	0.16	0.43	0.24	0.4	.12
After Yoga	0.35	0.08*	0.32	0.08**	0.32	0.09**	0.29	.08**

* P < 0.05, ** P < 0.001, paired 't'-test.

Table 1. Reaction Time in Seconds before and after 30 days yoga practice. The values are group mean SD.

REFERENCES

1. Malathi A. and Parulkar V. G. (1989) Effect of Yogasanas on the visual and auditory reaction time. Indian J Physiol Pharmacol; 33:110-112.
2. Madanmohan, Thombre D. P., Bharathi B., Nambinarayanan T. K., Thakur S., Krishnamurthy K. and Chandrabose A. (1992) Effect of Yoga training on reaction time, respiratory endurance and muscle strength. Indian J Physiol Pharmacol; 36:229-233.
3. Telles S., Hanumanthaiah B., Nagarathna R. and Nagendra H.R. (1993) Improvement in static motor performance following yoga training of school children. Indian J Physiol Pharmacol; 76,1264-1266.
4. Etnyre B. (1992) Reduction of reaction time preceding increased complexity of movement. Perceptual and motor skills; 74, 819-824
5. Leonard K. L. and Richard A.B.(1993) Influence of Sex, presentation order and trial blocks on young adults simple and Type-C reaction times. Perceptual and motor skills; 76, 1199-1210.
6. Sandra J.B., Jacques P.J.M. and George J. (1986) Chrzan Simple reaction time and movement time in normal human volunteers: a long term reliability study. Perceptual and motor skills; 63, 767-774.
7. Oxendine J.B.(1984) Reaction and movement speed in : Psychology of motor learning .Prentice-Hall, Inc.,New Jersey, USA, 273-384.

YOGA FOR WOMEN : EFFECT ON WEIGHT, WAIST, HIPS AND CHEST FLEXIBILITY - A STUDY

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ABSTRACT

We have compiled the data of 26 women who had been attending daily classes for atleast 6 months. In this study the measurements of weight, waist and hip circumference, maximum value of chest after complete inhalation and minimum value after exhalation were recorded. All these women practised various yogasanas followed by Pranayamas and relaxation techniques. They were given general instructions to follow moderation in dietary habits.

The cumulative probability distribution of the body weight in these subjects after yoga has shown that they can be divided in two population groups. 93% of women showed either decrease or no change in weight. All 3 women who were overweight reduced their weight. 81% of women showed a decrease or no change in waist and hip circumference. Chest flexibility increased in all subjects. The detailed analysis in this study shows that by doing yogasanas regularly the shape parameters and

chest flexibility can be improved.

In the recent past modernisation of cultures, urbanisation and industrialisation have greatly influenced our way of living and we have tended to drastically deviate from those well established ancient principles practiced and professed by our sages. We are trying to seek apparently comfortable living conditions where physical activities have been replaced by labour saving machines and appliances, and thus have grossly confronted the nature. Food habits, on the other hand, have changed. Eating of more and more artificially preserved and processed food items lacking ingredients essential for maintaining good health is on the increase. Our exaggerated expectations remaining unfulfilled, have resulted into elevated stress levels in our life. All these have given rise to so many disorders like high blood pressure, diabetes and obesity. In the promotion of physical and mental health and prevention of many of these disorders, yoga is supposed to play a vital role (1). Yoga-practitioner's integrated personality changes for the better as yoga has got holistic approach.

In the promotion of physical & mental health and prevention of many of these disorders, yoga is supposed to play a vital role. Yoga-practitioner's integrated personality changes for the better as yoga has got holistic approach.

Dr. Gharote from Lonavala studied the therapeutic effect of yoga on cases of obesity and the results were assessed -through measurements of skin-fold at various points. Results showed significant decrease in skin-fold measurement both in males and females (2) . However, we have studied in the present work the effects of yogic practices on fat accumulating parameters by measuring weight, waist-line, hips etc. in a group of women.

AIM

A large number of persons attend clinics or follow other practices for reducing obesity and for improving physical look. These are the cases in which influence of the state of mind of the persons on their bodies are fairly predominant. In the case of women it is seen that with increasing age there is increase in fat accumulation mainly at the hip regions. Our aim was to study the long term effects (atleast for 6 month duration) of yogic-practices on weight, waist-line, hips and chest flexibility in case of a group of women who performed yogasanas and pranayamas regularly.

METHOD

There has been a regular class of yoga practices in Brindavan Yoga Hall at Anushakti Nagar in Mumbai from 10.30 hours to 12.00 hours in the morning for women for the last 17 years. In this study, in the beginning of admission and thereafter every month, the measurements of weight, waist, hips, maximum value for the chest after complete inhalation and minimum value of the chest after exhalation were recorded. The women covered in the present study were in the age group of 22 to 69 years. These data were collected from 1995 to 1998. Participants were taught yoga practices and were supervised by the trained and experienced yoga teacher. They practised yogasanas and pranayamas followed by 20 minutes of relaxation techniques like Savasana Makarasana or Yoganidra. The asanas taught in this study were vajrasana, suryanamaskara, pavanamuktasana, bhujangasana, salabhasana, trikonasana, hastapadasana, cakrasana, dhanurasana, viparitakarani, sarvangasana and pranayamas followed by relaxation postures. In this group, there were women who were overweight and some were having different ailments like asthma, spondylosis (neck and back), and some were having no complaint. Due care was taken for yoga-practices contra-indicated in some individual subjects depending upon their physical conditions. In the present study, in the beginning of admission and thereafter every month, the measurements of weight, waist-line, hips, maximum value of chest after complete inhalation and

minimum value after exhalation were recorded. They were told the importance of balanced diet and were instructed to follow moderation in dietary habits.

RESULTS AND DISCUSSIONS

In this paper we have compiled the data for 26 women who had been coming continuously atleast for 6 months daily except Saturdays and Sundays. Though originally we have collected data for 32 women, but six women for personal reasons could not maintain regularity and they reported to the yoga teacher after a gap of two or three months in between the fixed span of six months decided in the present study . All these irregular yoga-practitioners showed gain in body-weights and increase in other parameters as compared to the general trend shown in case of regular yoga practitioners. It is worth mentioning here that the yoga practitioners were told the importance of balanced diet and they were instructed to do normal daily activity as before joining yoga class.

The data obtained during the present study are shown in Table-1. Statistical analysis was carried out with respect to weight-parameter in order to study its distribution in the subjects. The % cumulative probability less than the weight (as shown in Table-2) plotted against the weight revealed that the entire population of subjects is composed of two different groups, one of subjects from S.No. 1 to 14 (normal group) and another S.No. 15 to 17. Incidentally only 3 subjects having body-weight 84 Kg, 87 kg and 94 Kg fell in the obese group. The results show that in all three women body weight, hips and waist-line measurements had decreased. Some more data are needed to prove the statistical significance of these observations. The percentage changes in body weight, waist-line, hips and chest-flexibility are shown in Table-3 in the same order of serial number as shown in Table-1.

Serial Number	Weight		WAIST		HIPS		CHEST		CHEST	
	Before	After	Before	After	Before	After	Before	After	Before	After
1	65	67	90	88	102	103	99	100	94	93
2	65	59	95	92	109	104	97	95	95	93
3	73	73	98	99	121	122	103	103	101	100
4	63	63	92	93	114	114	91	90	89	87
5	57	55	93	92	101	95	96	98	95	95
6	54	55	94	90	105	101	88	89	85	85
7	68	68	90	88	107	108	100	99	98	97
8	60	57	87	83	100	96	89	88	87	86
9	94	87	100	100	123	117	110	105	108	103
10	87	82	95	96	127	124	107	106	105	104
11	60	57	88	82	101	97	98	99	96	96
12	84	78	106	104	123	118	115	111	114	109
13	54	53	84	85	100	97	93	94	91	90
14	51	48	80	85	100	94	90	85	89	89
15	50	49	78	72	100	100	83	83	81	81
16	59	57	77	77	110	105	90	92	88	86
17	63	60	80	81	107	106	95	94	93	90

18	68	62	84	79	107	102	100	98	97	92
19	74	72	102	100	126	122	104	103	103	101
20	58	56	87	88	106	105	92	94	90	90
21	55	55	88	88	104	104	94	93	90	88
22	67	65	87	84	105	102	95	95	94	£T2
23	67	66	97	95	108	108	102	102	101	100
24	63	62	95	92	106	107	100	99	98	97
25	73	73	94	94	109	109	100	103	98	100
26	65	64	97	97	108	106	103	103	102	100

Table 1: Initial and final measurements for the various Parameters in case of a group of women who practiced Yoga for 6 months regularly.

