3: LITERATURE REVIEW

HISTORY OF YOGASANAS

Yog or Yoga as spelt in English is very ancient philosophy and the time of origin of its practice and doctrine cannot be dated with accuracy. Description of yog is found in Rig Veda and ancient Hindu epic, Bagwat Gita. It is meant as balance and harmony of the mind and body also as skill in work. There are four basic forms of yoga: Karma yog: The yoga of action Bhakti yog: The yoga of devotion. Dynana yog: The yoga of knowledge. Raja yog: This is a system for control of the mind. The first three forms trace their origin in Bhagwat Gita. Components of Raja yog are Hatha yog, Mantra yog and Laya yog (Telang 1999). Hatha yog is thought to be the creation of the Lord Shiva and sage Patanjali is credited with propounding Hatha Yog (Wikepedia). There are further more forms of yoga as indicated in various Texts and practiced. There are eight basic elements of yog hence also called ashtangs. They are Yam, Niyam, Asana, (Yogasan), Pranayam, Pratyahar, Dharana, Dhyan and Samadhi. Hatha Yoga Pradipika mentions Adinaath and his disciples Matsyendranath, Gorakhanath. Many other yogis gained knowledge and became famous Hatha Yogis. The Yog Korunta, the legendary text is said to be the source of the Ashtang Vinyasa Yoga. It is rumored to have been composed in a dialect that originates prior to 3000 BC (Godfrey 2002). The Upanishads: span an era from 900 BC to the twentieth century. In fourteenth and fifteenth centuries specific yoga Upanishads were composed. They outline the techniques and effects of specific aspects of hatha yoga. The Hatha yoga Pradipika: composed in AD 1350 by Svatmarama describes the yoga postures. The Gherandha Samhita written in the seventeenth century outlines all limbs of yoga including postures.
The ground for its introduction to the western world was laid in 1893, with the visit of Swami Vivekanand to United State of America. He gained recognition when he represented Hinduism at the world Parliament of religions in Chicago. Soon after this, the world’s awareness of Indian philosophy began to grow through the work of groups such as the Theosophical Society arranged for the most of the ancient Indian philosophical texts available at that time to be translated, including the yoga sutras of Patanjali, which was interpreted by English novelist and Christopher Isherwood.

Over the next few decades, the west’s interest in Indian philosophy continued to grow. The teachings of J. Krishnamurty considerably widened the appeal and understanding of Vedic philosophy. With an increasing awareness of the philosophy grew an interest in the physical practice with which it was so closely linked ‘yoga’. In 1935, the eminent Swiss psychologist Carl g Jung described yoga as, ‘one of the greatest things the human mind has ever created’.

Another major stream of influence was Swami Sivananda of Rishikesh (1887-1963) and his many disciples, including Swami Vishnu-Devananda - founder of International Sivananda Yoga Vedanta Centers, Swami Satyananda - of the Bihar School of Yoga, and Swami Satchidananda - of Integral Yoga, among others. The popularization in the West of the medical aspect of Yoga is largely attributed to Dr.Swami Sivananda Saraswati's Bihar School of Yoga. Many modern schools of Hatha Yoga derive from the school of Sri Tirumalai Krishnamacharya, who taught from 1924 until his death in 1989. Among his students prominent in popularizing Yoga in the West were Sri K. Pattabhi Jois, famous for popularizing the vigorous Ashtang Vinyasa Yoga style, B.K.S. Iyengar who emphasizes alignment and the use of props, Indira Devi and Krishnamacharya’s son T.K.V. Desikachar who developed the Viniyoga
style. Desikachar founded the Krishnamacharya Yoga Mandiram in Chennai, with the aim of making available the heritage of yoga as taught by Krishnamacharya. There are various yoga institutes in Pune. Various projects are carried at the Kaivalyadham Yoga institute at Lonavala in Pune. Dr Nitin Unkule is a leading yoga teacher who has gained Doctorate in yoga in France. Iyengar institute is well-known in India and across the globe. Iyengar system is followed world-wide and certifies yoga teachers. There are many eminent disciples of B.K.S. Iyengar, who practice and teach yogasans. To name a few, Mrs. Jyoti Karandikar, Physiotherapist Dr Lalita Nadkarni, who is well known for using Yogasans therapeutically. All these institutes and teachers happen to be from same area where the research has been conducted. Dr M. G. Mokashi, a very senior Physiotherapist has explored effects of various yogasanas. Padmabhusan Dr K.H.Sancheti is a leading Orthopaedic Surgeon and also acknowledges the effects of yoga in preventive aspects and wishes to explore this traditional system with the modern view.

