CHAPTER 6

Discussion
DISCUSSION

Menopause is an important event in the life of a woman and can be associated with several physical and psychological changes. Since life expectancy of women has increased to 80 years, most women are now expected to live more than one-third of their lives after menopause. Hence the demographic, socioeconomic and ethical implication of this large elderly population is of utmost importance. Further, appropriate health care for this age group becomes very critical and essential.\textsuperscript{243} Effective health care management of menopause involves two important issues, first control of symptoms associated with menopause and the second, prevention and management of conditions that become more prevalent after menopause like osteoporosis, metabolic syndrome, cardiovascular diseases, neuro-degenerative diseases and cancer. Both these issues need to be addressed and strategies need to be developed that will help these women to maintain a healthy and productive quality of life. In the present study we explored the role of yoga therapy in the management of these two important areas of menopause.

For the purpose of this study, we recruited 216 women aged between 40-60 years with perimenopausal symptoms. We used the term perimenopause to include women aged between 40-60 years having menopausal symptoms associated with presence of regular or irregular menstrual cycles or absence of menstrual cycles. These women were divided into test group who received yoga therapy (n=111) and the control group (n=105) who received a set of physical exercises for a duration of 3 months.
Age at Menopause:

Of the total 216 subjects studied 99 women (yoga 51; control 48) had complete cessation of menstruation and had reached menopause at the mean age of 51.82± 3.98 years which is comparable with other world population data which has been reported to be 51.4 years.\textsuperscript{[357]} Age of menopause, which is genetically a programmed event, is subject to some variability. There appears to be ethnic, cultural and geographic differences in the onset of menopause. In the United States, African American and Hispanic women have been found to have menopause approximately two years earlier than white women.\textsuperscript{[358]} Malay women have menopause at approximately age 45 years, Thai women at the age 49.5 years, and Filipino woman between ages 47 and 48 years\textsuperscript{[359, 360, 361]} compared to them in our study women showed 51.8 years which is similar to women from other parts of India. Several other factors like general health status,\textsuperscript{[362]} socioeconomic status,\textsuperscript{[363]} parity,\textsuperscript{[364]} smoking,\textsuperscript{[365]} body mass,\textsuperscript{[366]} malnourishment and vegetarianism\textsuperscript{[367]} may be responsible for this variation. As per our knowledge, ours is the first study to record some of these variables in perimenopausal women from costal part of Karnataka state.

The prevalence of perimenopausal symptoms:

In this study we recorded data in detail of perimenopausal women aged between 40-60 years residing in Udupi district of Karnataka state, India. There are no significant studies from this region of the subcontinent regarding quality of life of perimenopausal women. The base line data for all the variables showed no significant differences between the yoga and exercise group, thus both groups were homogenous. The general health questionnaire showed no significant psychological distress in both groups, thus making them suitable to go through the interventional protocol.
The MENQOL questionnaire used in this study divides all symptoms into four domains. Past research has revealed significant difference in the reporting of symptoms in these four domains among women of different geographic and ethnic backgrounds. It is also known that these symptoms can start very early in the reproductive life of a woman even if they are menstruating regularly and can last for many years even after reaching menopause.\textsuperscript{368, 369}

The women from present study reported higher physical and psychological symptoms with a high frequency of physical symptoms such as feeling tired, decrease in physical strength and stamina, poor memory, muscles and joint pains, low back ache and flatulence. Although the overall symptom profile is consistent with other Indian women from Jammu,\textsuperscript{106} Mumbai,\textsuperscript{107} Chandigarh\textsuperscript{370} and Amritsar,\textsuperscript{371} the actual percentage, the intensity and frequency of individual symptom varied in these Indian women subpopulations. Similarly, some symptoms in women from other countries were comparable with present study for physical and psychosocial symptoms, while others differed in vasomotor and sexual symptoms (Table 52).\textsuperscript{108-111, 372} Recently a Pan-Asia Menopause study found that physical symptom of body or joint aches/pain was the predominant symptom as reported by 86.3\% women.\textsuperscript{372}
Table 52: Predominant perimenopausal symptom profiles in various studies conducted in India and Outside India

<table>
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<tr>
<th>Symptoms</th>
<th>INDIA A</th>
<th>INDIA B</th>
<th>INDIA C</th>
<th>INDIA D</th>
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1. **Vasomotor**
   - Hot flushes: 32, 54, 19, 55, 45, 67, 66, 36, 65
   - Night sweats: 25, 54, 55, 53, 47, 36, 56

2. **Psychosocial**
   - Poor memory: 74, 34, 77, 48, 44
   - Anxious/Nervous: 40, 29, 21, 11, 40, 71, 54, 34
   - Depressed: 35, 30, 8, 51, 63, 55, 37, 49

3. **Physical**
   - Feeling tired: 68, 73, 36, 42, 79, 67, 63, 93
   - Decreased strength/Stamina: 64, -
   - Aching Muscles & Joints: 55, 48, 37, 38, 71, 84, 82, 76
   - Flatulence: 51, -
   - Aches in Neck/head: 55, 56, 14, 38, 50, 73, 88
   - Difficulty sleeping: 44, 37, 21, 53, 45, 64, 59, 54, 45

4. **Sexual**
   - Changes in sexual desire: 27, -
   - Vaginal dryness: 23, -

A=present study; B= Jammu[106]; C= Mumbai[107]; D= Amritsar [371]; E= Kelantan, Malaysia[108]; F= Ipoh, Malaysia[109]; G= Pakistan [110]; H=Bangladesh [111]; I = North Carolina (USA).[372]
Physical symptoms are multifactorial in nature and are influenced by endocrine changes, demographic characteristics, psychosocial factors, environmental conditions, ethnic differences and difference by country.\(^{[373]}\) They could be also the result of health problems associated with aging and midlife crisis experienced by women in the age group of 40-60 years. Feeling tired, decreased physical strength and stamina are most commonly reported physical symptoms in Indian women. This symptom may be influenced by their belief that blood is equated with body strength. It is believed that the body has a fixed amount of blood and that no or reduced menses indicates deficiency of blood, which in turn may cause illness and fatigue.\(^{[370]}\) The findings would also be explained by social and cultural attitudes towards health. Asian women appears to be highly concerned about the physical strength, energy and other somatic symptoms, but not much about other domains of health.\(^{[374, 375]}\)