S.No.	Weight (kg)	No. of persons	Cumulative Frequency (n)	% Cumulative Probability less than the weight $(2n-1)/N, N=26$
1	50	1	1	1.92
2	51	1	2	5.77
3	54	2	4	13.46
4	55	1	5	17.31
5	57	1	6	21.15
6	58	1	7	25.00
7	59	1	8	28.85
8	60	2	10	36.54
9	63	3	13	48.08
10	65	3	16	59.61
11	67	2	20	67.31
12	68	2	20	75.00
13	73	2	22	82.69
14	74	1	23	86.54
15	84	1	24	90.38
16	87	1	25	94.23
17	94	1	26	98.08

Table 2 : Data for the distribution of population for statistical analysis

I. REDUCTION IN WEIGHT

The bar-chart on data of Table-3 is shown in fig.1 and depicts the percentage reduction in weight after doing yogic practices for 6 months. Out of 26 ladies in this group, 19 practitioners lost the body-weights while 2 women gained the weight (of the order of 4%) due to dietary indiscretion during festivals. There were 5 women, in whose case there were no change in body-weight. Arithmetic average of % reduction in body-weight works out to be 3.03 while taking all the 26 women into consideration. In 93% of yoga practitioners covered in this study, either the body-weights remained stable or there were reduction in body-weights.

II. REDUCTION IN WAIST-LINE

The bar-chart depicting the percentage change in waist-line is shown in Figure-2. From the data collected for the waist-line measurements, it is seen that there is reduction in waist-line for 18 women while in case of 6 women there is slight increase in waist (of the order of a centimeter in each case). For two women there was found to be no change in this parameter. The average percentage reduction in waist-line was found to be 2.11. In 81% of the cases, the waist-line parameter either decreased or remained stable.

% REDUCTION in WEIGHT	% REDUCTION in WAIST-LINE	% INCREASE in CHEST FLEXIBILITY	% REDUCTION in HIPS
-3.07	1.12	0	-0.98
9.23	3.16	0	4.59
0	-2.04	0	-0.83
0	-1.09	50	0
3.51	1.08	200	5.94
-1.85	4.26	33	3.85
0	2.22	0	-0.93
5	4.6	0	4
7.44	2.91	0	4.09
5.74	-1.05	0	2.36
5	6.82	50	3.96
7.14	1.89	100	4.06
1.85	-1.19	100	3
5.88	5.55	0	6
2	1.36	0	0
3.39	0	200	3.66
5	-1.25	100	0.93
8.82	5.95	100	4.67
2.7	1.96	100	3.17
3.45	-1.14	100	0.94
0	0	25	0
2.98	2.98	200	2.85
1.49	1.49	100	0
1.59	1.59	50	-0.94
0	9	0	0
1.53	1.53	400	1.85

Table 3: Percentage reduction in various parameters after 6 months

III. REDUCTION IN HIPS

The percentage reduction in circumference at hip-line for all 26 women is shown in figure-3. There was decrease for 17 women and increase for 4 women circumference at hip points while in case of 5 women there was no change observed in this parameter as found in the study. In 85% of the participants who have come regularly for yoga class, either the same parameter was stable or it got decreased.

IV. INCREASE IN LUNG FLEXIBILITY

The bar-chart depicting % changes in lung-flexibility is shown in figure-4. For 16 women there was increase in percentage lung flexibility and for 10 women there was no change in this parameter. None of them, however, showed decrease in their lung-flexibility. No restriction on diet, behaviour or other activities were advised in particular to be observed by yoga practitioners during the course of this study. Yoga is believed to have holistic approach and it imparts an all round improvement in our personalities. Habits covering ahar, vihar, a car and vicar are getting transformed in the positive direction. It has been shown that there is general improvement in well-being among the yoga practitioners at physical and mental levels. Their inter-personal relationship with the family members and in the society is improved considerably. The general reduction in mental stress due to relaxation, helps the body to cope up with the day to day activity efficiently. The yogic postures increase the blood circulation which reduces the toxicity in the body for the overall healthy growth like improved functioning of various glands, kidney and liver. The percentage increase in positive attributes are supposed to be due to the holistic approach that is the outcome of yogic attitude people feel while undergoing yogic training.

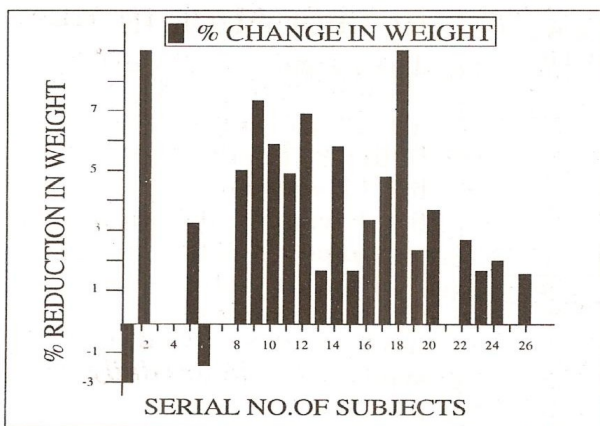


Fig 1

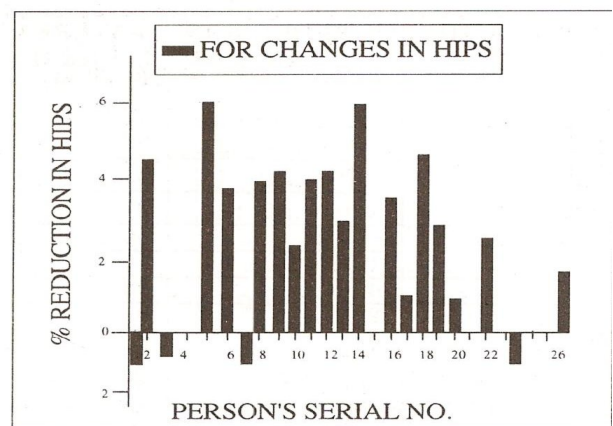


Fig 2

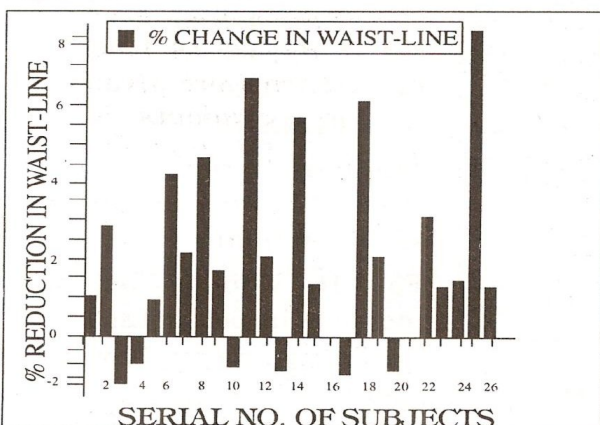


Fig 3

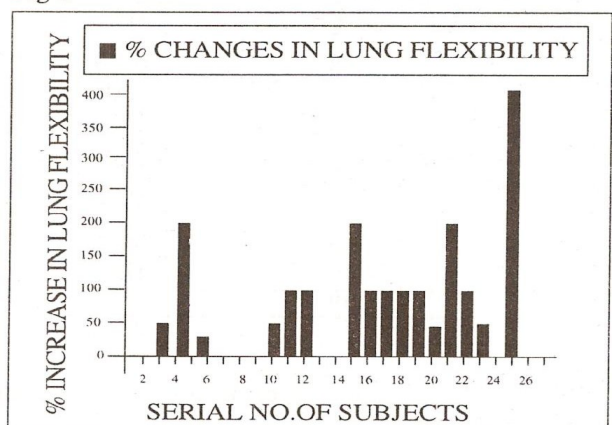


Fig 4

ACKNOWLEDGEMENT

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REFERENCES

1. "Yogic and Tantric Medicines" by Prof O P Jaggi, Publisher: Atma Ram and Sons, Delhi.
2. Gharote, M.L., "Evaluation of effects of yogic treatment on obesity", A paper read at the West Zone Scientific Seminar on Indigenous Systems of Medicine, held on 11th and 12th August, 1973, at the Haffkins Institute, Mumbai.

YOGA FOR MEMORY DEVELOPMENT OF SCHOOL-GOING CHILDREN

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ABSTRACT

The purpose of present study is to determine the effectiveness of 15 days Yoga Training in a Residential Camp as compared to 15 days 3 hours daily Yoga practice during school time along with other studies. This study has been carried out on 220 students divided into 4 Yoga groups and 4 Control groups. While two Yoga groups consisting of 28 students each were given Yoga Practice for 3 hours everyday for 15 days, the other two Yoga groups consisting of 27 students each were given Yoga training in a Residential Camp for 15 days. Students in corresponding Control groups-did not receive any Yoga training and carried out their normal studies in the school.

Research Project Report No.I covered a total population of 954 students divided into 12 yoga groups and 12 control groups and the analysis of results indicated a substantial increase in scores of Memory Related Tests for yoga group who were given yoga training for 3 hours everyday for 15 days as compared to the control groups, who showed a marginal change in scores. The purpose of the present study is to determine the effectiveness of 15 days yoga training in a Residential Camp as compared to 15 days - 3 hour daily yoga practice in a non residential camp.

MATERIALS AND METHODS

Formation of Yoga groups and Control groups: This study has been carried out on 220 students divided into 4 Yoga groups and 4 Control groups based on age factor as given below :

2.1.1 Yoga Groups

While students in Yoga groups 13 & 14 were given Yoga practice for 3 hours everyday for 15 days, the Yoga groups 15 & 16 were given Yoga training in a residential camp for 15 days.

2.1.2 Control Groups

Corresponding Control groups were formed as follows :

Students in these Control groups did not receive any Yoga training.