Yoga for health foundation is represented in 24 countries (Howard K, 1999). According to Time magazine, there are around fifteen million people practicing yoga in America today; there is probably an equivalent number practicing in Europe. (Robinson et al, 2002). Globalization over the past decade has opened new doors for many fields and research. The 2005 "Yoga in America" survey, conducted by Yoga Journal, shows that the number of practitioners in the US increased to 16.5 million with the 18-24 age groups, showing a 46% increase in one year. Yoga Journal Releases February 2008 ‘Yoga in America’ Market Study http://www.yogajournal.com/advertise/press_releases/10. Yogasans are popular in Europe and other continents. There are certified yoga teachers and institutes. In India, there are various yoga schools and number of
practitioners could not be identified. Certification is not yet necessary to teach yoga. Estimation of number of yoga practitioners in India not known

Yogasanas or Hatha Yoga: As the practice of asana evolved, it acquired a therapeutic function that in turn led to the construction of more and more sophisticated asanas. This led to the development of asana practice. The direct translation of hatha is force, although this is somewhat misleading. In his book ‘Light on Yoga’, contemporary Hatha yoga master BKS Iyengar describes hatha as force, but then he goes on to say, “...it is so called because it prescribes rigorous discipline, in order to find union with the supreme’. The word hatha also has its roots in the words ‘ha’ is an active or positive principle of existence and is symbolized by sun, heat, light and creativity. And ‘tha’ is an inactive or negative principle and is represented by moon, cold, darkness and receptivity. Hatha yoga implies the coming together of any set of polarities in order to find transcendence. Thousands of asanas are mentioned in literature and 36 are practiced everywhere according to Patel (2008).

The state of awareness or being state of asana, the third basic element:
In performing asana, the motivation is not so much to bring about a direct physical change, as to bring about a change in awareness. This is in turn, inevitably, brings about a change in the observed, the body. Practitioner should ensure that the stretches are not only balanced, but also that, in holding the posture which release patterns of postural imbalance (Coulter, 2002). Harmony or alignment only comes through awareness of each part of the body simultaneously. This requires a considerable effort of attention. The mind and body interaction has to increase. The stimulations from the skin, muscles, ligaments, are awakened throughout the body. This awakening of somatic (physical) intelligence unites mind and body.
When awareness is fully in action, then the action is complete, balanced and effortless (Telang, 1999).

Through the alignment of awareness, postures become asana, stretch becomes yoga...

Method of yogasanas practice:
Rules: The yoga posture (asana) is comfortable (sukha), Stability (sthira), in the body free from tension manifesting the infinite beyond duality. (Yoga sutras II 46, 47, 48, Desai,). The method of Yoga posture: The foundation: those parts of the body that are in contact with the floor are actively and evenly engaged against the floor. The Core: where the foundation of the posture gives a practitioner the possibility of establishing stability (sthira, yoga sutras II 46), the core of the body gives the possibility of establishing comfort (sukha, yoga sutras II, 46). The core of the body is the central axis that runs from perineum to the brain, encompassing the spine and including throat, tongue, palate, eyes and ears. This indicates the involvement at multiple organ level, hence must be effective than other forms of exercises. This unifies the whole body into a single energetic and structural dynamic. Establishing the Yoga postures is mentioned in number of steps which allow establishing foundation, core to whole body. Initial Control from distal to proximal as it is easy to control smaller motor units (Coulter, 2002)