The presence of psychosocial symptoms in subject of this study was found to be predominant. In a study in Malaysian women, psychological symptoms such as anxiety (71.4%), irritability (65.7%), sleep problems (64.3%) and mood swings (62.8%) were found to be common.\(^{[109]}\) While similar studies conducted in Thailand\(^{[376, 377]}\) and other parts of Asia\(^{[378]}\) also have reported frequent presence of psychological symptoms, the specific features of these symptoms seems to vary according to the methodology adopted by individual studies. It is likely that other factors are influencing the development of these psychological symptoms, such as normal aging process, or possibly mid-life crisis and many other non-menopausal factors experienced by women of 40-60 years of age. It is also not clear whether hormonal shifts occurring during perimenopause are cause of psychological symptoms. Although some observational studies have found HRT to be efficacious in alleviating both mood and somatic symptoms during perimenopause,\(^{[379, 380]}\) randomized
placebo-controlled trials have not been able to find that, use of an estrogen/progesterone combination significantly improves mood.\textsuperscript{[381, 382]} Women who smoke may have increased psychological symptoms\textsuperscript{[383]} and also lack of adequate income and financial difficulties may be associated with depressive symptoms.\textsuperscript{[384]} Moreover, understanding and belief about menopause may also be due to the differences in health education between countries. Nevertheless, as cross-cultural and anthropological studies have suggested, it seems that Asian women are more likely to have a more positive view of menopause compared to their western counterparts.\textsuperscript{[385]} The National comorbidity study found rates of recurrent depression to be highest among women between the ages of 45 and 54 years when compared to with those of older women.\textsuperscript{[386]} However, increased depressive symptoms seem not to be associated with menopause.\textsuperscript{[387,388]} Bosworth et al\textsuperscript{[389]} in their study of 581 American women observed that climacteric symptoms but not menopausal status as such were associated with higher rates of depressive symptoms. Hence further qualitative studies are definitely warranted to determine, what is the true nature of psychological problems in menopausal women?

In the present study, 36.6\% reported hot flushes which were lower as compared to women from Jammu (54\%)\textsuperscript{[106]} and Amritsar (50\%)\textsuperscript{[370]} but higher than women from Mumbai (19\%).\textsuperscript{[107]} This kind of national variations were also observed in Malaysian studies. While one study\textsuperscript{[108]} reported 45\% of hot flushes which was lower compared to other Malaysian study,\textsuperscript{[109]} where the subjects were mostly disturbed by joint and muscular discomfort (84\%) followed by anxiety (71\%) and hot flushes (67\%). Similar variations in symptoms were also observed in menopausal women from Pakistan\textsuperscript{[110]} and Bangladesh.\textsuperscript{[111]} Neslihan from Turkey also reported higher rates of musculoskeletal symptom compared
with vasomotor symptoms\textsuperscript{[112]} Compared to these figures, in western countries the proportion of women who report hot flushes may be as great as 80\%\textsuperscript{[390]} and vasomotor symptoms are viewed as typical predominant symptom in Caucasians\textsuperscript{[391]} compared to Asian women. However, Indian women migrated and living in Birmingham reported high incidence of hot flushes and their menopausal experience was similar to that of their Caucasian counterparts.\textsuperscript{[391]} This evidence shows that experience of menopause and attribution of symptoms during the menopausal transition varies in women of same ethnic origin depending on their country of residence. The effects of environmental and socio-cultural factors such as diet, exercise and other life style modifications on determination of type of symptom reported and the severity of the symptoms cannot be denied. Obermayer \textsuperscript{[392]} suggested that dietary factors in Asian could contribute to lower frequency of hot flushes, as phyto-estrogens have a role in reducing vasomotor symptoms. However, this does not seem to explain the difference of hot flush incidence observed in our study compared to studies from other parts of India. Fu et al,\textsuperscript{[393]} compared the estrogen levels and found higher levels in Taiwanese women than in Australians and suggested that there might be a relationship between cultural lifestyle factors and the estrogen level. In the same way, cultural and lifestyle factors in Indians may play a role in estrogen levels and the menopausal experience. Host of other factors like narrowing of the hypothalamic thermoregulatory zone,\textsuperscript{[394]} changes in hypothalamic neurotransmitter activities\textsuperscript{[395]} including noradrenergic and opioid neurons,\textsuperscript{[396,397]} imbalance in neurotransmitter like norepinephrine and serotonin,\textsuperscript{[398, 399]} levels of β-endorphins\textsuperscript{[400]} have been implicated in the development of vasomotor symptoms and role of these factors will be discussed in the later part of this section.
The symptoms related to sexual domain were least reported by our study subjects. 29.6% reported change in sexual desire and only 25.5% reported vaginal dryness. Compared to Caucasian females, reported prevalence of sexual complaints in our subjects is much lower,\textsuperscript{[372,401]} which can be again due to several reasons. Indian women are known to be hesitant about sexual issues and hence may not report the sexual complaints. It also may be due to the attitude towards sexual life after menopause with high acceptance of menopausal changes. In a Nigerian study\textsuperscript{[402]} conducted in 563 women of Yoruba descent on the attitudinal analysis to menopause showed that up to 94% of the respondents still felt adequate as women. This degree of attitudinal adjustment to menopause in Eastern women appears to be better than that reported by Wilbush \textsuperscript{[403]} for western women. Cultural experience has been postulated to have a modulating effect on the way women adopt to menopause \textsuperscript{[404]} and it is possible that the adult orientation of African and Asian societies would be of benefit to menopausal women in this population.

The present study thus clearly documents the significant presence of various perimenopausal symptoms in the local population severely affecting the quality of life. Many of these women expressed their deep distress and helplessness regarding these symptoms which were seriously interfering in their day to day living. Several women were not even aware that these symptoms were the natural consequences of their reproductive lives. They were pursuing various therapies in the belief that they are suffering from some systemic diseases. Thus, it is important to search and develop a cost effective, simple, community based therapeutic tool to provide symptom relief, to improve health status and in this perspective yoga emerges as the appropriate system to deal effectively with issues
related to perimenopause. The present study clearly demonstrates the clinical utility of yoga in significantly reducing the perimenopausal symptoms in all the domains.

**The Perimenopausal symptoms:**

**Physical Domain:**

Physical domain of MENQOL questionnaire was the most affected domain in our study subjects who complained about all the sixteen symptoms included in this category. Three months of yoga intervention significantly improved ($p<0.001$) all the sixteen symptoms thus proving very effective in perimenopausal symptom management. Aching in muscles and joints, pains in the back of neck or head, low back ache were significantly reduced. Overall physical quality was improved with subjects reporting increased physical strength and increase in stamina. The physical exercise in the control group improved only six symptoms (muscles and joint pains, feeling tired, pain in the back of neck or head, decrease in physical strength, decrease in stamina, lack of energy) and the difference was less significant when compared to yoga group.