Sl. No.	No. of Students	Average Age	Standard Deviation	
13	28	11.11	0.87	Jr.
14	27	13.04	0.73	Sr.
15		13.90		Sr.

SI. No.	No. of Students	Average Age	Standard Deviation				
16		11.93		Jr.			
1013	28	28	27	11.11	0.87	0.61	Jr.
1014	27			13.68	0.48	0.60	Sr.
1015				13.67			Sr.
1016				11.15			Jr.

Design: Both Yoga groups and Control groups were given 4 memory related tests in the beginning and at the end of 15 days period. These two tests were similar in nature but not identical. Junior Yoga group No. 13 and Senior Yoga group No. 14 were given Yoga training for 3 hours everyday for 15 days while Junior Yoga group No. 16 and Senior Yoga group No. 15 attended a fully Residential Yoga camp for 15 days and received intensive Yoga practice.

Yoga Practice Syllabus: The syllabus consisted of the following:

1. Suddhi Kriyas with special emphasis on Kapalabhati
2. Yogasanas
3. Pranayama with special emphasis on Bhramari
4. Dharana / Dhyana practice with special emphasis on awareness.
5. Practice of Trataka and mudras.
6. Practice of deep relaxation techniques.
7. Bhagavad Gita Sloka Recital / Songs.
8. Stories based on Yama and Niyamas.
9. Yogic games.
10. Satvic Ahara to stimulate memory specially milk, fruit, nuts etc,

Assessment Tests :

Audio Test (Recall ability Test)

25 words were read loudly with a gap of 5 seconds between two words. Then after 10 minutes students were asked to write down these 25 words. Each correct answer scored one mark.

Visual Test (Recognition Test): 25 articles were shown one at a time for 10 seconds each. After 10 minutes, students were asked to write down names of 25 articles shown to them. Each correct answer scored one mark.

Audio - Visual (Recognition / Recall Test): 25 pictures of common objects were shown one at a time. Also, the name of each object was read loudly while showing each picture. After 10 minutes students were asked to write down the names of objects. Each correct answer scored one mark.

Answering Questions After hearing A Story (Retention / Recall Test): An inspiring story was read out to the group. After 10 minutes students were asked to answer 10 questions which were then evaluated for score.

DATA GENERATION AND ANALYSIS

For Yoga Group: Following data has been generated for 110 students (4 groups) who took Yoga training :

1. Age and Sex.
2. Academic status.

3. Economic status of Family.
4. Scores of 4 Memory Tests before starting 15 days of Yoga practice.
5. Scores of 4 Memory Tests at the end of 15 days Practice.

For Control Group: Similar data was collected for 110 students (4 groups) who served as Control groups and did not receive any Yoga Training but were engaged in normal activities of school.

Analysis: The analysis carried out yielded the following results:

1. Average age of each group with standard deviation.
2. Average score of each group with standard deviation for Audio Test No. 1.
3. Average score of each group with standard deviation for Visual Test No.2.
4. Average score of each group with standard deviation for Audio Visual Test No.3.
5. Average score of each group with standard deviation for answering question after hearing a story Test No.4.
6. The above data is contained in Tables A, to A,,.

Comparison of Results: Graphical Presentation of comparison of results analysed is shown in Tables Bt to B4. The comparison of percent increase in scores with respect to initial scores both for Yoga group and Control group is also included in the above tables.

Discussion of Results: Results of this Research indicate the following :

Audio Test No.1 - Recall Capacity: Yoga Jr. Group Residential Programme showed an increase in scores of 101.52% as compared to Yoga Jr. Group Non-Residential Programme who showed an increase in scores of 51.24% while Control groups showed marginal increase of 0.7% to 8.24%. Yoga Sr. Group Residential Programme showed an increase in scores of 76.67% as compared to Yoga Sr. group Non-Residential programme who showed an increase in scores of 50.49% while Control group showed marginal increase of 1.08% to 8.3%.

Visual Test No.2: Yoga Jr. Group Residential Programme showed an increase in scores of 90.36% as compared to Yoga Jr. Group Non-Residential Program who showed an increase in scores of 53.89% while Control groups showed marginal increase of 1.34% to 1.46%.

Yoga Sr. Group Residential Programme showed an increase in scores of 48.67% as compared to Yoga Sr. group Non-Residential Program who showed an increase in scores of 42.18% while Control group showed marginal increase of -3.38% to -2.85%.

Audio Visual Test No.3: Yoga Jr. Group Residential Programme showed an increase in scores of 73.18% as compared to Yoga Jr. Group Non-Residential Program who showed an increase in scores of 42.18% while-Control groups showed marginal increase of 1.34% to 4.53%.

Yoga Sr. Group Residential Programme showed an increase in scores of 60.5% as compared to Yoga Sr. group Non-Residential program who showed an increase in scores of 38.30% while Control group showed marginal increase of 2.99% to 6.98%.

Questions on Story: Yoga Jr. Group Residential Program showed an increase in scores of 68.15% as compared to Yoga Jr. Group Non-Residential Program who showed an increase in scores of 54.88% while Control groups showed marginal increase of 4.36% to - 1.85%.

Yoga Sr. Group Residential Program showed an increase in scores of 49.70% as compared to Yoga Sr. group Non-Residential program who showed an increase in scores of 39.77% while Control group showed marginal increase of -1.40% to 2.09%.

SCIENTIFIC RELEVANCE/IMPACT OF RESULTS

The results of this Research provide an indication that Yoga training in a fully residential camp of 15 days has greater impact on memory as compared to Yoga training in a non-residential program of 3

hours daily for 15 days.

REFERENCES:

1. Dr. H.R. Nagendra & Dr. Shirley Telles. Yoga & Memory Vivekanand Kendra Yoga Prakashana, Bangalore.
2. Baddeley A.D. 1993. Your Memory - A User's Guide, New York; Avery.
3. Nagendra, HR.; Mohan, T & Shri Ram A. (1988). Yoga in Education, Bangalore Vivekananda Kendra Yoga Research Foundation.
4. Yoga for Memory Development of School Going Children - Research Project Report No. 1 .

MEDITATION FOR CERTAIN AILMENTS THROUGH A YANTRA

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ABSTRACT

'Yantra is a mystic diagram, that stores cosmic energy. Meditation upon a yantra have been known to produce results, pertaining to the physical, mental and even spiritual states of the practitioner. A special yantra was prepared by the author for the benefit of patient with ailments like Asthma, Arthirits, blood-pressure, diabetes and mental problems. A pilot study was conducted in the 'Yoga Jeevana Kendra' upon 50 patients, by prescribing meditation upon the Yantra.

'Yantra' is a mystic diagram that sotres cosmic energy for a desired purpose. Meditation upon a yantra with due preparations have been known to produce results, pertaining to physical, mental and even spiritual states of the practitioner. This theory is utilized in this practice for the benefit of patients suffering from certain ailments. The aim was to control/heal Asthma, diabetes, blood pressure, Arthritis and certain mental problems.

METHOD

Subject: A special Yantra was prepared by the author for meditation. This Yantra represents the three bodies, physical (body), subtle (mind) and causal (spirit) bodies of an individual, finally merging at the centre or 'Bindu' of the Yantra, which represents pure consciousness.

Design: Before practicing the meditation, certain kriyas like relaxation, asanas, pranayama etc. are practised to prepare the body and mind for meditations. Next, meditation on the Yantra is practiced. 'Prana' is the medium employed during meditation. Slowly the scattered energy of the physical body is harnessed and merged in the subtle body, which again is harnessed and merged in the causal body, which is merged into the highest objective, namely consciousness or 'Bindu' at the centre of the Yantra, After meditation the practitioner retraces the path, and comes back to the physical plane. During this practice the spiritual energy comes down to enrich the mental and physical bodies. This process helps to correct the imbalance in the physical and mental planes, leading to control/heal the ailments.

RESULTS

A pilot study was conducted in "Yoga Jeevan Kendra' upon 50 patients, prescribing meditation upon the Yantra. The following results, statistically significant, were observed:

- 1) 30 patients were completely healed
- 2) 15 patients were partially healed
- 3) 5 patients showed positive response

CONCLUSION

The above meditation practiced regularly helps to control/heal many ailments. 'Negative emotions like fear, anger, depression, worry etc are 'reduced and a calm state of mind is developed by the practitioner. The total personality of the practitioner improves by leaps and bounds, helping him to face life situations in a better manner.

BASELINE OCCUPATIONAL STRESS LEVELS AND PHYSIOLOGICAL RESPONSES TO STRESS MANAGEMENT PROGRAM

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ABSTRACT

The present study evaluated the physiological changes of a yoga based stress management program for 26 asymptomatic, male, middle managers. The Occupational Stress Index (OSI) and autonomic parameters were measured. Correlations were made between occupational stress scores and physiological measures. Data of subjects with OSI greater or less than the median were analyzed separately. There were no significant correlations between the measures of both the groups.

Work related psychosocial stressors are known to affect the body functions through psychological processes, and influence health through four types of closely interrelated mechanisms - emotional, cognitive, behavioral, and physiological (Levi, 1990). The health outcome depends on situational (e.g., social support) and individual factors (e.g., personality, coping repertoire). The increase in occupational stress has led to many work site stress management programs (Fiedler, Vivona - Vaughan, & Gochfeld, 1989), which have attempted to reduce workers' stress. The efficacy of these procedures for asymptomatic employees is questioned, with no objective physiological changes recorded. The present study was conducted: (i) to evaluate psychophysiological responses to a two-day, yoga based stress management program, and (ii) to correlate occupational stress indices, with base line physiological measures and with changes in physiological measures after the two-day program.

