Chapter II

REVIEW OF RELATED LITERATURE

The purpose of the study was to find out the influence of yogasana and pranayama to improve the endocrine system and it secretion of hormones are useful on selected developing general motor ability among high school student. After outlining the problem the next step is to examine the literature, to identity properly the extent of the problem, to develop an understanding of various techniques available for such a study and to develop ideas that contribute to the overall rational and interpretation of results.

The literature in any field forms the foundation upon which all future work will build. The study of relevant literature is an essential step to get a full picture of what has been done and said with regard to the problem under study. The review of the literature is the basis of most of the research projects in the physical science, natural science, social science and humanities. Such a review brings about a deep insight and a clear perspective of the overall field.

Wood. C., (1993) studied the effects of three different procedures, relaxation, visualization and yogic breathing and stretch (pranayama) on perceptions of physical and mental energy and on positive and negative mood states have been assessed in a group of normal volunteers (N=71, age ranged 21-76). Pranayama produced a significantly greater increase in perceptions of mental and physical energy and feelings of alertness’ and enthusiasm than the other two procedures. Relaxation made subjects significantly more sleepy and sluggish immediately after the session than pranayama. Visualization made
them more sluggish but less content than pranayama and more upset than relaxation after the second session.

Thus, a 30 min programme of yogic stretch and breathing exercises, which is simple to learn, and which can be practiced even by the elderly had a markedly ‘in vigoratilng’ effect on perceptions of both mental and physical energy and increased high positive mood. A more extensive investigation is planned to establish whether such a programme can readily be incorporated in eery life, and with what long-term results.

Patricia L. Gerbarg MD and Richard P. Brown MD (2008) to observed endocrine changes that have been associated with meditation and Sudarshan Kriya. A study of three months practice of Sudarshan Kriya resulted in significant reduction in cortisol (one measure of stress response system activation in the brain) and correlated significantly with decreased depression scores over a three-week period.47 Another study of 12 highly trained yoga meditators (average 6-1/2 years experience) compared with 11 elite runners showed an increase in CRH (corticotrophin-releasing hormone) but not endorphins after meditation. The 11 elite runners showed the same magnitude CRH release after running as the meditators, but the runners also released a beta-endorphin not found in the meditators.48 The hypothalamic pituitary adrenal (HPA) axis is essential in the stress response and survival of mammalian species. It is abnormally overactivated during biological depression and is alternately overactivated and depleted in patients with posttraumatic stress disorder.
There is data suggesting that meditation and probably hyperventilation cause release of pituitary hormones, probably through hypothalamic output mediated through vagal afferents. The 5-fold increase in vasopressin associated with meditation is significant. There is older evidence that vasopressin is decreased in depression. Furthermore, vasopressin and oxytocin receptors are generally found together in the brain. Oxytocin has been described as the “cuddle” hormone. It is very important for affiliative and monogamous social bonding in voles. It is known that stimulation of oxytocin in voles will result in increased bonding to the next vole with which that animal comes in contact with. In humans, there is evidence that oxytocin is necessary for uterine contractions in childbirth, generates milk production in new mothers, influences bonding and affection of the mother for her baby, and is a primary sexual arousal hormone. There is some evidence of low oxytocin levels in major depression and of SSRIs (selective serotonin reuptake inhibitors) facilitating oxytocin secretion. The antidepressant effect of SSRIs may be partially mediated by oxytocin. Further studies of oxytocin release during Sudarshan Kriya in depressed patients would elucidate the importance of this mechanism. I hypothesize that hyperventilation in Sudarshan Kriya releases oxytocin as well as vasopressin. Thus oxytocin may turn out to be the “I belong to you” hormone.

Vedat Cinar, et al, (2009) investigated the effects of strenuous exercise and calcium supplementation on cortisol and adrenocorticotrophic hormone levels in athletes at rest and exhaustion. Thirty male athletes, ages 17–21 years, were enrolled in the 4-week study. They were divided into three groups as follows: group 1 (n=10): training without supplementation; group 2 (n=10): training and
calcium supplemented, and group 3 (n=10): calcium supplemented without training. Venous blood samples were obtained for determination of the hormones. One-month supplementation with calcium does not influence the cortisol and adrenocorticotropic hormone in athletes, but strenuous exercise results in a significant increase in their levels with or without supplementation (p<0.05). Keywords ACTH. Cortisol. Calcium supplementation. Strenuous exercise. Athletes Introduction During training, exercise causes the psycho- and physiological systems to work jointly to manage energy use by the body. Hormonal secretion is affected by leptin and stokins, secreted from fats. Strenuous exercise imposes a stressful condition on the body, changing its homeostasis. The hypothalamus–hypophysis adrenal axis is also involved in the protection of homeostasis. There have been several studies investigating the relationship between exercise and hormones. Cortisol and catecholamine levels are elevated during exercise. Chronic medium-level elevation of cortisol is observed in well-trained athletes.