The sequence: to begin with standing poses: Tadasan or Sagacity, followed by sitting postures, then lying postures and ending with relaxation or Shavasan (Iyengar, 2001). Slow methodical way is the key. Pain: indicator or signal of potential or tissue damage should be considered as it may result in further tightening of tissues. The edge: knowing when to stop must be learnt, no aggressive practice. By going to one’s edge challenges the habit of limitations. Increase limits; draw on more of the subject’s potential. New postures in memory stay with same
lesson. The asanas are chosen to complement each other with gradual progression. The muscles work mainly in groups rather than individually, so that an asana that stretches and exercises one muscle group is always followed by one that works on another complementary group. Yoga also gently teaches the art of forging a balance between work and relaxation. A yoga session is punctuated by regular pauses for rest as needed. Working towards both sides evenly develops the muscles and reduces asymmetry between right and left sides. Posture improves and gradually this can bring correction or prevention of postural imbalance.

According to Vanda (1991) developing sense of inner awareness makes yogasanas unique. There is an extraordinary dynamism in static yogasan postures due to this awareness. There are ceaseless stimulus along the spine in response to gravity and breath awareness. The practitioner starts breathing deeply during practice and other muscles start coordinating with muscles activated in breathing. There is a tuning effect of several muscles with inhalation and exhalation which becomes source of immense power. These concepts explained by several yoga teachers are still difficult to understand and analyze. The researcher believes that this cannot be explained or quantified. Hence has been beyond reach of quantitative analysis. Possibly less studies of clinical controlled trial are found. That are hypothetico-deductive in nature. Qualitative studies are found in abundance which are not considered as highest methods for research.

Correct alignment and concept of strengthening of core muscles is developed in Yogasanas. The core strength is increased through Mula-bandh, Uddiyana-bandh, Jalandhar-bandh and Ashwini mudra mentioned in many yoga texts. Physiotherapists have realized the importance of core muscle strengthening relatively very recent in past 12-15 years and now
forming basis of various movement therapies. It indicates that physiotherapy has its roots in yogasanas.

Co-ordination is excellent mental and physical training, stimulating the two-way communication channel to learn movements and recruitment patterns. Yogasan practice starts with simple small movements progressing to complicated combinations. Repetition of these movements brings up efficiency. Strengthening and endurance is built by challenging stability, working with long levers and increasing hold time. Each yoga posture or yogasan uses certain muscles to support, lift or stretch parts of body against the force of gravity and their own inherent resistance. A part of body mass becomes set of weights and acts like resistance and the hold time gradually progressed to maximum adding endurance to the strength.

While muscles are stretched in routine activities, they may not be stretched to the maximum. In yogasanas, muscles are given a maximum stretch, which can only be achieved by working gradually and slowly by multiple joints involved. This stretch is then held or sustained. They may be stretched during active eccentric contraction which increases elasticity. As the muscles are increasing their flexibility, they are also developing strength. Hence awareness first increases control then elasticity. Yogasanas increase flexibility is the first thought when asked about effects of yogasanas. In true sense flexibility develops later.

Use of eye sight as mentioned as Drushti is focus on certain points of limbs during attaining yogasan. Progression is then made by closing the eyes. Hence complete concentration is needed. Holding the postures and repetitions gain endurance. When postures are connected together without rest, development of cardiovascular fitness is rapid.
EFFECTS OF YOGASANAS

Research on yogasanas by medical professionals is relatively recent and ongoing; considering the history of yogasanas practice. Amongst these studies on musculoskeletal system are limited so far. Most of the studies have documented effects on vital signs blood pressure, heart-rate, and respiratory rate. Many yoga teachers explain indirect effects of yogasanas for emotional stability and relief of stress. According to Dr Coulter (2002) yogasanas can prevent the physical and mental suffering caused by stress, poor posture. If mind is not at ease there is increased muscle tension or tone, heart rate increases, blood pressure rises and this further prevents mind from rational thinking. Yogasanas can reduce stress through various mechanisms. Yoga provides efficiency in the functioning of central nervous system and peripheral autonomic nervous system (Joshi & Kotwal, 1999)