METHOD

Subjects: The subjects were 26 male volunteers who were attending a two-day workshop on self-management for excessive tension through yoga. Their ages ranged from 34 - 54 yrs (group average age \pm SD, 43.0 \pm 5.5 years), and none of them had previous experience of yoga or any relaxation procedures. All subjects were in the same occupation (middle managers from an electronic goods company) for at least two years prior to the test.

Design : Assessments were made at the beginning and end of the two-day workshop. During polygraph assessments subjects were seated in a dimly lit, sound attenuated room.

Assessments : The Occupational Stress Index (OSI) (Srivastava & Singh, 1981) was given before the program. The OSI has 46 statements to which the participant had to respond with "Yes or No". For

29 statements 'Yes' was scored as 1 and 'No' as 0, whereas for 17 statements it was the reverse, i.e., 'No' was scored as 1, and 'Yes' as 0.

The following data were recorded using a 4-channel polygraph (Medicaid Systems, Chandigarh, India): (i) EKG was recorded using standard limb lead I configuration. The EKG was digitized using a 12 bit analog-to-digital converter (ADC) at a sampling rate of 500 Hz. The data recorded were visually inspected off-line and only noise free data were included for analysis (Raghuraj, Ramakrishnan, Nagendra, & Telles, 1998). The R waves were detected to obtain a point event series of successive R-R intervals, from which the beat to beat heart rate series was computed. Frequency domain analysis of heart rate variability (HRV) data was carried out for the 5-minute recordings. The mean heart rate was obtained from this record. The mean values were removed from the heart rate series to obtain the HRV values. The HRV power spectrum was obtained using Fast Fourier Transform (FFT). The power in HRV series in the following specific frequency bands was studied, viz. the very low frequency (VLF) band (0 - 0.05 Hz), low frequency (LF) band (0.05 - 0.15 Hz), and high frequency (HF) band (0.15-0.50 Hz). The low frequency and high frequency values were expressed as normalized units, which represent the relative value of each power component in proportion to the total power minus VLF component ($LF\ norm = LF / (total\ power - VLF) \times 100$; $HF\ norm = HF / (total\ power - VLF) \times 100$) (Task force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996). (ii) The breath rate (in cycles per minute) was calculated by counting the breath cycles in 60 second epochs, continuously. For each subject, the average of the values obtained during the 5-minute session was used for analysis.

DATA ANALYSIS

- (i) Pre-Post stress management program comparisons were based on a t- test for paired data.
- (ii) The polygraph data of subjects with OSI greater than the median were analyzed separately from data of subjects with OSI less than the median. These data were also compared (pre-post) with the paired t-test.
- (iii) The Pearson product-moment correlation coefficient was used to assess correlations between (a) base line OSI and baseline autonomic measures, (b) base line OSI and pre-post differences of autonomic measures.

Yoga based Stress management program : An idea from the traditional yoga texts that a combination of activating and pacifying practices may help reach mental equilibrium (Chinmayananda, 1984), was the basis for the main practice during the two-day program, called 'cyclic meditation'. It includes the practice of yoga postures interspersed with relaxation while supine, so as to have a combination of "activating" and "pacifying" practices (Nagendra & Nagarathna, 1997). Apart from the yoga practices the two day stress management program also consists of a series of lectures (5 hrs) on topics such as ancient Indian phylosophysical concepts about stress.

RESULTS

The group means \pm SDs obtained in pre and post recordings are given in Table 1. The whole group (n=26) showed a significant decrease in breath rate after the two day program, with no other changes.

The polygraph data of subjects with OSI greater or less than the median (= 24.5) were analyzed separately. Subjects with OSI more than median (n = 13) showed a significant decrease in breath rate, in the power of the low frequency component of the heart rate variability spectrum, and in the low frequency: high frequency ratio (LF/HF). In these subjects the power of the high frequency component was significantly more after the program. In contrast, the subjects (n = 13) with OSI less than the median, showed no change after the program.

Parameters		Whole group (n=26)		OSI < median (n=13)		OSI > median (n=13)	
		Pre	Post	Pre	Post	Pre	Post
Heart Rate (bpm)	Mean	83.3	84.6	79.0	81.1	87.7	88.1
	SD	12.9	11.9	12.0	10.7	12.7	12.4
Respiratory Rate (cpm)	Mean	17.4	16.3***	17.8	17.0	17.0	15.5**
	SD	4.2	4.6	4.7	4.6	3.9	4.7
Low frequency (in nil)	Mean	35.0	34.3	36.2	36.4	34.8	31.3*
	SD	6.6	9.6	8.7	12.3	4.2	6.2
High frequency (in nTJ)	Mean	64.9	65.6	63.5	63.5	65.1	68.6*
	SD	6.6	9.6	8.9	12.3	4.2	6.2
LF/HF ratio	Mean	0.55	0.56	0.60	0.64	0.54	0.46*
	SD	0.1	0.3	0.2	0.4	0.0	0.1

*p<.05, **p<.01, ***p<.005, paired t test, "post" compared to "pre".

Table 1: Means \pm SB's of Autonomic Variables pre-post recording sessions in groups with OSI less than or greater than median.

There was no correlation between the OSI at baseline and polygraph measures i) at base line (ii) recorded post compared with pre.

DISCUSSION

At the end of a two-day yoga based stress management program, the breath rate was lower, with no other change. However when subjects were categorized based on their occupational stress index (OSI), as OSI greater or less than the median, the two categories showed different trends. The 'OSI greater than the median' group showed a decrease in breath rate, also peak power of LF of the HRV, and LF/HF, with an increase in the HF peak power. The 'OSI less than the median' group showed no change.

In this study one of the main questions to be answered was whether the two-day stress management program would change objective measures in the asymptomatic middle managers, who were participants. Apart from a decrease in breath frequency, there were no other objective signs of reduced physiological stress after the program. However, subjects with more than the median levels of the occupational stress index showed changes in the LF and HF components of the HRV spectrum. The LF component is known to correspond to sympathetic and HF to vago-sympathetic activity of the ANS (Malliani et al 1991). Subjects with high occupational stress scores at baseline appeared to be more likely to show reduced sympathetic activity after the two-day program. These results are in keeping with those of a previous study, which described that subjects with higher initial arousal and inability to focus attention showed better physiological rest after isometric squeeze relaxation, rather than meditation (Weinstein, & Smith, 1992). However there was no linear correlation between occupational stress indices and baseline physiological measures, or changes (post-pre) in them.

Hence the results suggest that following a two-day yoga based stress management program subjects with higher levels of occupational stress, who do not necessarily show raised sympathetic arousal at baseline, show significant reductions in sympathetic activity.

REFERENCES

1. Chinmayananda, S. (1984) Mandukya Upanisad, Sachin Publishers, Bombay, p,275.

2. Fielder, N., Vivona-Vaughan, E., and Gochfeld, M. (1989) Evaluation of a work site relaxation training program using ambulatory blood pressure monitoring. *Journal of Occupational Medicine*, 31(7), 595-602.
3. Levi, L. (1990) Occupational stress. Spice of life or kiss of death? *American Psychologist*, 45(10), 1142-1145.
4. Malliani, A., Pagani, M., Lombardi, F., and Cerutti, S. (1991) Cardiovascular neural regulation explored in the frequency domain. *Circulation*, 84, 482-492.
5. Nagendra, H.R., and Nagarathna, R. (1997) *New Perspectives in Stress Management-Bangalore: Vivekananda Kendra Prakashan*, p. 50.
6. Raghuraj, P., Ramakrishna, A.G., Nagendra, H.R., and Telles, S. (1998) Effect of two selected yogic breathing techniques on heart rate variability. *Indian Journal of Physiology and Pharmacology*, 42(4), 467-472.
7. Srivastava, K.K and Singh, A.P. (1981) Construction and standardization of an occupational stress index; a pilot study. *Indian Journal of Clinical Psychology*, 8,133-136.
8. Task force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. (1996) Heart rate variability: Standards of measurement, Physiological interpretation, and Clinical Use. *Circulation*, 93(5), 1043-1065.
9. Weinstein, M and Smith, J.C. (1992) Isometric squeeze relaxation (progressive relaxation) vs meditation: absorption and focusing as predictors of state effects. *Perceptual and Motor Skills*, 75, 1263-1271.

INFLUENCE OF YOGA TRAINING ON DEXTERITY SKILLS OF SCHOOL CHILDREN

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ABSTRACT

This study was carried on to evaluate the effect of yoga training on tweezer dexterity which is a test for fine motor skills and manual dexterity which is a test for gross motor skills. The yoga group showed a significant improvement in both tweezer and manual dexterity. The yoga group showed a significant improvement in tweezer dexterity (41.6% increase in number of pins placed in given time) and manual dexterity (14.1% decrease in time taken to complete the task). This suggests that yoga helps in improving fine and gross motor skills.