Buono M.J et al. (1986) examined plasma adrenocorticotropic hormone (ACTH) and cortisol levels following brief high intensity exercise in order to analyses the response of the hypothalamin-pituitary-adrenocortical axis to exercise. Six male subjects attended two testing sessions, before which they refrained, from food and exercise for eight hours. For the first session each subject performed an incremental load (25 w/min.) exercise test to exhaustion on a cycle ergometer while for the second session one minute bout of exercise on a cycle ergometer at 120 percent of the previously determined oxygen consumption rate was performed. Blood samples were collected at rest, immediately following the exercise bout, as well as at 5, 15 and 30 minutes post-
exercise. The results of the analysis show that brief high intensity exercise results in significant increases in plasma ACTH and cortisol levels.

Izumi Tabata et al. (1990) investigated the effects of physical training on the responses of serum adrenocorticotropic hormone (ACTH) and cortisol concentration during low-intensity prolonged exercise. Five subjects who had fasted for 12 h cycled at the same absolute intensity that elicited 50% of pre-training maximal oxygen uptake (~O2max), either until exhaustion or for up to 3 hovers, before and after 7 weeks of vigorous physical training [mean daily energy consumption during training exercise, 531 kcal (2230 kJ)]. In the pretraining test, serum ACTH and cortisol concentrations did not increase during the early part of the exercise. Increases in concentrations of both hormones occurred in all subjects when blood glucose concentration decreased during the later phase of the exercise. The mean values and SEM of serum ACTH and cortisol concentrations at the end of the exercise were 356 ng/l-1, SEM 79 and 438 l-g.l-l., SEM 36, respectively. After the physical training, VOzm~x of the subjects improved significantly from the mean value of 50.2 ml.kg -1 .min -1, SEM 2.5 to 57.3 ml.kg-l-min -1, SEM 2.0 (P<0.05). In the post-training test, exercise time to exhaustion was prolonged in three subjects. Comparing the pre- and post training values observed after the same length of time that the subjects had exercised in the pre-training test, the post-training values of serum ACTH (44 ng/l, SEM 3) and cortisol (167 pg/ml, SEM 30) concentration were less than the pre-training value (P<0.05). However, after the subjects stopped exercising in the post-training test, the serum ACTH (214 ng/l, SEM 49) and cortisol (275 pg/ml, SEM 50) concentrations were not significantly different from those measured after the subjects stopped exercising in the pre-training test (P> 0.10).
Handziski Z, et al., (2006) evaluated the changes in some hormonal parameters in professional soccer players during a half-season competition. They included 30 professional soccer players from a soccer club of our National Soccer League in this study. All sport medical examinations were conducted three times: before the preparation phase, before the competition phase (after previous phase) and after finishing the competition phase. There were significant differences in all evaluated hormones between three phases of soccer training process, including significant decrease in T/C of more than 30% at the end of the competition phase (phaseIII). The decrease in muscle mass after the preparation phase and the increase in fat mass at the end of competition phase were insignificant. The hormonal changes indicated that some indices could indicate overreaching and overtraining at the end of professional soccer competition season. Although insignificant, the decrease in muscle mass after the preparation phase and the increase in fat mass at the end of competition phase were undesirable effects for us.

