

2 – SCIENTIFIC ROOTS OF YOGA PRACTICE

As one can surmise from reading historical accounts of the origin and practice of yoga, it has often been lumped into the category of cult endeavors and popularly portrayed as having little or no scientific foundation in practice or effect. If one considers only the historical writings and their modern adaptations, it is easy to understand this criticism; however, when we fully examine the effects of physical yoga, the truth emerges. Physical yoga's inclusion into modern therapeutic medicine and its validation in scientific literature has ensured its place as a mainstream endeavor in improving health and combating disease. It has long been a given that Yoga promotes one's ability to relax (1) but it also improves quality of life in a number of ways (2). Regular participation in Yoga improves walking gait (3) and reduces both perceived pain (4) and inflammatory response (5). The positive health effects do not end there. Consistent practice improves blood pressure (6), reduces incidences of insomnia (7), improves joint function and decreases symptoms of osteoarthritis (8), improves diabetic status (9), and lowers cholesterol levels and other contributors to cardiovascular disease risk (10). If we are to truly be experts in the practice of yoga, not only do we have to understand how to do it and teach it, but we also have to understand the science behind its effects on fitness and health.

SCIENCE RISES FROM MYSTICISM

The early claims made about yoga practice range from the commonplace to the miraculous. In the Hatha Yoga Padipika, it is stated that yoga can neutralize poison, eliminate any disease, crush evil, and create immortality in its practitioners (11). Because Western researchers were interested in the nature of these claims and their philosophical or religious bases, most publications were in this area (along with

extended academic debate on the original authors and creators of yoga's philosophical documents). Late 19th and early 20th century academic output on the subject was rare and, in general, quite esoteric, with little concern for applying the principles of yoga as a system of exercise.

The writings of the early masters stimulated great interest in the examination of the theoretical and philosophical nature of yoga, a favorite and fertile topic for both comparative religious studies and social studies. As early as 1827 there were attempts to translate the conceptual basis of yoga into a form understandable by the western academic (12). Colebrooke's work, the first paper to directly evaluate the original Sanskrit texts, concluded that yoga was centered upon the mystic and fanatical rather than on coherent philosophical bases. Senart in 1900 (33) and Vallée Poussin in 1937 (14) published papers on the relationship and similar structure of the systems of meditation between Yoga and Buddhism.

Mircea Eliades was one of the most influential academics in this arena with numerous academic analyses of the history and philosophy of yoga published throughout his career:

- The Comparative History of Yoga Techniques, 1933
- Yoga: Essai sur les origines de la mystique indienne, 1936
- Techniques du Yoga, 1948
- Traité d'histoire des religions, 1949
- Le Chamanisme, 1951
- Patanjali et Yoga, 1962

For any exercise program to be considered valid and useful it must not only produce results, but also stand up to objective scientific scrutiny. The numerous influences on the academic development of physical education and physical culture during the mid-19th century contributed to an expansion of interest in physical health and fitness. Many

ideas seemed well founded; some were innocuous. Some, like yoga, were seen with superstition and there was a clearly stated need for a “larger amount of the science of physiology with which to direct and extend the application” (15). However, it was not until the mid-twentieth century that more “scientific” studies began.

PHYSIOLOGICAL & FITNESS EFFECTS

Some of the first scientific papers on yoga were not about how the system worked but on some rather interesting capabilities of yogis:

Case of acquired ability to suck liquid into the rectum and colon.
Kjellberg S.R., et al., Nord Med. 44(27):1102-3, 1950

Remarkable feat of endurance by a yogi priest.
Vakil, R.J., Lancet 2(6643):871, 1950

Research that actually examined the effect of yoga on aspects of fitness emerged about the time of Indra Devi’s publication of her best-selling book “Forever Young, Forever Healthy.” The impact of the media and culture on scientific interest cannot be discounted. Without the entrepreneurs bringing yoga into the public eye, the ivory tower would never have noticed and become interested.

Once the novelty of the strange abilities of yogi had diminished, more robust examinations of the effects of yoga on human fitness began. An obvious starting point was consideration of the effects of yoga training on range of motion – since extreme joint flexibility was a commonly displayed ability of most master yogi. It was immediately assumed that the physical practices (asana) in which practitioners engaged induced improved flexibility, an assumption that was formalized in the scientific and clinical literature as early as 1964 (16). As mentioned earlier, this relationship of yoga postures with improved flexibility led to the postures being sanitized of their yoga association,

stripped of their Sanskrit names and being included as stretching exercises for the general public, athletes, and clinical populations. The fact that this occurred half a century ago and the practice persists to date is heavily indicative of the perceived and actual benefits of yoga on range of motion. If it didn't work, most likely practitioners would have abandoned the practice long ago.