The science of yoga helps a developing individual to achieve an integrated, stable and healthy personality development. The physical, mental and emotional dimensions of our personality are important by themselves but their integrated functioning gives the person the total psychosomatic control and health. Disturbance in any of these dimensions may create ill health and disease. Therefore according to Patanjali who defined yoga, as "chitta vritti nirodha" is a process which brings in changes, in the psychosomatic systems of the body both in positive and negative directions.

The effect of yoga on the changes in bodily functioning have been measured through various modalities like skill of dexterity, mirror star, hand steadiness and critical flicker fusion frequency. According to Ghose and Ghorpade (1991) the use of muscles of hands, legs and fingers are very important in performing activity and operations in different jobs performed by individuals in day to

day life(1). Such performances are of great advantage in living. They are measured by various type of dexterity tests which show to what extent the person is capable of responding to a situation where the speed of the gross movement of hands, arms, manual rhythms and coordination of eye and fingers are necessary. Particularly attention, concentration and the factors, which are mostly involved in performance in dexterity. They are often either disturbed or deteriorated due to disturbance in the psychological state of an individual. Therefore practice of yoga which is supposed to stabilize the attention, concentration and coordination in day to day life are of great importance Manjunath and Telles (1998) found that the measure of dexterity gives an indication of the positive effect of yoga, on psychomotor activities in different job situations(2). This has been measured through dexterity test like motor manual tests, hand dynamometer grip strength. With children tweezer and manual dexterity test have been used by Raghuraj and Telles, (1997). They used tweezer dexterity, which was assessed by adapting O' connor tweezer dexterity(3). The particular procedure was tried out in the present study to see the effect of yoga on the dexterity skill of school children which is related to their attention, perception and speed of performance .

METHODS

Subjects: The subjects belonging to yoga and control groups were 94 school children. They had an age range of 12 to 14 years, attending a 10 days of yoga training course. They were divided in to two groups; experimental (n=47) and control group (n=47). All the children were matched as far as their age and education were concerned. They were 20 girls and 27 boys.

Design: The two groups were assessed on a tweezer dexterity and manual dexterity tasks detailed below. Tests were administered at the first day and the end of the tenth day.

Assessment: (a) The assessment was modeled on the O' Connor tweezer dexterity and manual dexterity test (4). The apparatus was manufactured by Anand Agencies, Pune, India. Which has 100 holes (2mm in diameter and 20mm deep) spaced 15mm apart. Subjects were instructed to pick up cylindrical metal (1.5mm in diameter and 25mm in length) with a tweezer using the dominant hand and place them in holes in a metal plate as quickly as possible. The number of pins placed within 2 minutes was noted.(b) Manual dexterity test assessed by manual dexterity board (length 104cm & width 28cm) was used. It had 56 holes with 56 pegs. Subjects were asked to put the pegs as quickly as possible in to the holes. The time taken for the completion of every task individual trial of the tasks was recorded.

Yoga training: Subjects of both group (manual and tweezer dexterity) received 10 days yoga training which consisted of asanas 90 min, pranayamas 60 min, kriyas 30 min , meditation 20 min , devotional sessions 60 min, guided relaxation 60 min and lectures on the theory and philosophy of yoga 60 min everyday .

S.No	Manual dexterity		Tweezer dexterity		Yoga Before	Control After	Yoga Before	Control After
	Yoga Before	Control After	Yoga Before	Control After				
Mean	90.17	77.45*	98.40	95.29	20.97	29.70*	21.21	21.70
SD	12.84	8.86	17.59	15.76	6.63	6.04	5.18	4.27
%Change		-14.13%		-3.15%		41.63%		2.30%

* P < 0.001 , Student's 't'- test.

Table 1 : Scores obtained by both groups in Manual and Tweezer dexterity tests. The values are groups Mean \pm SD

Data analysis: For each of the two groups separate Students' 't'- test were used to test for significant between the Day 1 and Day 10.

Results and Discussion: From Table 1 it is evident that the mean time score of manual dexterity of yoga group decreased from 90.2 sec to 77.4 sec whereas in the control group the score of the same test decreased from 98.4 sec to 95.3 sec. This indicates that the yoga group is better in their average performance; on their manual dexterity test, similarly in tweezer dexterity test the rate of performance of yoga group increased to 20.97 to 29.7 units (no. Of pins inserted). On the average they were better than the subjects of control group, were the average unit of performance remained constant at 21, without showing much change. The findings clearly indicate the effect of yoga in improving the dexterity skill of school children. The finding of the present study is similar to the findings of Telles and Raghuraj (1998). The qualitative analysis of the data of male and female children did not show much difference in their dexterity skills. The yoga training increased their efficiency in dexterity and had an impact on their total growth of emotional and behavioral aspects indicating a positive trained in their growth of personality.

REFERENCES

1. Ghos, PK, Ghorpade MB. Industrial and organizational psychology, Bombay, Himalaya publishing house, 1991.
2. Raghuraj P and Telles S. Muscle power, dexterity skill and visual perception in community home girls trained in yoga or sports and in regular school girls. Indian Journal of Physiology and Pharmacology 1997; 41(4): 409-415.
3. Manjunath N K and Telles S. Factors influencing changes in Tweezer dexterity scores following yoga training. . Indian Journal of Physiology and Pharmacology 1999; 43(2): 225-229.
4. Super DE, Chtes JO. Appraising vocational fitness: by means of psychological tests. New York, Harper & Row 1962.

4.4 POSTER PRESENTATIONS

YOGA AND MOTOR FUNCTIONS

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ABSTRACT

The practice of yoga has been reported to improve the muscle strength and manual dexterity, however the factors, which influence its effects, are not well known. In the present paper the effects of yoga training on motor functioning are reviewed, taking into account different age groups, adults (25-45yrs) and children (10-15yrs) of both sexes for 3 motor functions, (i) Tapping speed was measured to assess motor speed of both hands. There was a significant improvement after yoga which was more in adults (n=53) than children (n=152) the percentage change between the adults

and children were 22.82% versus 17.95%, also females did better than males (32.3% versus 26.6%). (ii) Grip strength was measured in three groups after yoga: normal adults (n= 37), normal children (n=86) and patients with rheumatoid arthritis (n=20), increased hand strength of both hands was found in all the 3 groups. The patients showed more improvement than normal adults and children (82.6% versus 18.9% and 12.2%) also females of all groups did better than males. (Hi) Motor speed required more attention to find detail and additional accuracy improved in yoga compared with drill (33.4% versus 25.4%). Hence, in summary yoga practice improved motor function.

In many areas of human learning there is growing evidence of a comprehensive neurophysiological evaluation of motor function and motor coordination, which are evaluated by comparing performance with the dominant Vs non-dominant hand¹. As regular practice of yoga has been reported to improve the muscular and general physical efficiency^{2&3}, are already been shown to be benefit in hand steadiness and motor coordination⁴.

The present review study aimed at: (a) Assessing the affects of yoga training on finger tapping speed, with subjects categorized according to age⁵ and gender⁶. (b) Assessing grip strength following yoga training and relative change in the factors such as age, gender and occupation⁷. (c) Assessing performance in tests for speed⁸ and accuracy after yoga or drill.

STUDY ON FINGER TAPPING SPEED

SUBJECTS

There were 91 adults: 53 yoga and 38 control. The control group was selected within the same age range to evaluate the effects of retest on motor speed. The age mean +SD adults of yoga group (28.21 +7.6 years), adults non-yoga group (29.91 +6.8 years). Assessments were also made in 152 children age mean (14.21 +1.3 years), 67 girls. All the subjects were right hand dominant, based on standard questionnaire (e.g., the hand used to write, comb, throw a ball).

DESIGN OF THE STUDY

Assessments on adult subjects were made at the beginning (initial) and end (final) of a 30 day period during which the yoga group (n=53) received training in yoga, while the control group (n=38) carried on with their routine activities. Assessments on the 152 children were carried out at the beginning (initial) and end (final) of 10 days of yoga.

EQUIPMENT

Finger Tapping Test - Originally called the Finger Oscillation test⁹, this test is a component of the Halstead-Reitan battery¹⁰. The tapping board (Anand Agencies, Pune, India), consists of a wooden plank raised on one side by an angle of approximately 8° to the horizontal, providing an inclination on which the wrist could rest while tapping. Tapping would depress a metal bar, connected to a counter, so that each tap would increase the reading by T. The counter could be manually reset to zero.

PROCEDURE

Subjects were asked to tap the metal bar as many times as possible during a period of 30 seconds. Assessment were made for both hands, the right hand was tested first followed by the left hand, with a gap of 10 seconds, in between. The number of taps was noted at the end of 10, 20 and 30 seconds, as the Tapping Speed (TS) i.e., TS1, TS2 and TS3.

TRAINING IN YOGA

The yoga groups received yoga training for approximately 8 hours a day, which was aimed at all round (physical, mental, intellectual, and spiritual) development. The 10-day program for children and 30-day program for adults had certain similarities. These programs consisted of: (i) yogasanas, specialized physical postures which are meant to increase physical stamina and mental balance; (ii) pranayama or voluntary regulation and slowing of the breathing which is carried out to achieve a

relaxed state of mind and to increase inner awareness; (iii) kriyas, techniques which bring about cleansing of the eyes and internal organs (eg. respiratory tract, abdominal muscles, and some other viscera); and (iv) devotional sessions. In addition to these specialized practices, the training for children also included games. To improve the attention span and memory as well as the telling of meaningful stories to foster a sense of values and feelings of responsibility.