Khalsa S B (2004) has done a bibliometric analysis of published research studies. According to his findings there is substantial increase in research on the clinical application of yoga in past three decades. A majority of this research has been conducted by Indian investigators and now increasing contribution from U.S. and England regions. Yoga as a therapy is relatively novel and emerging clinical discipline within the broad category of mind-body medicine and increasing worldwide use of yoga as category of alternative medicine. Raub (2002) have done a literature review on Psycho physiologic effects of Hatha yoga on musculoskeletal and cardiopulmonary function. Details could not be traced on-line.

Preventive benefits of Yogasanas

Physiological, biochemical and various overall beneficial effects have been reported by a number of studies in normal subjects practicing yoga. Oxygen consumption reduced to the extent of 16 to 25 percent by regular
practice and reduction in metabolic rate as observed by Wallace. Reduction in heart rate by 5 beats per minute (from mean of 71 to 66) was reported. Also improved athletic performance with reduction of heart rate (Joshi & Kotwal 1999). Modulation of cardiovascular response to exercise was achieved by yoga training (Madanmohan et al 2004, Bera et al, 1993,). Effect of yogasanas on ability to voluntarily reduce heart rate was noted on 12 individuals compared to 12 control subjects (Telles et al 2004). The speed and accuracy in performing complex perpetual motor test improved in 10 subjects study done by Blasdell, reported by Joshi & Kotwal (1999).

Yoga practice is associated with attenuated weight gain in healthy, middle-aged men and women; was an extremely useful finding on a very large scale study by Kristal et al (2005). Participants included were 15,550 adults, aged 53 to 57 years, recruited to the Vitamin and Lifestyle (VITAL) cohort study between 2000 and 2002. Regular yoga practice was associated with attenuated weight gain, most strongly among individuals who were overweight. Although causal inference from this observational study is not possible, results are consistent with the hypothesis that regular yoga practice can benefit individuals who wish to maintain or lose weight.

A randomized comparative trial was undertaken comparing yoga with relaxation (Smith et al 2007) on 131 subjects. Changes in the State Trait Personality Inventory sub-scale anxiety, General Health Questionnaire and the Short Form-36. Yoga appeared to be comparable to relaxation therapy. Chaudhary et al (1988) and Bera et al (1998) also demonstrate positive effects of Shavasan. In another study, there was a 27% increase in GABA levels in the yoga practitioner group after the yoga session (0.20 mmol/kg) on 8 yoga practitioners. These findings demonstrate that in
experienced yoga practitioners, brain GABA levels increase after a session of yoga. This suggests that the practice of yoga should be explored as a treatment for disorders with low GABA levels such as depression and anxiety disorders (Steeter et al 2007).

There have been studies on effect of yoga techniques and yoga based lifestyle modifications on total serum cholesterol, Serum LDL cholesterol, regression of disease of coronary arteries (Yogendra et al, 2004). There have been studies to prove that yogasanas are beneficial for patients suffering from multiple sclerosis. There was improvement in energy and fatigue (Oken et al, 2004).

There are many studies available now that confirm success from patients doing Yoga, a minimum of twice weekly, while undergoing treatments for their breast cancer. Effects on other areas include experiment on breast cancer patients around the time of their radiation treatment. The study found increased physical function, slightly better levels of social functioning, and lower levels of sleep dysfunction and fatigue giving indications that yogasanas practice had positive effect on quality of life in this adverse and life threatening condition (Anderson, 2006).