Asanas, one of the important components of yoga brings physical steadiness and comfort to the body \[^{20}\] resulting in firmness, health and lightness of all the limbs.\[^{21}\] The beneficial effects of asanas are primarily on musculo-skeletal system. The gentle and optimal contraction and stretching of muscles and joints caused by the performance of the asanas seems to result in the improvement of mobility and flexibility thereby reducing the physical symptoms related to muscles and joints. The better circulation and oxygenation occurring to muscles improves the metabolism thereby improving the strength and energy and also reducing fatigue and tiredness. Asanas also improve the postural instability, which
is a common problem encountered with advancing age\textsuperscript{[405]} and the postural balance is improved by asanas through striking a harmony between sensory and kinetic movements of musculoskeletal system.\textsuperscript{[406, 407]} Several studies have demonstrated that asanas improves dexterity, hand grip strength and coordination of musculo-skeletal system which may explain the improvement in physical symptoms. Pranayama also contributes to the increase in hand grip strength.\textsuperscript{[408]}

The improvement in physical strength and fitness caused by yoga seems to be related to several factors. Tran et al\textsuperscript{[409]} who studied the effects of hatha yoga on physical fitness evaluated several parameters like muscular strength and endurance, flexibility, cardio-respiratory fitness, body composition and pulmonary function. In this study, yoga practice showed increase in isokinetic muscular strength for elbow extension, elbow flexion and knee extension by 31\%, 19\% and 28\% (p<0.05) and knee flexion increased by 57\% (p<0.01). Ankle flexibility, shoulder elevation, trunk extension and trunk flexion were also increased by 13\%, (p<0.01), 155\% (p<0.001), 188\% (p<0.001) and 14\% (p<0.05). Improved hip extension, stride length and decreased anterior pelvic tilt have also been observed in elderly group.\textsuperscript{[410]} Collectively all these changes resulted in significant improvement in quality of life\textsuperscript{[411]} which was observed in our study also.

One of the most difficult symptom to manage, that is chronic or recurrent low back pain was also significantly improved after yoga intervention in our perimenopausal women which supports an earlier study conducted in normal adults.\textsuperscript{[412]} Joshi\textsuperscript{[413]} has conducted an explorative study to observe the efficiency of yogic treatment of insomnia and he observed
improvement in sleep after one month of yoga intervention. In our study also yoga therapy significantly improved the symptom of difficulty in sleeping in perimenopausal women.

Apart from providing effective physical movements, the actual physiological mechanisms by which yoga can improve physical symptoms are not clear. The intense stretching and muscle conditioning associated with attaining and holding yoga postures increases skeletal muscle oxidative capacity and decrease glycogen utilization, possibly caused by increased vascularization, increased intramuscular oxygen and glycogen stores, increased oxidative enzymes or by increased numbers of mitochondria.\[414\] In addition, passive muscles stretch in animal models for as little as 30 minutes per day has been associated with increased muscle growth and contractile strength.\[415, 416\] Pansare et al\[417\] found that yoga training significantly increased serum lactate dehydrogenase (LDH) levels after 6 weeks. LDH provides energy to exercising muscle and normally increases about two fold after long duration submaximal exercise, indicating that yoga can have an effect similar to endurance training. Endurance performances also results in maximum oxygen consumption (V\textsubscript{O\textsubscript{2}}\text{max}) which is achieved when an individual’s ability to deliver oxygen to exercising muscles reaches a plateau during step-wise progression to maximal exercise leading to lactate accumulation.\[414\] However, with continued practice the subjects were able to achieve significantly higher work rates with reduced V\textsubscript{O\textsubscript{2}} per unit work, and without increased blood lactate levels.\[418\]

Yoga practice also may increase the absorption of the calcium from the intestine, stimulate bone remodeling and maintain the load bearing capacity of the bones; reduces the pain in the back of the head, neck, lower back and headache by influencing limbic system
modulation of endogenous pain control system.\cite{419} This is supported, in fact, by two limited studies of yoga in osteoarthritis of the hand\cite{420} and carpal tunnel syndrome\cite{421} showing greater improvement in pain than in control group. In combination with breath control, which adds additional neuromuscular effects, Hatha yoga has provided benefit in other musculoskeletal related pain management, especially back pain\cite{422, 423} and in the management of multiple sclerosis.\cite{424}

**Psychosocial Domain:**

The psychosocial domain included symptoms related to cognitive function and memory, life affirmation, mood, anxiety, depression and loneliness, all of which were significantly improved after yoga therapy intervention. Ours is the first study to document the beneficial effects of yoga on perimenopausal related psychological symptoms. This is further supported by the earlier general evidences showing the impact of yoga including meditation on the functioning of nervous system leading to increase in alpha rhythm, intra-hemispheric coherence and homogeneity in the brain\cite{425, 426} and increase in P 300 phase amplitudes\cite{300} all these seem to enhance the cognitive processes. Pranayama practice used in our study may probably also influence cerebral function by increasing the power of alpha and beta band and decreasing the hemisphere asymmetry in the beta 1 band resulting in the balancing effect on the functional activity of the left and right brain hemispheres as reported by Stancek and Kuna.\cite{427} Poor memory, which was the most common psychosocial symptom experienced by our perimenopausal women (75.5%) significantly improved (p<0.001) by yoga which seems to be directly related to other cognitive functions like perception, thinking and reasoning. This improvement in important cognitive functions has been postulated due to the decrease in auditory and visual reaction time brought by yoga
practice.\textsuperscript{297} A decrease in reaction time indicates an improved sensory-motor performance and enhanced processing ability of central nervous system.\textsuperscript{297}

The other psychosocial symptom which improved more significantly with yoga than exercise was anxiety. Anxiety can be a very difficult symptom to manage, affecting severely the quality of life. With three months of yoga practice, our perimenopausal women experienced remarkable decrease in anxiety. Similar practice of yoga for 2 to 3 months has shown to produce significant decrease in the basal anxiety scores in different group of participants.\textsuperscript{305, 306} Sharma et al\textsuperscript{307} found that two months of sahaja yoga by patients of severe depression who were on anti-depressant medication led to higher rates of remission, statistically more reduction in Hamilton depression and anxiety scores as compared to those patients who were only on anti-depressant medication. Similarly, Michelson et al\textsuperscript{310} reported that 3 months Iyengar yoga program for women suffering from mental anxiety resulted in significant improvements in perceived stress, state and trait anxiety, subjective wellbeing, decrease in fatigue and depression. Physical wellbeing also increased and those subjects suffering from head ache or back pain reported marked pain relief. Similar improvement in physical symptoms of headache and back pain observed in our perimenopausal women also may be partly related to the reduction in anxiety levels.