DATA ANALYSIS

The baseline changes in tapping speed from initial to final assessments were calculated comparing tapping speed in 0-10 seconds (TS1), 10-20 seconds (TS2) and 20-30 seconds (TS3) on Day 1 and Day 30 (adults) and Day 1 and Day 10 (children) using Student's 't'-test. This was done separately for initial and final assessments of yoga groups.

RESULTS

Both adults and children in yoga groups showed significant increase in TS1, TS2 and TS3 of both hands after 30 days and 10 days of yoga practice. The control group had no change.

DISCUSSION

There was a significant increase in base line tapping speed (TS) which may be attributed to better motor coordination 11, 12 and 13 in adults and children of both sexes. Yoga practice for 30 and 10 days increases the initial speed 8 of tapping. It is also interesting to understand whether this result is restricted to speed of finger movements or affects gross motor activity.

STUDIES ON HAND GRIP STRENGTH

SUBJECTS

There were (a) 37 normal adults volunteers (21 males) of mean age +SD 29.9, +7.13 years, with a equal number (n=37) in control group 27.17, +6.42 years, (b) 86 children 13.5, +1.03 years were assessed (61 boys) with a control group of 86 mean age +SD 14.19, +0.91 years of equal number of boys and girls, (c) The assessment were also made in 20 Rheumatoid Arthritis (RA) patients mean age +SD 32.5, +6.24 years (10 males) with the same number (n=20) 31.9, +6.18 years in a control (non-yoga) group. All subjects were right hand dominant, assessed by a questionnaire which determined the subjects' preferred hand on a variety of tasks such as throwing ball or holding a broom.

DESIGN

Assessment on adult normal volunteers was made at beginning and end of 30 day. The children's were carried out at beginning and end of 10 day where in case of patients' pre and post assessments were taken at beginning and end of 14 day. During these 14 days, the yoga groups received training in yoga and control groups carried on their routine activities.

ASSESSMENT

Handgrip strength was assessed using a grip dynamometer¹⁶ (Anand Agencies, Pune, India.). Subjects were tested in 6 trials, 3 for each hand alternately with 10 sec. gaps trial. During the assessment subjects were asked to keep their arm extended at shoulder level, horizontal to the ground¹⁴. The maximum value obtained during the three trials was used for analysis.

YOGA TRAINING

The subjects of all these three yoga groups practiced asanas, pranayama, meditation, lectures and kriyas. Each of the specific practices has been described in detail¹⁵.

DATA ANALYSIS

The data obtained for each of 3 groups at beginning and end were analysed by using two-tailed Student's 't'-test.

RESULT

There was significant improvement in hand grip scores in all the 3 yoga groups i.e. adults, children and patients ($p < .001$, Student's 't'-test). There is no such significant change in control groups.

DISCUSSION

The significant improvement in the grip strength of both hand in all the 3 yoga groups at the end shows remarkable in patients (males and females) 82.6% change compare to adults (18.9%) and children (12.2%), and females did better than males. So the practice of yoga with relaxation were believed to influence the grip strength¹⁶.

STUDIES ON MOTOR SPEED AND ACCURACY

SUBJECTS

Thirty-six ($n=36$) school girls between the age of 9 to 11.5 years, were randomly assigned to yoga and drill groups. Subjects were right hand dominant, assessed by a questionnaire.

DESIGN

Assessments were made at beginning and end of a month. During the month the yoga group received one-hour yoga training while drill group practiced physical training (FT) exercise also for an hour, all the days of the week for four weeks.

ASSESSMENT

Assessments were three paper and pencil tests for 30 sec. each (Mc-Quarrie, 1960¹).

a. The first performance was on an accuracy test (a dot test from the Mc-Quarrie Battery), in which there were 10 rows of 10 circles of 0.4 cm diameter each, with variable distances between them. The subjects stood by the side of the table and had 30 sec to mark as quickly as possible, following the rows, a dot inside each circle. The test was accomplished with one hand, then with the other, and the number of dots was recorded for each hand.

b. On which there were seven rows of 10 circles of 0.9 cm diameter each, displayed with fixed distance in a zigzag manner between them. The subjects stood by the side of the table, and had 30 sec to mark 3 small visible pencil dots inside each circle as quickly as possible. The test was accomplished with the right hand followed by the left, and number of dots was recorded for each hand manually.

c. On a Modified Manual Typing Test from the "EUROFIT" Physical Fitness Test Battery (Council of Europe, 1983) 18, the subject stood by the side of the table, and with one hand, had 30 sec. to perform as quickly as possible, alternately right and left, placing dots in two circles of 6 cm. diameter each, separated by a distance corresponding to the subjects' shoulder width. Afterwards, the performance was repeated with the other hand and number of taps for each hand was recorded.

TRAINING

a. Yoga - Loosening exercises - 10 minutes; Breathing exercises - 10 minutes; Suryanamaskara (3 rounds) - 8 minutes; Asanas, Pranayama and Chanting - 22 minutes; Relaxation -10 minutes each day.

b. Drill - Brisk exercises - 15 minutes; Dumb- bell lifting - 20 minutes; Running - 25 minutes.

DATA ANALYSIS

The data were analysed for both (yoga and drill) groups by using paired 't' test, and then further by percentage change.

RESULT AND DISCUSSION

Both the groups showed improvement in all the three ($p < 0.001$, Paired 't'-test). The degree of improvement in the one dot test (accuracy) and the gross motor task, the yoga group showed marginally better improvement than the drill group.

SUMMARY

The practice of yoga improved rapid finger movements without fatigue, grip strength and speed and accuracy of finger movements.

REFERENCES

1. Reitan RM, Wolfson D. Halstead Rattan NeuroPsychology Test Battery: theory and clinical application. Tucson, AZ: NeuroPsychology Press 1985.
2. Nayar HS, Mathur RM, Kumar RS. Effect of yoga exercises on human physical efficiency. Indian J Med Res 1975; 63:1369.
3. Salgar DC, Bisen VS, Jinturkar MJ. Effect of Padmasana-A yogic exercise on muscular efficiency. Indian J Med Res 1975; 63: 768.
4. Karen S, Blasdel MS. The effects of the Transcendental Meditation technique upon a complex perceptual-motor task. In David WJ, John TF, eds. Scientific research on the Transcendental Meditation program, West Germany, Maharishi European Research University press 1997; 322-325.
5. Gardner RA, Broman M. The purdue pegboard: Normative data on 1334 school children. Journal of Clinical Neuropsychology 1997; 1:156-162.
6. Thomas JR, French KE. Gender differences across in motor performance: A meta- analysis. Psychological Bulletin 1985; 10:260-282.
7. Kilshaw D, Annett M. Right and left hand skill: I. Effects of age, sex and hand preference showing superior skill in left handers. British Journal of Psychology 1983; 74: 253-268.
8. Annett M. The growth of manual preference and speed. British Journal of Psychology 1970; 61:545-558.
9. Halstead WC. Brain and intelligence. Chicago, IL, Univer. Of Chicago press 1947.
10. Reitan RM, Davison LA. Clinical NeuroPsychology; current status and application. New York: Hemisphere 1974.
11. Telles S, Hanumanthaiah B, Nagarathna R, Nagender H R. Improvement in static motor performance following yoga training of school children. Percept Mot Skills 1993; 76: 1264-1266.
12. Finlayson MAJ, Reitan RM. Effect of lateralized lesions on ipsilateral and contralateral motor function. Journal of Clinical NeuroPsychology 1980; 2: 237-243.
13. Haaland KY, Delaney HD. Motor deficits after right or left hemisphere damage due to stroke or tumor. NeuroPsychologia 1981; 19: 17-27.
14. Madan M, Thombre D P, Bharathi B, Nambinarayan TK, Thakur S, Krishnamurthy N, Chandrabose A. Effects of yoga training on reaction time, respiratory endurance and muscle strength. Indian J Physiol Pharmacol 1992; 36 (4) :229-233.
15. Yoga : asanas, pranayama, mudras. Vivekananda Kendra, Madras, 1977.
16. Mohinder P, Malic SL. Effect of smoking on anthropometric somatotype and grip strength. Indian J Med Res 1988; 87:494-499.
17. Me Quarrie D. Test d'Aptitude Mecanique de Me Quarrie. Paris: Centre de Psychologic Applique, 1960.
18. Council of Europe, Committee for the Development of sport. Handbook for the EUROFIT Test of Physical Fitness. Rome: Council of Europe 1983.

EFFECT OF YOGA ON PERCEPTION AND PERFORMANCE

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ABSTRACT

Performance in any activity is better when one is relaxed and in good physical and mental health. This review summarizes effects of yoga on different aspects of human performance. Different yoga practices have effects on (1) Higher brain functions - such as improved spatial memory after yoga. Yoga practice has also been shown to improve planning and deciding strategies, using a simple test (i.e., The Tower of London test). Maze learning also improves following yoga. Our recent results suggest that these effects are optimized by quite natural surroundings, (2) Motor functions such as hand steadiness, manual dexterity, tapping speed and grip strength and (3) Measures of sensory perception, for example critical flicker fusion frequency, degree of optical illusion and depth perception improve following yoga. Hence yoga practice facilitates varied aspects of performance.