A frequently included aspect of Hatha yoga is the inclusion of respiratory training, in the form of controlled and restricted flow breathing (pranayama). There had been reports of yoga masters who could reduce respiratory rate by as much as 75% of normal. Such observations might suggest alterations in oxygen handling kinetics or metabolic processes, so this was of interest to exercise scientists seeking to understand the processes and limits of human physiology (17, 18, 19). Most changes seen in pulmonary function are small to moderate in magnitude and are generally explained by improved respiratory muscle control leading to improved vital capacity (20, 21).

Metabolic adaptation induced by yoga has been investigated (22) in order to determine if the system of exercise was sufficient to meet American College of Sports Medicine recommendations for exercise intensity. Yoga practice has been documented to be normally conducted at a level of effort below that required to meet such recommendations (23). While this observation is borne out by data demonstrating that cortisol (the catabolic hormone) actually diminishes in concentration (24) during a yoga workout – indicative that an adaptive stress may not be present – the changes in actual health-related fitness measures noted suggest an atypical mechanism of fitness improvement (25, 26, 27, 28, 29). Although the degree of effort involved and physiological outcome is variable depending on workout construction, the link of yoga practice to health status is robust. This link seems tied to a dose response, with higher participation frequencies producing larger results (30).

Part of the mixed bag of results for the metabolic cost of yoga and its small adaptive drive can be linked directly to the intended outcome of the yoga training employed. If the intent is to increase range of motion, induce relaxation or manage perceived pain (31), intensities must be, and are intentionally, low. To measure cardiovascular demand and outcomes with yoga routines intending to reduce stress or pain and to increase range of motion only is a flawed approach.

CARDIOVASCULAR EFFECTS

If the metabolic cost of yoga is purportedly too low to drive cardiovascular adaptation, how can it promote improved cardiovascular health as practitioners believe it does? Part of this question and explanation must be rooted not in mechanism but actual reports of improved cardiovascular function.

As with respiratory rate, early researchers acted upon anecdotes of master yoga practitioners often being reported to be able to reduce heart rate to such low levels that coma or death should have been a result (32). These observations and early works led to the concept that yoga practice could be used to reduce hypertension and such a relationship has been consistently explored for more than forty years (33, 34, 35, 36, 37).

If yoga can improve blood pressure status, might it follow that it can also affect the development of ischemic heart disease or coronary artery disease? This is a question that has been examined for decades with most studies demonstrating the small, but significant, effect of yoga in the reduction of signs indicative of cardiovascular disease risk. These beneficial effects include an improved blood lipid profile, reduced blood glucose, reduced body fat mass, and reduced oxidative stress (38, 39, 40, 41, 42, 43, 44).

If exercise intensity is too low to meet American College of Sports Medicine guidelines on exercise prescription, how does yoga generate its beneficial effects? It is quite

possible that the practice of yoga exercises selectively activates neuromuscular or cardiovascular genes that in turn produce the protective effects noted. A direct effect on gene expression by yoga practice has been reported (45). In a study investigating gene regulation in blood lymphocytes it was noted that two genes were up-regulated within two hours of a yoga session (46). This data suggests that the mechanical activity of yoga exercises may be satisfactory, apart from any cardiovascular demand, to produce a gene regulatory response. These effects are similar to those seen in the heart where a single stretch of the myocardium produces an up-regulation of protective Heat Shock Protein 70 (47). These are changes that lie outside the traditional skeletal muscle adaptive pathways relative to metabolism and suggest that yoga is beneficial as an exercise modality even if it does not strongly affect aerobic metabolism.

ORTHOPEDIC EFFECTS

As mentioned earlier, yoga has always been associated with having complete or greater than normal range of motion around the joints. This capability to increase range of motion was seen to have potential therapeutic value very early on. The first mention of yoga relative to orthopedic health was in a 1962 opinion piece on the potential value of yoga as a physiotherapeutic intervention (48). A similar piece was published in 1977 (49). Specifically, yoga has been examined and determined to produce mild to moderate improvements in osteoarthritis, carpal tunnel syndrome and low back pain (50, 51, 52, 53, 54, 55, 56). It has also been seen to improve gait and stability in geriatric populations, both important aspects of quality of life and daily function (57, 58).