DiBenedetto et al (2005) evaluated 19 elderly participants (age 62 to 83) for effects of yogasanas on gait parameters. Findings of this exploratory study suggest that yoga practice may improve hip extension, increase stride length, and decrease anterior pelvic tilt in healthy elders, and that yoga programs tailored to elderly adults may offer a cost-effective means of preventing or reducing age-related changes in these indices of gait function. Peak hip extension and stride length significantly increased 8 week yogasanas programme thrice a week.
There are studies on effects of yogasanas on osteoarthritis of hand (Garfinkel et al, 1994) and carpal tunnel syndrome by Garfinkel et al (1998) reveal that yogasanas are beneficial in management and improve pain and function. Findings by Boyle et al (2004) on effects of yoga training and a single bout of yoga reveal that yoga can lessen the symptoms of delayed onset muscle soreness.

A randomized control trial was conducted in subjects with non-specific chronic low back pain comparing Iyengar yoga therapy to an educational control group (Williams et al 2005). Both programs were 16 weeks long. Subjects had low back pain for 11.2+/-1.54 years and 48% used pain medication. Overall, subjects presented with less pain and lower functional disability than subjects in other published intervention studies for chronic low back pain. Of the 60 subjects enrolled, 42 (70%) completed the study. Multivariate analyses of outcomes in the categories of medical, functional, psychological and behavioral factors indicated that significant differences between groups existed in functional and medical outcomes but not for the psychological or behavioral outcomes. Univariate analyses of medical and functional outcomes revealed significant reductions in pain intensity (64%), functional disability (77%) and pain medication usage (88%) in the yoga group at the post and 3-month follow-up assessments. These preliminary data indicate that the majority of self-referred persons with mild chronic low back pain will comply to and report improvement on medical and functional pain-related outcomes from Iyengar yoga therapy.

The effect of Iyengar yoga and strengthening exercises for people living with osteoarthritis of the knee was done as a case series by Bukowski et al (2006). This study on 15 subjects found functional changes and improvement in quality of life in traditional exercise and a yoga based approach that should encourage further comprehensive and carefully designed studies of yoga in osteoarthritis. Evaluation was done by using WOMAC scale and Global assessment questionnaire on six weeks practice.

Kolasinski et al (2005) did a pilot study on 7 subjects (out of 11 who enrolled initially) to check effects of Iyengar yoga for treating symptoms of osteoarthritis of the knees. Statistically significant reductions in WOMAC Pain, WOMAC Physical Function, and Arthritis impact measurement scale 2 (AIMS 2). Affect were observed when participants' status were compared to their pre-course status. WOMAC Stiffness, AIMS2 Symptoms, Social and Role, Physician GA, and Patient GA measured trends in improvement of symptoms. No adverse events from treatment were reported. This pilot study suggests that yoga may provide a feasible treatment option for previously yoga-naive, obese patients >50 years of age and offers potential reductions in pain and disability caused by knee OA. (This study was found in 2005, two years after the present study was started in 2003)

All above studies report no adverse effects on the knee complex or any other area.

ADVERSE EFFECTS
Guidance from properly trained teacher is necessary (Iyengar 2001). If body awareness not present initially, yoga injuries can be as common as sports ones (Isaacson, 2003). Howard, (1999) mentions that articles in physiotherapy journals suggesting that certain yoga postures damage the body by overstretching the muscles or straining joints and incorrect practice leads to injuries. But very few and specific cases are found in the
literature. Walker et al (2005) have come across rarely occurring bilaterally Sciatic nerve compression. The authors present a woman with profound lower extremity weakness and sensory abnormality after falling asleep in the head-to-knees yoga position (also called Paschimottanasan) having bilateral sciatic nerve involvement. Clinical and electro diagnostic findings are discussed. Whether the patient was on any medications or was too tired at the time of yoga practice was unclear.

Another case is reported as a 40-year-old man developed swelling of the face and neck associated with respiratory distress of sudden onset. These symptoms followed a yoga exercise called "pranayam", which had involved a vigorous Valsalva maneuver (Kashyap et al 2007).