Yoga is an ancient Indian tradition, which through diverse physical and mental practices the practitioner strives to achieve a state of all round personality development. The scientific evaluation of yoga has proved its beneficial effects, dispersed among diverse areas. Apart from using yoga as an effective therapeutic tool in various ailments, the other major area of its application, which is also relevant today, is the perception and performance. Perception and performance are the consequence of two factors viz. competence and attitude, and competence is a product of knowledge and skill. This review summarizes the influence of yoga on different aspects of perception and performance, viz. 1. Higher brain functions, 2. Motor functions and 3. Sensory perception.

1. HIGHER BRAIN FUNCTIONS

The practice of transcendental meditation (TM) was shown to improve the ability to focus attention, the organization of memory and short term recall, in college students (Berrettini, 1976). Since hemispheric memory functions are known to be lateralized, our earlier study on the effects of breathing through a particular nostril on the performance on verbal and spatial memory scores, showed significant improvement in spatial memory scores alone (Naveen, Nagarathna, Nagendra & Telles, 1997). 108 school children were randomly assigned to four groups and each group practiced a specific yoga breathing technique (right nostril, left nostril, alternate nostril and breath awareness). Following 10 days of yoga training, all four trained groups showed a comparable significant increase in spatial memory scores (84%), with no change in verbal scores. 120 children belonging to four groups, i.e., yoga residential camp, yoga nonresidential camp, a creativity residential camp and a control group, were assessed on verbal and spatial memory tasks. After 10 days on retest, the yoga residential group alone showed an increase in spatial memory scores (44%), while the remaining groups showed no significant improvement. These results suggest that the effect of yoga in increasing spatial memory scores be optimized by quiet, natural surroundings. Thus, it has been speculated that yoga practice facilitates the functioning of right brain featured by creative, intuitive aspects more than the left brain, which is logical and analytical in nature. Other important areas of higher brain functions in which yoga has shown its beneficial effects are human learning and planning. This review summarizes only one recent study in which effects of yoga training was studied on maze learning. Maze learning is a task, which gives information about the highest levels of mental functioning involving the process of choosing, trying and rejecting or

adopting alternative courses of conduct or thought. 31 adults when assessed on a maze learning task (the time taken to complete the maze and number of blind alleys taken (errors) determined the performance) showed significant reduction in time taken and error scores of trial one following 30 days of yoga training, while the non yoga group showed no change.

2. MOTOR FUNCTIONS

Motor functions are the most essential components of the human performance. This paper reviews research contributions related to the influence of yoga on gross and fine motor skills. Manual dexterity and the ability to perform fractionated movements depends on the opposable thumb (Napier, 1956). Dexterous or skilled actions depend on the speed of gross movements of hand and arms, manual rhythm and co-ordination of eye and finger control (Ghosh & Gorpade, 1991). In a recent report on yoga and dexterity, apart from the beneficial effects of yoga, various other factors influencing the improvement were discussed (Manjunath & Telles, 1999). A group who volunteered for yoga performed better on a dexterity task compared to those who were deputed from their work place. The ability to maintain ones hand extended, yet steady is essential for a wide range of tasks. In a report on hand steadiness (Telles, Hanumanthiah, Nagarathna and Nagendra, 1993), static motor performance was studied in 45 school children belonging to yoga and non yoga groups. Yoga group showed a significant reduction in errors on Day 10, while the control group showed no change. This improvement in static motor performance could be related to improved voluntary control, eye-hand coordination and improved concentration as a sequel of yoga. The influence of yoga on motor speed is well documented in another study. The frequency of successive, rapid alternating movements has been a standard measure to evaluate motor speed (Shimoyama, 1990). In a recent study, a similar (finger tapping) task was used to assess motor speed of both hands in 53 adults and 152 children after yoga and 38 adults of a non yoga group (Dash & Telles, 1999). There was a significant increase in tapping speed values recorded during the first 10 seconds compared to those at 20 and 30 seconds. No such improvement was seen in non-yoga group. These results suggest an increase in motor speed for repetitive finger movements following yoga training, but not in strength or endurance, as the increase was not sustained over 30 seconds. The beneficial effects of yoga is not limited to fine motor skills but also extended to gross motor performances. Raghuraj and colleagues (1997) have reported the effects of pranayama on handgrip strength. 130 right hand dominant school children were assessed for grip strength of both hands. Following 10 days of yoga there was a significant increase in handgrip strength, though no lateralized effect was seen in the groups who practiced different uninostril breathing techniques.

3. SENSORY PERCEPTION

Perception is a process of recognizing and interpreting environmental events. This is a constructive process that is influenced by proximity, similarity, closure, context, past experience and expectation. Attempts have been made by many authors to unravel the influence of yoga on sensory perception and various factors influencing them. Meditation has been reported to cause significant changes in perception, attention and cognition (Brown, 1977). There are several reports describing the effects of Transcendental meditation on sensory perception. One reported that the performance in auditory discrimination was superior post meditation (Piroit, 1976), and another study showed increased sensitivity to subtle aspects of Rorschach test for perception (Brown & Engler, 1980). A separate study on visual sensitivity and mindfulness meditation (Brown, Forte & Dysart, 1984), showed that the meditators could detect shorter single light flashes and required a shorter interval to differentiate between successive flashes correctly compared to non meditators.

This perceptual sensitivity was not restricted to subtle aspects of the stimuli, as detection of high frequency flickering stimulus or the Critical Flicker Fusion Frequency (CFF) was found to improve. The CFF is the frequency at which a flickering stimulus is perceived to be steady, with higher values suggesting greater perceptual accuracy. In the above mentioned study (Vani et al., 1995) 18 subjects belonging to two groups (yoga and control) were studied using CFF apparatus. It was inferred that the stress reducing effect of yoga could be related to the improvement in CFF as CFF is known to reduce during specific stressors. Further research in this area confirmed these results. Telles and others to steady the role of yoga in reducing the visual geometric illusions made an early attempt. Yoga training for 1 month showed a significant (86%) reduction in the degree of optical illusion perceived using muller lyer lines. This effect could be related to cognitive judgmental factors, more than the retinal and cortical factors. These results suggest that yoga when practiced as an individual technique or as an integrated set could help the aspirant to get the most desired benefits. Hence yoga training facilitates varied aspects of human perception and performance namely higher brain functions, motor functions and sensory perception.

REFERENCES

1. Berrettini, R. B. (1976). The effects of transcendental meditation on short-term recall performance. Master's Thesis, Department of Education, Pennsylvania.
2. Brown, D. P. (1977). A model for the levels of concentrative meditation. *International Journal of Clinical and Experimental Hypnosis*, 25: 236-273.
3. Brown, D. and Engler, J. (1980). The states of mindful meditation: a validation study. *Journal of Transpersonal Psychology*, 12: 143-192.
4. Brown, D., Forte, M. and Dysart, M. (1984). Visual sensitivity and mindful meditation. *Perceptual and Motor Skills*, 58: 775-784.
5. Coren, S. and Girgus, J. S. (1973). Visual spatial illusions: many explanations. *Science*, 179: 503-504.
6. Dash, M. and Telles, S. (1999). Yoga training and motor speed based on finger tapping task. *Indian Journal of Physiology and Pharmacology*, 43 (3): 458-462.
7. Ghosh, P. K. and Ghorpade, M. B. (1991). *Industrial and organizational psychology*. Bombay, Himalaya Publishing House.
8. Kember, P. (1985). The transcendental meditation technique and academic performance: a short report on a controlled longitudinal pilot study. *British Journal of Educational Psychology*, 55:164-166.
9. Manjunath, N. K. and Telles, S. (1999). Factors influencing changes in tweezer dexterity scores following yoga training. *Indian Journal of Physiology and Pharmacology*, 43 (2): 225-229.
10. Manjunath, N. K. and Telles, S. (1990). Planning ability and speed of execution improve following yoga training. *Indian Journal of Physiology and Pharmacology*, (In Press).
11. Manjunath, N. K. and Telles, S. (Unpublished data). Quiet natural surroundings optimize the effect of yoga in increasing spatial memory scores.
12. Manjunath, N. K. and Telles, S. (1999). Improvement in visual perceptual sensitivity in children following yoga training. *Journal of Indian Psychology*, (In Press).
13. Napier, J. R. (1956). The prehensile movements of the human hand. *Journal of Bone Joint and Surgery*, 38B: 902-913.
14. Naveen, K. V., Nagarathna, R., Nagendra, H. R. and Telles, S. (1997). Yoga breathing through a particular nostril increases spatial memory scores without lateralized effects. *Psychological reports*, 81: 555-561.
15. Prakash, M. and Malik, S. L. (1988). Effect of smoking on anthropometric somatotype and grip strength. *Indian Journal of Medical Research*, 87: 494-499.