The mechanisms for the decline in cognitive function in menopausal women and how yoga therapy improves the brain capacity is not clear. Estrogen receptors have been detected in the pyramidal cell nuclei of the ventral hippocampus and other specific brain areas that are involved in learning, memory and cognition. Cyclical changes in synaptic genesis and spine density of the hippocampus have been shown to be induced by estrogen,
which get depleted in this age, resulting in declining cognitive functions. However, estrogen replacement therapy does not improve the cognitive functions suggesting the role of non-estrogen factors. Electrophysiological studies on cognitive functions of the brain during yoga intervention have suggested increased attentional resources. Based on these findings Chatha et al have hypothesized that the improvement in cognitive functions after yoga are brought about by better information processing in the subtle layers of the frontal lobe. The same mechanism may be responsible for the improved cognitive functions observed in our subjects also. Meditation component of yoga seems to be most responsible for these changes since practice of meditation has been shown to improve higher and more complex mental functions.

Several other mechanisms like altered neurotransmitters, changed brain blood flow and brain metabolism and sympathetic activation seem to be responsible for psychosocial symptom improvement brought by yoga practice. Kjaer et al used positron emission tomography (PET) scan technique to demonstrate 65% increase in endogenous dopamine release in the ventral striatum during yoga meditation. Dopamine modulates excitatory glutamatergic synapses from the frontal cortex and thus regulates the conscious states at the synaptic level. Streeter et al have demonstrated increase in brain levels of ε-amino butyric acid (GABA) after a session of yoga. This may partly be responsible for psychological wellbeing since low GABA levels can cause depression and anxiety disorders.

PET studies have shown that yoga results in regional alteration in cerebral blood flow with mean blood flow remaining unaltered. Increased blood flow was found in dorso-lateral and orbital frontal cortex, anterior cingulate gyri, left temporal gyri, left
inferior parietal lobule, thalamic region, all of which support an executive attentional network. Recent studies have shown that yoga with meditation practice also alter brain structures and therefore, brain activity. Luders et al studied anatomical correlates and found significantly larger grey matter volumes in meditators in the right orbito-frontal cortex, right thalamus and left inferior temporal gyrus. In addition, they showed significantly larger volumes of the right hippocampus. Both orbito-frontal and hippocampal regions have been implicated in emotional regulation and response control. Thus, large volumes of these regions may be responsible to cultivate positive emotions, retain emotional stability, and engage in mindfulness behavior. The improved psychological functions may also be due to the direct effect of yoga practice on hypothalamic pituitary axis (HPA).

**Vasomotor Domain:**

Compared to physical exercise group, yoga showed most significant effect in managing the symptoms of vasomotor domain. All the three symptoms in this domain, that is, hot flushes, night sweat and sweating were significantly reduced only in the yoga group while no improvement was observed in any of the symptoms in control group. Hot flushes, especially when they are severe, are difficult to manage and seriously affect the overall quality of life. The hot flushes are not only subjectively experienced, they are associated with measurable indices like increased blood flow in the face, upper limbs and hands, increased skin temperature, decreased skin resistance and increased heart rate. This study clearly shows the usefulness of yoga therapy in managing this difficult symptom. An earlier pilot study which used yoga treatment for hot flushes in 14 postmenopausal women demonstrated significant improvement in hot flush frequency and severity, which was associated with improvements in sleep, musculoskeletal symptom and quality of life. In
Another pilot study conducted in six women, eight weeks of yoga intervention showed improvement in quality of life including vasomotor symptoms. Our study supports and confirms the effectiveness of yoga in large number of women.

The factors responsible and mechanisms involved in the generation of hot flushes seem to be multifactorial such as resetting of the thermoregulatory centre, pulsatile increase of luteinizing hormone, changes in hypothalamic neurotransmitter activity, altered noradrenergic and opioid neuron activities, changes in β-endorphin levels and modifications in sympathetic and parasympathetic nervous system.

Concerning the specific causes of the hot flushes, the temporal correlation between decreasing ovarian function and the symptoms suggest changes in estrogen levels also may be involved. However, decreasing estrogen levels as such are not likely to be the cause of the hot flushes, since pre pubertal girls and women with primary amenorrhea do not experience flushes nor the sudden increase in LH levels is the cause of flushes, since women who are hypo-estrogenic due to pituitary insufficiency still experience the flushes. Gonadotropin releasing hormone (GnRH) - agonist treatment and danazole treatment abolishes the LH surges without reducing the frequency of hot flushes. These findings suggest that the vasomotor symptom improvement brought about by yoga intervention may not involve these factors and probably it is due to the effect on autonomic nervous system. Several scientific studies on yoga practice have demonstrated the effect in modulating autonomous nervous system with special attention to decreased sympathetic nervous system activation. Especially the decreased sympathetic tone seems to play an important role in menopausal hot flushes. Hot flushes appear to be due to a narrowing of the
thermoregulatory null zone so that small increase in core body temperature results in vasodilatation and sweating.\textsuperscript{[445]} This abnormality in thermoregulation seems to be due to altered central nervous system adrenergic neurotransmission. This theory is supported by studies that show systematic administration of Yohimbe, an $\alpha$-2-adrenergic antagonist that increase norepinephrine release, provokes hot flushes and administration of clonidine, an $\alpha$-2-adrenergic agonist that decreases norepinephrine release, reduces the frequency of hot flushes.\textsuperscript{[446, 447]}

Effect of yoga to reduce sympathetic activity and thereby to improve vasomotor symptoms seems to be both peripheral and central. Sharma et al\textsuperscript{[328]} have observed decrease in pulse and respiratory rates and increase in galvanic skin resistance in healthy subjects after two months of yoga intervention. Changes in galvanic skin resistance was chiefly due to changes in peripheral autonomic tone, altering the sweating and cutaneous blood flow. The studies by Bhatia et al\textsuperscript{[419]} have showed central effect of yoga which influences various neural sites involved in sensory imagery (hippocampus and higher order association region) and executive systems.