Be particular with knees and neck is the advice by Godfrey: Especially vulnerable, while being crucial to functioning. Never permit your practice to maintain pain in knees or neck. In the knee there should never be even a flicker of sensation around the sides and front of the knee cap. Problems can develop in the connective tissue of the knee so incrementally that the damage is done before you recognize any problem. Tightness in the back of the knee, however, is usually not a problem (Godfrey, 2001). An article is traced ‘The four most common yoga injuries and how to avoid them.’ Heaner-M-K (2003).

According to physiotherapist and yoga teacher, Patel (2008), there should be no adverse effects and pain relief is possible by practice of yogasanas by various mechanisms, relaxation of muscles or release of muscular tension; regulation of breath to increase pain tolerance; increased lubrication of joints reducing painful stiffness; improving pliability of soft tissues around joints and strengthening of antigravity mechanism for erect posture. According to her applications of yoga are in four areas or ways:
Personality development, stress management, complete health, disease prevention and cure. She has presented an integrated approach which she refers as Physio-Yoga.

Olive Smith (1934) and Lindsley (1935) emphasized that at rest ‘subjects can relax a muscle so completely that no active units are found on EMG.’ Relaxation sometimes requires conscious effort and in some cases special training. Lindsley found that relaxation was not difficult in any of his subjects. The findings have been confirmed by thousands of investigators using modern electrical apparatus including fine fire electrodes (Basmajian 1998). Relaxation training has been shown effective to reduce symptoms of stress, anxiety. Total body relaxation also has proved to be very useful in the rehabilitation clinics along with targeted relaxation of specific muscles in spasm. Relaxation therapy enhances subsequent training of improved motor performance in various conditions. Patients with chronic pain conditions are found to be chronically depressed with strong feelings of helplessness, anger and resistance to most proposed treatment. Relaxation therapy has statistically and clinically useful therapy in management of low back pain, tension headaches.


The literature reviewed that yogasanas have a positive effect on the musculoskeletal system. Since there were only a handful pilot studies (traced after the start of the present study) demanded of further exploration from physiotherapy aspect.
3.1 The Knee joint complex

The knee complex consists of tibiofemoral and patello-femoral joints. The tibiofemoral joint is the largest joint in the body. It is a complex joint both anatomically and biomechanically. It is designed for mobility as well as stability; it functionally lengthens and shortens the lower extremity to raise and lower the body or to move the foot in space. Along with the hip and ankle, it supports the body when standing, and it is a primary functional unit in walking, climbing, sitting and squatting activities. It is a modified hinge joint having basic two degrees of freedom (third negligible). The synovium is extensive and many of the bursae and pouches around the knee joint. The articular surfaces of the tibia and femur are not congruent and two bones move different amounts. The patello-femoral joint is a modified plane joint. The patella improves the efficiency of extension during last 30° (degrees) of extension. The superior tibio-fibular joint is a plane synovial joint between the tibia and the head of the fibula. In 10% of the population, the capsule of this joint
is continuous with that of the tibio-fibular joint (Magee, 2008). Movement occurs in this joint with any activity involving the ankle. Hypo mobility at this joint can lead to pain in the knee area on activity, because the fibula can bear up to one sixth of the body weight. Because of its anatomical arrangement, the knee is a complicated area to assess. In addition, Lumbar spine, hip and ankle may refer pain to the knee. Weakness or mobility restriction of hip or ankle joint has a direct impact on the stability and function of knee-complex (Levangie & Norkin 2001).

Normal gait on level ground requires 60° to 70° knee flexion range, ascending stairs- 80°, sitting in chair 90° and more. Normal ranges: 0 or up to 5 hyperextension, Knee flexion 120 degrees with hip extended. 135 deg when hip is flexed. 160 deg with passive element: squatting position or sitting on heels. During flexion of unweighted knee, two sets of particular muscles hamstrings (hip & Knee) and gastrocnemius (knee & ankle) act. Range of movement (R.O.M) is limited by contractile insufficiency, tension of quadriceps, anterior part of capsule, tension of both cruciate ligaments in extreme passive flexion & contact of posterior portion of leg with posterior portion of thigh and buttocks. Extension or return from flexion is done by quadriceps, is limited by contractile insufficiency, tension in hamstrings and gastrocnemius, tension of cruciate ligaments, tibial and fibular collateral ligaments, posterior aspect of capsule & oblique posterior ligament (Rasch & Burke, 1978).