16. Raghuraj, P., Nagarathna, R., Nagendra, H. R. and Telles, S. (1997). Pranayama increases grip strength without lateralized effects. *Indian Journal of Physiology and Pharmacology*, 41 (2): 129-133.
17. Shallice, T. (1982). Specific impairments of planning. *Philosophical Transactions of the Royal Society of London*, 298:199-209.
18. Shimoyama, I., Ninchoji, T. and Uemura, K. (1990). The finger tapping test: a quantitative analysis. *Archives of Neurology*, 47: 681-684.
19. Telles, S., Hanumanthiah, H., Nagarathna, R. and Nagendra, H. R. (1993). Improvement in static motor performance following yogic training of school children. *Perceptual and Motor Skills*, 76: 1264-1266.
20. Telles, S., Nagarathna, R., Vani, R. P. and Nagendra, H. R. (1997). A combination of focusing and defocusing through yoga reduces optical illusion more than focusing alone. *Indian Journal of Physiology and Pharmacology*, 41 (2): 179-182.
21. Telles, S., Vempati, R. P. and Reddy, S. K. (Unpublished data). Effect of yoga training on maze learning. Vani, R. P., Nagarathna, R., Nagendra, H. R. and Telles, S. (1997). Progressive increase in critical flicker fusion frequency following yoga training. *Indian Journal of Physiology and Pharmacology*, 41 (1): 71-74.

EFFECT OF YOGA ON MEMORY

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ABSTRACT

Earlier studies have shown improvement in spatial memory following yoga breathing through a particular nostril in school children. The present study tested spatial and verbal memory in adults following general yoga practices. The present study was carried out to assess whether general yoga practices would alter the performance of adults on spatial and verbal memory tests, compared to those of a control group who did not do yoga practice. The yoga group showed a significant improvement in both spatial (70%) and verbal (50%) Memory ($p < 0.001$; Students t- test). The results suggest that general yoga practice helps in improving spatial and verbal memory, in adults with better improvement in spatial memory. These results are similar to those seen in children, related to yoga breathing.

The influence of yoga on the development of memory needs to be established through systematic and extensive scientific research. The nasal cycle is an ultradian rhythm characterized by alternating patience of the left and right nostrils with a periodicity of 1 to 8 hours (Keuning, 1968). Some reports suggested a connection between the phase of the nasal cycle and the cerebral hemisphere, which is dominant, mediated through a neural reflex (Werntz, Bickford, Bloom, Shannahoff-khalsa, 1983). The practice of Transcendental Meditation (TM) was shown to improve academic performance in university students (Kember, 1985). Specifically, by practicing TM, college students were able to enhance their ability to focus attention, the spontaneous organization of memory, and short-term recall also were better (Berrettini, 1976). Remembering involves three factors, i.e. (a) encoding and storing information, (b) retaining it during a period of disuse, and (c) retrieving it when required. Techniques to improve memory are possibly most effective in improving the ability

to encode and store information (Hilgard, Atkinson, & Atkinson, 1975). An improvement prerequisite for this ability is being able to be attentive, and concentrate on the task at hand. There are specific yoga breathing practices (pranayama) which involve breathing selectively through a particular nostril. These techniques can be practiced effortlessly for prolonged periods and allow the effects of unilateral nostril breathing to be studied. The effects of three pranayama practices (which involve left nostril, right nostril, and alternate nostril breathing) on autonomic functions and metabolism have been reported to be similar to the effects of forced uninostril breathing (Shannahoff-khalsa, 1991; Telles, Nagarathna, & Nagendra 1994). Another study was carried out by practicing of right nostril breathing increased the performance of school children on spatial memory test, compare to those of a control group. (Naveen KV, Nagarathna, R, Nagendra, HR, & Telles, S 1997). The present study was carried out to assess whether practicing general yoga would alter the performance of normal adults on spatial and verbal memory tests, compared to those of a control group who did no specific practice.

METHODS

Subjects : 22 healthy volunteers participated in this study. They were between 18 to 43 years of age were attending a 30 day residential yoga-training course during their vacation. There was also a control group of 22 volunteers who were matched with the yoga group for age range. They were similarly assessed before and after 30 days , during which they carried on with their routine activities. Hence, performance of this group primarily is relevant to answering the question of whether an observed effect is merely a retest effect. 42 subject were judged right - hand dominant and 2 subjects were judged left - hand dominant, based on their self - reports as well as actual observation of the hand used by the subject to hold a pen while writing.

Design: The subjects were given the memory test on Day 1 and Day 28.

Assessment: The subjects were told that the memory tests were for their self-assessment to understanding the benefit they derived from the course. They were subsequently given a report, so they were not given further details about the study. The control group was also told that the tests were for their self -assessment and were also given a report. For both verbal and spatial tests a correct response was scored as 1\1 and an incorrect response as zero. A practice trial showed that many subjects got a maximum score (with no score for further change) when a free - recall test was used, so for the actual assessment a delayed re- call test was used, as this is known to be more difficult (Russel 1979). However, there was no special interference on recall.

On both tests 22 subjects were assessed at a time while seated approximately a meter apart to avoid distraction. The test materiel was projected on a screen, allowing 10 sec for each slide. After the 10 slides were shown, a mathematical problem (e.g. $7 \text{ minus } 4 \text{ plus } 5 \text{ minus } 3 \text{ plus } 4 \text{ plus } 7 \text{ minus } 10$) was projected in the screen. Immediately after this, the subjects were asked to recall and write down (or in the case of spatial memory, to write the number of the angles) within 60 sec the 10 test items which had been shown to them.

To test verbal memory standard nonsense syllables of three letters, e.g. XOL were selected from a prepared list (Baddely, 1993). Two different sets of nonsense syllables were presented on Day 1 and 28. The test for spatial memory consisted of 10 simple

line drawings Geometrical or other shapes which could be described verbally, e.g., a square or a circle, were not used. The drawings were very simple and easy to reproduce. As described for verbal memory, there were two separate, similar sets of 10 line drawings each for Day 1 and 28th.

Yoga training: Subjects received 30 days yoga training which consisted of asanas 90 min, pranayamas 60min, kriyas 30min, meditation 20min, devotional sessions 60min, guided relaxation 60min and lectures on the theory and philosophy of yoga 60 min everyday.

Data analysis: For both verbal and spatial memory tests a correct answer was scored as 1, whereas

a wrong answer was scored 0. For each of the two groups separate Students t-test were used to test for significance between the Day 1 and Day 28 memory test scores.

Results: The group means SD of memory test scores obtained by the two groups for both verbal and spatial tests at initial and final assessments are given in Table 1. The Students t -test showed a significance difference between the groups. The spatial and verbal memory test for yoga group showed $p < 0.001$. The percentage improvement for spatial memory was 70 %, the percentage improvement for verbal memory was 50 %. The control group did not show any significant improvement in spatial and verbal memory scores. Scores obtained by both groups in spatial and verbal memory tests are given in the table given below.

Discussion: The present study showed that 28 days of yoga practices caused a significant increase in spatial and verbal memory scores but not in the control group. Blakeslee(1980) stated that the right hemisphere is more involved with the recall of nonverbal,spatial information, while the left hemisphere is more involved with verbal memory. Several factors could have contributed to the increase in spatial memory & verbal memory of the yoga group. Subjects were enthusiastic about performing well on the tests, which they had been told were a way of assessing the benefits they had obtained during the course, but this may have been less applicable for the control group as they received no specific treatment. So the practice of general yoga helps in improving verbal and spatial memory, in adults with better improvement in spatial memory. These results are similar to those seen in children, related to yoga breathing.

S.No	Groups		Spatial Memory				Verbal Memory			
			Pre		Post		Pre		Post	
1.Yoga	Mean	SD	10	2.22	17	1.64	6	1.65	9	1.71
2. Control	Mean	SD	5.7	3.10	5	2.08	3	1.69	3.8	1.82

*P < 0.001, (70 %); *P < 0.001, (50%) paired 't' test. The values are group mean SD, Day 1 verses Day 28

REFERENCES

1. Keuning.J. On the nasal cycle. International Journal of Rhinology 1968;6: 99-136.
2. Werntz DA, Bickford RG, Bloom FE, and Shannahoff-khalsa DS. Alternating cerebral hemispheric activity and the lateralization of autonomic nervous function. Human Neurobiology 1983;2:39-43.
3. Kember P.The Transcendental Meditation technique and academic performance: a short report on a controlled longitudinal pilot study. British Journal of Psychology 1985; 55:164-166.
4. Berrettini RB . The effects of the Transcendental Meditation on short-term recall performance. Masters Thesis, Department of Education, Pennsylvania 1976.
5. Hilgard ER, Atkinson RC, and Atkinson RL. Introduction to Psychology.New Delhi; Oxford & IBH Publishing Co. 1975.
6. Shannahoff-khalsa DS, Lateralized rhythms of the control and autonomic nervous system. International Journal of Psychophysiology 1991; 11(3):222-251.
7. Telles S, Nagarathna R, and Nagendra HR. Breathing through a particular nostril can alter metabolism and activities. Indian Journal of Physiology and Pharmacology 1994;38:133-137.
8. Naveen KV , Nagarathna R, Nagendra HR , and Telles S.Yoga breathing through a particular nostril increases spatial memory scores without lateralized effects. Psychological Reports 1997;81:555-561.
9. Blakeslee TR. The right brain. London; Macmillan. 1980.
10. Nagendra HR, Telles S. Yoga and Memory 1996.