It is interesting to note that in our study, physical exercise failed to relieve vasomotor symptoms. Since low opioid activity seems to be involved in the mechanisms that elicit hot flushes, physical activity which is known to increase central opioid activity,\textsuperscript{[448]} should have diminished the rise of hot flushes. Similarly other three somatic symptoms related to vasomotor domain that is, palpitation, headache and dizziness have significantly improved only by yoga intervention and not by physical exercise. Further studies may be required to explain this observation.
Sexual Domain:

The other significant difference between yoga and control group in symptom relief was observed in the sexual domain. All the three symptoms of this domain, that is, changes in sexual desire, vaginal dryness and avoiding intimacy were significantly improved only in the yoga group while physical exercise had no effect on these symptoms. Though the reported prevalence of sexual complaints in Asian women is lower than in their Caucasian counter-parts, improvements in these symptoms definitely contribute to the overall quality of life. The beneficial effects of yoga may be due to the strengthening of the reproductive organs and the pelvic floor anatomy by various asanas. The postures like Trikonasana, Parsvakonasana, Janushirsasana, Upavistakonasana and Ashwini mudra are known to improve the tone of the muscles of the pelvic region and enhance the blood circulation to the urogenital area\textsuperscript{[449]} which in turn can reduce the vaginal dryness and maintain the softness of vaginal walls. These asanas also improve the problems related to stress induced urinary incontinence. These asanas train the sphincter muscles of anus, urethra and vagina to maintain the proper muscle strength and thereby relieve the menopausal symptoms. Milani et al,\textsuperscript{[450]} who carried out yoga intervention in 51 women with stress incontinence, demonstrated significant clinical improvement. These women learned to have a better control and thereby to manipulate the perineal muscle and then were able to manage their urinary incontinence.
In the present study, improvement in symptoms in the entire domain of MENQOL resulted in significant improvement in overall quality of life in perimenopausal women by yoga intervention. Menopause is a unique experience and an important phase in a woman’s life, because of the complexity of changes during this phase. Therefore it is very essential to create awareness so that she can be comfortable during this period. The MENQOL questionnaire was developed on the basis of a woman’s own qualitative experience.[238] Though this instrument has been used in the past to assess menopausal symptoms, ours is the first study where it is effectively used to demonstrate the clinical utility of yoga in improving the quality of life in perimenopausal women.

**Anthropometric Measures:**

Apart from improving perimenopausal symptoms, the other significant benefit provided by yoga therapy was the improvement of anthropometric measurements. All the anthropometric parameters measured in the present study, body weight, BMI, waist circumference (WC) and hip circumference (HC) were significantly reduced in the yoga group while control group of physical exercise showed reduction in WC and HC only. Obesity can be a difficult problem to manage and this study shows yoga as a simple and effective method to control body fat including abdominal and visceral adipose tissue and thus help to prevent chronic diseases such diabetes and cardiovascular disease which are related to central obesity.[451, 452] Although, previous studies have reported decline in body weight,[290] reduction in waist/hip ratio,[453] and/or improvement in body composition[454] following yoga based interventions, ours is the first study to report the effect of yoga on the anthropometric measurements in perimenopausal women.
It is significant that only yoga intervention improved both BMI and WC, because when assessing adipose tissue distribution for detecting risk of obesity related diseases the various parameters reflect different aspects of this complex problem and may contribute independently in the assessment. Generally, a high value of BMI indicates excessive body fat and constantly relates to increased health risks and mortality, a normal BMI however, may not reflect normal levels of abdominal fat. On the other hand, WC seems to be better predictor of abdominal and visceral fat\(^{[455]}\) and also a risk factor for the metabolic syndrome.\(^{[172]}\) However, Asian women have a tendency to have a higher percentage body fat and visceral fat than Caucasians and African Americans within the same BMI.\(^{[456]}\) Reduction in WC associated with reduced body fat and BMI with yoga suggests decreased amount of total body fat while only reduction in WC without any change in BMI by the control physical exercise group shows redistribution of the abdominal fat. Thus yoga seems to be more beneficial than physical exercise in managing obesity and related complications.

It is also to be noted that various anthropometric parameters in practice have different utility values in assessing adiposity at base line and after weight loss. For example, in waist to hip ratio (WHR), WC was a better surrogate than WHR.\(^{[457]}\) BMI is also a good surrogate for abdominal fat after weight loss as shown by Dual energy x-ray absorptiometry studies of regional and total body fat.\(^{[458, 459]}\) Significant reduction in both BMI and WC in our subjects confirms that yoga therapy is effective in reducing total body fat including abdominal fat that will be useful in preventing morbidity and mortality associated with central obesity of perimenopause.
The various yoga postures used in this study with forward and backward bending, right and left side bending, right and left side twisting along with lifting of both legs results in muscular movements, increasing flexibility, heightens the physical performance and thereby prevents fat deposition.\textsuperscript{[21, 460]} The accompanying pranayama practice also contributes to the reduction in body weight by increasing the peripheral blood flow and stimulation of the sympathetic system.\textsuperscript{[461]} The right nostril breathing used in pranayama helps to reduce obesity also by improving digestive function and increasing the basal metabolic rate.\textsuperscript{[460]} This has been further supported by the studies conducted by Vaze et al.\textsuperscript{[462]}

**Blood Pressure:**

Along with adiposity, high blood pressure is another important risk factor for the development of atherosclerosis and cardiovascular disease (CVD) and also insulin resistance syndrome (IRS).\textsuperscript{[463, 464]} Of the core indices of IRS, blood pressure is the endpoint that has been most extensively studied with respect to the influence of yoga based interventions and most of these studies reported significant improvement in both systolic and diastolic blood pressure as compared to baseline values\textsuperscript{[292, 465, 466]} or to the controls receiving enhanced usual care.\textsuperscript{[335]} Again, ours is the first study to demonstrate the effect of yoga intervention in significantly reducing the systolic and diastolic pressure associated with reduction in adiposity and thus highlights the protective role of yoga in prevention of long term complications in perimenopausal women. This finding about the yoga effectiveness seems to be very critical because it can be extended to the general population also. Roughly 20% of the population is likely to have mild hypertension. Blood pressure in this group can be reduced either by modifying behavior alone or by a judicious combination of this treatment with antihypertensive drugs.\textsuperscript{[332]} When this is associated together with the reduction in blood
pressure along with other cardiac risk factors like adiposity and/or glucose intolerance brought about by yoga intervention, we may indeed have found a mass therapeutic strategy for primary prevention\textsuperscript{[467]} that is safe, cheap, effective and acceptable.