While improvements in joint motion and improved stability are not often considered architectural changes, improving hyperkyphosis (dowagers hump) is an architectural change in vertebral column architecture. A small scale study of 75 year old women with diagnosed hyperkyphosis improved, as evidenced by an over 0.5cm increase in standing

height after a program of yoga training (59). Interestingly, other fitness measures, including body awareness and perceived health, also improved as a result of the training. It is apparent that the physical practice of yoga has positive orthopedic effects that include improved range of motion, a more stable and coordinated gait, and improvement in vertebral architecture.

NEUROCOGNITIVE EFFECTS

Early studies of the 1960's of yoga and brain function were not particularly complementary. Terms like "brain wash" and "mysticism" were used in the medical literature as the neural and cognitive effects were poorly understood and there was a general distrust remaining in regards to yoga masters and their ethics and results (60, 61). There were also attempts at establishing yoga as a para-psychological endeavor like hypnosis (62). However, a simultaneous exploration of the use of yoga as complimentary psychological and psychiatric therapy was emerging along with conjectures about the mechanism of proposed therapeutic outcomes (63).

As with cardiovascular and pulmonary investigations, early studies investigated neural functions in Indian yogis to determine if their neural function differed from normal populations (64). In fact, during the psychedelic sixties there was a boom in considering yoga as a psychiatric and psychoanalytic tool in the treatment of numerous psychiatric conditions (65, 66). Generally the relaxation effects of yoga were being espoused by physicians as a means to treat anxiety, stress, and insomnia, among others. In the hay days of the benzodiazepines (valium was released in 1963) there were 2.3 billion doses sold in 1978 and in the USA alone. Physicians were looking for a means of using fewer prescriptions to treat symptoms and yoga seemed to present a viable option. One author in 1972 implied that yoga mimicked the same outcomes as tranquilizers and in fact could be considered a tranquilizer (67). Thirty five years later it was noted that

physical yoga practice increased the levels of gamma-aminobutyric acid (GABA) in the brain (68). Any time GABA concentrations increase, a reduction in anxiety and/or a perceived state of relaxation occurs. Another researcher demonstrated that 12 weeks of yoga induced a reduction in cerebral blood flow, also indicative of reduced stress and anxiety (69). So it appears that early anecdotal reports and opinions were warranted in this aspect.

The most modern research continues to investigate the beneficial effects of physical yoga practice on a variety of neurocognitive outcomes. Interestingly, it appears that as few as seven weeks of yoga training can improve academic performance, an effect likely mediated by a reduction in perceived stress (70). Another modern result suggested by new research is improvement of comfort in conditions of social stress and comfort with body image after completing a program of yoga training (71).

Depression is now also a target for examination where yoga is concern as studies focus on a potentially therapeutic response from yoga practice (72). While the relaxation effects of yoga may not be as relevant for the population who suffers from depression, the subjects in this study experienced a decrease in depression, and unique to yoga therapy, had a discernible reduction in attention focused on presumed sources of distress that led or contributed to depression.

Yoga can make you healthier and more fit in a number of ways. Though it won't make you run a sub-3 hour marathon or bench press three wheels on each end of the bar, it will improve your range of motion (or flexibility) around virtually any moveable joint in the body. It will also improve muscular control and body stability. If you are a beginning exerciser it will make you stronger and improve endurance. For yoga instructors, these things are all important to communicate to trainees so they understand what they stand to gain from participation. These parameters are easy to measure and as such are

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excellent measures to use to show trainees their progress. This progress breeds more regular participation and adherence to exercise and health practices.

Harder to measure objectively, but also important in today's stress-filled world, are the relaxation and anti-depressive effects of yoga. While the data does support that there are defined effects, it is possible that the trainee may not fully appreciate and communicate the perceived benefit in neurocognitive function for up to five years. This means that the physical practice and the resulting physical function improvements must be the focus in the early years of yoga training, since seeing those measurable benefits will aid in retaining the trainee in regular practice until the neurocognitive results are later realized.

Finally, one must understand that there is no clinical or scientific evidence that yoga can cure disease. It cannot cure the common cold. It cannot cure cancer. In the most liberal of consideration, it may aid in treating, not curing, some orthopedic conditions. With fact based practitioners, the truth and tangible results will sell and keep clients returning. Mythology and empty promises will not.

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