Flexion extension movement is primarily in sagittal plane but includes frontal plane components hence termed coupled motions. Flexion is coupled with varus and extension with valgus. Femoral longitudinal axis is oblique and of tibia vertical. The longitudinal axes form an angle medially at knee of 180° to 185°. The medial condyle is more distally than lateral due to articulation hence the knee joint axis is not horizontal. There is
automatic rotation known as locking during extension from flexion also known as screw home mechanism. Medial and lateral rotation is nil in full extension and maximum up to $35^\circ$ at $90^\circ$ of knee flexion, Lateral rotation $20^\circ$ and medial $15^\circ$. Varus and valgus movements are limited and they are more accessory movements. In frontal plane $80^\circ$ with full extension, $13^\circ$ to $20^\circ$ with knee flexion. The anatomical structure and complex movements need an objective evaluation.

Muscles: Semitendinosus & semimembranosus are knee flexors and internal rotators. Sartorious and gracilis assist the same. Biceps femoris is flexor and external rotator. Gastrocnemius and plantaris assist flexion, (assist extension when foot is fixed); popliteus is prime mover for internal rotation of tibia or when tibia is fixed in weight bearing, outward rotation of femur on tibia. Quadriceps: Rectus femoris, vastus lateralis, vastus intermedius & vastus medialis. Ilio-tibial band or IT tract connects ilium with lateral tubercle of tibia, the patella, linea aspera & lateral condyle of femur. Tensor fascia lata inserts into IT band, inserts into tibia and blends with fibrous expansions from vastus lateralis & biceps femoris. Tension of the tract reinforces the lateral retention apparatus of knee and maintenance of erect posture.

Effects of yogasanas on the knee joints were not found in the literature search checked physically in many books, journals and data bases: Allied and complementary medicine AMED, Medline, EMBASE & CINAHL. Importance of exploring effects of yogasanas on the knee complex lied in the structural and functional aspects of knee in static and dynamic postures.
3.2 SELECTION OF THE OUTCOME MEASURES FROM LITERATURE

There are many scales for measuring knee complex. The Lysholm knee scoring scale (Tegner & Lysholm, 1985) have focused only on the short-term consequences and instruments such as the WOMAC Osteoarthritis Index (Roos et al, 1998) only on the long-term consequences. The Knee injury and Osteoarthritis Outcome Score (KOOS) was developed as an extension of the WOMAC Osteoarthritis Index with the purpose of evaluating short-term and long-term symptoms and function in subjects with knee injury and osteoarthritis. The KOOS was published in 1998 and is available at: http://www.koos.nu

The KOOS holds 42 items in five separately scored subscales: Pain, other Symptoms, Function in daily living (ADL), Function in Sport and Recreation (Sport/Rec), and knee-related Quality of Life (QOL). The KOOS has been validated, has high test-retest reproducibility (ICC >0.75) and used to evaluate physiotherapy. The effect size is generally largest for the subscale QOL followed by the subscale Pain. The KOOS is a valid, reliable and responsive self-administered instrument that can be used for short-term and long-term follow-up of several types of knee injury including osteoarthritis, to assess changes from week to week induced by treatment (medication, operation, physiotherapy) or over years due to the primary injury or post traumatic OA.

The proponents state that the measure is relatively new and further use of the instrument will add knowledge and suggest areas that need to be further explored and improved. The KOOS is a knee-specific instrument, developed to assess the patients' opinion about their knee and associated problems. The score is a percentage score from 0 to 100, 0 representing extreme problems and 100 representing no problems. This direction, 100 indicating no problems, is common in Orthopaedic instruments and