Several factors and mechanisms seem to be involved in the effect of yoga on reducing blood pressure and improving the cardiac function. Selvamooorthy et al\textsuperscript{[468]} found that baroreflex sensitivity was reduced in essential hypertension. After three weeks course of yoga therapy, they measured several cardiovascular responses like cold presser response at 40°C, alpha index of EEG, blood catecholamine and plasma renin activity. Results showed that at the end of three weeks, significant reduction in blood pressure occurred with gradual improvement in baroreflex sensitivity. Changes in other parameters indicated progressive attenuation of sympatho-adrenal and renin-angiotensin activity. This beneficial effect of yoga has been attributed also to a decrease in the frequency and intensity of proprioceptive and enteroceptive impulse traffic reaching the hypothalamus.\textsuperscript{[469]}

Regular yoga practice, especially pranayama, shavasana and meditation component seems to have profound impact on cardiac function, producing an overall reduction in oxygen consumption, metabolic rate and load on the heart\textsuperscript{[470, 471]} which in turn may improve the heart pressure. This is further contributed by the effect of pranayama on autonomic activity. In pranayama, breathing through right nostril has been shown to increase in sympathetic activity while left nostril breathing reduces it,\textsuperscript{[472]} which can modulate ventricular performance. The changes in ventricular performance are brought about by increased parasympathetic and decreased sympathetic activity through yoga training,\textsuperscript{[473]} indicating the potential benefit in maintaining cardiac health. By the reduction in systolic
and diastolic blood pressure observed in our study along with Bharashanker et al.’s \cite{317} observation of significant reduction in resting pulse rate and valsalva ratio following yoga training in subjects above 40 years indicates increase in baroreflex sensitivity. Hence it can be concluded that yoga is useful in reducing age related deterioration in cardiovascular functions.

Menopause has also been associated with an increase in plasma catecholamine,\cite{474} resting heart rate\cite{116} and other markers of sympathetic activity\cite{475} and a reduction in parasympathetic tone\cite{476} factors strongly implicated in the pathogenesis of both IRS and CVD.\cite{477} Yoga by altering most of these indices may prove to be very beneficial in reducing deterioration of cardiovascular functions in perimenopause women also.

**Biochemical Parameters**

**Fasting blood sugar (FBS) and Glycated hemoglobin (GHB):**

In the present study compared to the control, the yoga group showed significant reduction in both FBS and GHB levels. Several studies have documented reduction in FBS and GHB levels in diabetic patients following the practice of yoga either alone or in combination of with other therapies.\cite{291} Our study also showed that yoga is effective in improving the indices of insulin resistance in non-diabetic perimenopausal women. This observation is important because insulin resistance increases dramatically with menopause\cite{175, 478} and is considered to be a key factor underlying the abrupt increase in CVD risk among women after menopause.\cite{479, 480} Our study again supports the protective role of yoga against long term complications of menopause.
Several factors and mechanisms seem to be responsible for the improved glucose metabolism associated with yoga intervention. Chaya et al.\textsuperscript{319} observed that regular practice of yoga resulted in increased insulin sensitivity and attenuation of the negative relationship between body weight or waist circumference and insulin sensitivity. Our finding of improved visceral adiposity associated insulin resistance indices supports this observation. Yoga practice also leads to increased sensitivity of $\beta$-cells of pancreas to glucose signal which seems to be a sustained change resulting from a progressive long term effect of asanas.\textsuperscript{481}

Gorden et al.\textsuperscript{482} have reported that the beneficial effects of yoga in improving glycemic control in type 2 diabetic patients is by increasing percentage insulin binding receptor and also increase in the internalization of insulin-receptor complex. Hyperinsulinemia induces insulin receptor loss by means of the down-regulation mechanism and prolonged hyperglycemia may induce the impairment of insulin receptor kinase in the muscles, resulting in the worsening of glycaemic control.\textsuperscript{483} Insulin internalization into cells and intracellular insulin processing are altered in individuals with type 2 diabetic mellitus resulting in cellular resistance to insulin. Yoga intervention overcomes this problem by favoring binding of insulin to receptors and also increasing the internalization of insulin-receptor complex.\textsuperscript{482}

The molecular mechanism by which yoga seems to regulate blood glucose metabolism may help to explain one interesting finding observed in the present study. In our yoga group, the intervention for a period of twelve weeks resulted in significant decrease in FBS while serum cortisol levels remained unchanged. On the other hand, the exercise group
showed no change in FBS but showed significant increase in serum cortisol levels for the same time period. This observation indicates a basic difference in the mechanism by which yoga and physical exercise may affect or regulate the glucose metabolism and blood glucose levels. Physical exercise may induce lowered blood glucose which may stimulate the cortisol secretion which in turn tries to increase blood glucose level by stimulating gluconeogenesis. Further, glucocorticoids (cortisol) inhibit the peripheral utilization of glucose in the extra hepatic tissues thus acting in manner antagonistic to insulin. On the other hand, yoga seems to regulate changes in blood glucose level mainly through modulating insulin receptors, which may be a more effective way to regulate this central pathway. Regulation through hormones may have several additional effects on various organs, metabolic pathways and enzymes, substrate and product concentrations. This hypothetical role of yoga in modulating glucose metabolism through enhancing peripheral utilization without involving hormonal pathways is supported by Gorden et al\textsuperscript{[482]} who observed no significant change in serum cortisol levels at baseline compared with values after six months of yoga intervention. The thyroid stimulating hormone (TSH) which also plays an important role in carbohydrate metabolism was not affected by yoga intervention in the present study as well as in another study\textsuperscript{[482]} and further supports the above hypothesis. The normalization of insulin/glucose ratio with a reduction in the free fatty acids levels after yoga asanas\textsuperscript{[484]} is an additional evidence for better peripheral utilization of glucose. These beneficial effects of yoga on the insulin receptors and glucose kinetics may prevent the exhaustion of the beta-cell and the development of a beta-cell secretory defect, thereby preventing the development of further complications associated with chronic hyperglycemia.
The reduction of glycated hemoglobin levels, which reflect glucose level during the past 120 days show yoga to maintain persistent glucose homeostasis.

No significant change in blood glucose level associated with significant reduction in glycated hemoglobin levels observed in the physical exercise group is difficult to explain. Episodic reduction in blood glucose levels due to exercise may be one of the possible reasons. However, this effect of exercise on glycated hemoglobin must be borne in mind while interpreting the glycated hemoglobin values in diabetic perimenopausal women who are in physical exercise regimes. The reduced levels of glycated hemoglobin may not actually reflect the decline in blood glucose resulting in the misinterpretation.

**Lipid Profile:**

Significant reduction in serum total cholesterol (TC) and low density lipoprotein cholesterol (LDL-C) after yoga intervention compared to the control group is one of the important observations of the present study. Compared to yoga, the exercise group showed significant increase in both TC and LDL-C levels. Abundant evidence has accumulated relating the concentration of lipids and their associated blood transporting lipoproteins with the occurrence of atherosclerosis in general and CVD in particular.\(^{485, 486}\) Increased CVD risk associated with menopause may be related to these metabolic changes,\(^ {487}\) which seems to be an accelerated event happening among women who had recently entered the menopause.\(^ {488, 489}\) An accelerated increase of TC by age 50 years could be expected to cause a relative escalation in CVD morbidity, although the relative CVD mortality does not accelerate.\(^ {490}\) This hypothesis is, however, not supported by Swedish National myocardial infarction data,\(^ {491}\) as these data suggest that the incidence of myocardial infarction in
women approximately doubles by five year’s increase of age. Yoga not only prevented this accelerated increase in TC, it significantly reduced the serum TC and LDL-C levels, providing protection against CVD. Though earlier studies have shown this lipid lowering effect of yoga in patients with hypertension, diabetes or CVD\textsuperscript{[338, 339, 492]} ours is the first study to demonstrate significant positive changes in blood lipids following yoga intervention in otherwise healthy perimenopausal women. Moreover, reduction of serum levels of TC and more importantly levels of LDL-C are the major therapeutic objectives of drug therapy in prevention of CVD risk. The lipid lowering effects of yoga therapy can be considered as an effective, safe alternative non-pharmacological intervention for handling risk of CVD.

The serum triacylglycerol (TG) levels, which have been reported to be increased in menopausal women,\textsuperscript{[493, 494]} were not significantly altered after yoga intervention in our study. Findings on serum HDL-C levels in menopause have been inconsistent with studies reporting both increased\textsuperscript{[495, 496]} and decreased values.\textsuperscript{[494, 177]} Again, in our study no change in HDL-C levels was observed after yoga intervention, though the TC/HDL-C ratios were significantly reduced. This finding also may be important, because a large body of evidence shows positive association between TC/HDL-C ratio and atherosclerotic mortality in women like in men, although women’s absolute risk seems to be lower.\textsuperscript{[497]}
Reduction in TC levels without associated changes in TG and HDL-C levels indicate that the decrease may be solely due to decrease in cholesterol component of LDL fraction after yoga intervention. However, the reasons or mechanisms for the altered lipid and lipoprotein metabolism in menopause are not clear. Normal estrogen level seems to protect females against CVD through its anti-atherogenic effects during premenopausal period and hormone therapy has been shown to lower LDL-C levels. However, controlled trials in postmenopausal women do not constantly find that estrogen therapy reduces the progression of atherosclerosis. A temporary rise in HDL-C concentration around the menopausal transition has been suggested as the possible cause for improved lipid parameters which however have not yet been explained by known hormonal or enzymatic effects. One study has indicated hepatic lipase as a possible mediator of lowered HDL2-C as well as increased LDL-C in long term menopausal women. Similar to regulation of glucose metabolism through insulin receptors, yoga also may stimulate the peripheral utilization of LDL particles by modulating cellular LDL-receptors and thereby reducing serum LDL-C levels. Further exploration of the suggested relationship of yoga and various cell receptors is definitely worthwhile.

Menopause related testosterone predominance appears to be implicated as another key factor in development of CVD risk factors. It is biologically plausible, based on mounting evidence from cross-sectional clinical studies showing that testosterone is associated with insulin resistance, altered lipid levels and high blood levels of glucose and from epidemiological data showing that androgens are associated with hemostatic and inflammatory markers. The levels of sex hormone binding globulin (SHBG) which binds testosterone and transports it to target organ were also altered in menopausal women.
Altered SHBG level are strongly associated with central obesity and changes in lipid levels.\textsuperscript{504} Yoga which has been shown to reduce serum testosterone levels\textsuperscript{292} thus, may bring about the improvement in lipid profile parameters by reversing the effect of excess testosterone. Apart from these, beneficial effects of yoga on leukotrienes, IL-1, IL-6 and TNF are likely to be responsible\textsuperscript{290} which definitely requires further investigation.

Along with dyslipidemia, dysglycemia, central obesity and hypertension are the other factors which cluster to form metabolic syndrome (MS), which is known to promote the risk for future development of Type 2 diabetes mellitus and CVD\textsuperscript{505} especially in women above 55 years of age in the menopausal phase.\textsuperscript{506} Studies of MS in Indian menopausal women have shown a prevalence ranging from 19.2\% to 32.4\%\textsuperscript{507, 508} indicating this problem to be significant and severe, requiring urgent and immediate therapeutic action. Currently there is no single and simple tool to manage all the components of MS. Our study clearly demonstrates that yoga improves all indices of MS risk in perimenopausal women including glucose intolerance, lipid profiles, anthropometric characteristics and blood pressure, thus providing protection against complications of MS. Two of the parameters under lipid profile, that is serum triglycerides and HDL-C showed no influence by yoga intervention in our study. The role of these two parameters in the development of MS is controversial. Most cross-sectional studies show that postmenopausal women are more likely than premenopausal women to have higher triglycerides and lower HDL-C levels independent of age,\textsuperscript{509} but some large European studies\textsuperscript{510, 511} show no significant differences in TG or HDL-C levels after adjustment for age. Longitudinal results are also mixed. In two studies from Asia, premenopausal to postmenopausal changes in HDL-C and TG were not significant.\textsuperscript{512, 513} Thus, the significant role of yoga therapy in MS
management and prevention of cardiovascular complications in perimenopausal women is an important observation of our study.

State and trait anxiety

The menopausal transition is often accompanied by chronic stress (physical, psychological and spiritual) with associated depressive symptoms, including tension, anger, anxiety, irritability and other negative affective states. Along with contributing to the various perimenopausal symptoms in all the four domains, there is evidence that chronic stress and negative mood states are strongly associated in a bidirectional manner, with insulin resistance, glucose intolerance, central obesity, dyslipidemia, hypertension and other component of MS. Likewise, prospective studies have shown depression, a common comorbidity in perimenopausal population and a powerful predictor of CVD morbidity and mortality, to increase risk for metabolic complication by 2 to 3 fold. Sleep disturbance in woman also rises dramatically during the midlife years further adding to the stress. Thus stress seems to be the basic, core phenomenon triggering multiple interrelated factors leading to this complex, devastating and increasingly common disorder. Increased sympathetic activity, enhanced cardiovascular reactivity and reduced parasympathetic tone are the pathological mechanisms through which chronic stress seems to develop and progress to the MS and related CVD complications. The influence of yoga on sympathetic and parasympathetic activity helps to neutralize the various factors resulting due to stress. Although studies that specifically target perimenopausal women populations are lacking, investigation in healthy adults and other chronically ill populations suggest that yoga decreases perceived stress and reactivity to stressors, enhance stress related coping, reduce symptoms of depression and
anxiety, decrease anger, tension and fatigue,[531, 533] reduce sleep disturbance [534] and enhance physical and psychological well-being. [530, 531, 535] The significant decrease observed in both state and trait anxiety in our study confirms that yoga is effective in managing stress in perimenopausal women also. Compared to yoga, the physical exercise was less effective in addressing the various perimenopausal issues, probably due to its failure in relieving stress and anxiety status.

We feel that this effect of yoga to reduce anxiety, stress and other negative mind disorders and thereby to create total relaxation is the most powerful attribute of yoga which may be responsible for most of the beneficial effects in health and disease. Though the mechanisms underlying the beneficial effects of yoga are not yet well understood, the observed changes may occur via at least two major pathways. Firstly, by reducing the activation and reactivity of the sympathoadrenal system and the hypothalamic-pituitary-adrenal (HPA) axis and promoting feelings of well-being, yoga may alleviate the effects of stress and foster multiple positive downstream effects on neuroendocrine status, metabolic function and related systemic inflammatory responses.[291, 536, 537] Secondly, by directly stimulating vagus nerve, yoga may enhance parasympathetic activity and lead to positive changes in cardio-vagal functions, in mood and energy state and in related neuroendocrine, metabolic and inflammatory responses. (Fig 31) [291, 536, 537] In addition, yoga may reduce body weight and visceral adiposity which further reduces the risk of MS and CVD complications.[538]
Chapter 6

Discussion

Fig 31: Suggested mechanisms of yoga intervention in reducing cardiovascular and metabolic complications. Modified from Innes K, Vincent H\textsuperscript{[537]}

- Improved coagulation and fibrinolytic profile
- ↑ Endothelial Function

YOGA THERAPY

ASANA

PRANAYAMA

DHYANA

Path 1
Vagal Stimulation

Path 2
Parasympathetic activation

Enhanced Metabolic Profile

- Insulin Sensitivity
- Glucose Tolerance
- LDL-Cholesterol
- Total Cholesterol
- Visceral adiposity
- Improved Mood

- Heart Rate
- Blood Pressure
- Inflammatory Cytokines

- Stress
- Sympathoadrenal reactivity
- HAP-axis activation

- ↑ Endothelial Function

Pathways:

- Parasympathetic activation
- Vagal Stimulation
In addition to physiologic improvements, yoga may provide a positive source of social support, a factor strongly associated with reduced risk for CVD,[539] and may aid in improving health-related attitudes and life style choices, in part by enhancing psychological well-being, and this way also play an important role in symptom management and prevention of perimenopausal complications.

**Quality of life:**

Though the objective of this study was not to compare the effect of yoga and physical exercise in perimenopausal women and the physical exercise group functioned only as control, some beneficial effects were observed in the physical exercise group also, suggesting it also can be used in the perimenopausal management. However, research data suggest that older adults, especially older women, may experience greater barriers to initiating and continuing exercise programs.[540] Among older adults engaged in physical exercise, adherence rates indicate only 15% of older women actually participate in regular sustained activity. Moreover, an estimated 50% or more older adults who begin on exercise program are reported to drop out within first six months[540] with adherence much lower in other populations.[541] Initiation and maintenance of an exercise routine may also be affected by safety, monetary, hygiene, weather, injury, and other concerns that are particularly important among older women.[540, 543]

Yoga, the traditional mind-body therapy, provided all round benefits, is part of Indian culture and readily accepted by older women and now even in western countries. [544] Yoga therapy, as shown in this study, improved a range of physical, psychological, vasomotor, sexual symptom outcomes and factors related to MS and CVD risk in
menopausal women. Yoga is low speed, low impact and noncompetitive in nature and can be safely practiced by elderly, unfit and overweight individuals. Yoga practice can be performed virtually anywhere and for any length of time and typically brings gradual positive benefits, including feelings of relaxation and tranquility helping to encourage continued adherence. Moreover, even short term (2-12 weeks) yoga interventions have been shown to result in significant gain in cardiovascular and psychological health, as well as in flexibility, endurance, and strength\cite{544, 545, 546} which are powerful incentives for continued practice. Thus, a customized yoga program which can be performed at home may offer excellent therapeutic benefit to these women as shown in our study.

In summary, yoga offers acceptable and cost effective intervention for menopausal women demonstrating promise for improvement of physical, psychological and spiritual health, prevention and management of CVD and associated chronic disorders, thus contributing significantly to the overall quality of life. However, rigorous, controlled studies investigating the effects of yoga on MS and CVD risk factors or related clinical end points remain relatively few. Also, few studies have examined the long term effects of yoga and thus mechanisms underlying the benefits associated with this discipline remains poorly understood. Clearly, additional high quality research is definitely warranted to confirm and further explore the potential healing effects of yoga not only in older women but in the general population also.
It has been asked whether in yoga there is something for everybody. The answer is ‘yes’. One standard work on the subject, written over a thousand years ago,\textsuperscript{[21]} states:

\begin{verbatim}
Yuva vriddho ativriddho va vyadhito durbalah api va |
Abhyasat siddham apnoti sarva yogesu atandritah” ||
\end{verbatim}

Yoga is for children, adults, aged and also for ill and the weak. It is for everybody. There is one condition however- the individual has to practice it in a disciplined manner regularly. Life after all, rests only in the individual. As Emerson put it in one of his poem:

\begin{verbatim}
“The cordial quality of pear or plum  
Rises as gladly in the single tree  
As in whole orchards resonant with bees.”
\end{verbatim}

Yoga is something to do, yet its benefits are not something to make, but something to take. Yoga is in every way integral living, including the whole man, the whole woman- material, mental, ethical, and spiritual-by which each of the levels of being serves all others and results in complete sanity and happiness.\textsuperscript{[547]} Its method follows the method of the gardener, who provides soil, water and sunshine allowing the seed to attain the whole, healthy total life.