Izumi Tabata et al. (2008) investigated responses of serum ACTH and cortisol concentration to low intensity prolonged exercise. In experiment 1, 10 subjects fasted for 12 h and performed bicycle exercise at 49•3% O2max (±4•3%) until exhaustion or up to 3 h. During the early part of the exercise, serum ACTH and cortisol concentrations did not increase from the pre-exercise values (ACTH: 44±5 μg/1, cortisol: 139±52 μg/1). Whilst the time to serum ACTH concentration increasing varied among the subjects (60•180 min), the increases of this hormone occurred for all subjects (175±85 ng/1, P<0•05) when blood glucose concentration decreased to a critical level of 3•3 mmol/l. At the
end of the exercise, blood glucose concentration decreased to 2.60±0.21 mmol/1, and serum ACTH and cortisol concentrations increased to 313±159 μg/1 and 371±151 μg/1, respectively. In experiment 2, four subjects performed the same intensity exercise until exhaustion, and were then given 600 ml of 20 g glucose solution, and immediately afterwards, they were asked to repeat the same exercise. The subjects continued the exercise for between 30 to 90 min until again reaching exhaustion. During the second exercise, blood glucose concentration increased to the pre-exercise value (2.72±0.58 to 4.00±0.22 mmol/1, P<0.05) and simultaneously, serum ACTH concentration decreased considerably (354±22 to 119±54 ng/1, P<0.05). The results of the present study suggest that serum ACTH and cortisol concentration during low intensity prolonged exercise may be dependent on blood glucose concentration.

Ronkainen H. R. A, et al. (1986) investigated the long-term effects of endurance exercise on the function of the adrenal cortex of 18 female runners and 12 control subjects and 13 joggers and 11 control subjects, which were found by measuring the serum concentrations of cortisol and dehydroepiandrosterone sulfate and the responses of cortisol to intravenous ACTH injection. All of the participants were studied over one menstrual cycle during light training in the autumn and hard training in the spring. The mean spring versus autumn concentrations of cortisol was significantly increased in runners during the follicular and luteal phases of the menstrual cycle. Chronic endurance exercise did not appear to alter the function of the adrenal cortex, while an undefined spring-associated factor, possibly the high luminosity, appeared to induce an increase in cortisol secretion in female runners.
Kursat Karacabey1, et al, (2005) determined the differences in the humoral immune parameters, serum ACTH and cortisol levels existing between sportswomen and sedentary subjects and the effect of acute aerobic and anaerobic exercise on these parameters. 40 sportswomen (Groups 1 and 2) and 20 sedentary women (Group 3) were enrolled and Group 1 performed aerobic exercise on a treadmill for 30 minutes while the Group 2 was subjected to the Wingate effort test for 30 seconds. Before exercising (at 8.30 a.m), immediately after the exercise, and 4 hours, days 2 and 5 days after exercising blood samples were obtained and the levels of IgA, IgG, IgM, complement 3 (C3) and complement 4 (C4) were determined turbidometrically. Before exercise: the means of IgA and IgG values in the G1 and G2 groups were higher than the Group G3, and the mean cortisol levels in the sedentary group was significantly higher (p < 0.05). After Exercise: Whereas the C3 and C4 levels decreased significantly at the end of the exercise in Group 1 and 2 (p < 0.05), the IgA, IgG (p < 0.05) and IgM levels (p < 0.01) at the 4th and 5th determinations were observed to be significantly higher in only the Group 1. The cortisol and ACTH levels were found to have increased significantly (p < 0.05) in the Group 1. In Group 2, no changes were observed in the IgA, IgG and IgM levels. They conclude that regular and moderate exercise has favorable effects on the immune system by increasing immunoglobulines which are potent protective factors.

Guezennec. C.Y., et al., (1989) measured the effect of enhanced venous return on atrial natriuretic factor (ANF) secretion during exercise and upright posture and the consequences on renin angiotensin aldosterone system (RAAS) activity. Six healthy male subjects were submitted to four different procedures. All procedures were performed in the same position, i.e. riding on a support with
legs hanging. Two procedures were performed at rest: the subjects were studied after a 25-min rest in this position, with and without the lower limb fitted with an anti-G suit inflated to 60 mmHg. Two procedures were carried out with physical exercise; arm-cranking was performed in the same position with and without the anti-G suit inflated to 60 mmHg. Venous blood was collected before and after each procedure in order to measure plasma ANF, plasma aldosterone concentration (PAC), plasma renin activity (PRA), corticotrophin (ACTH) and catecholamine level. The data mean ±SEM showed that the ANF plasma level decreased significantly (p<0.05) from 32.5±4 to 28±6 pg • ml$^{-1}$ after a 20-min rest in the upright posture, whereas this effect was abolished with anti-G suit inflation. Physical exercise with and without the anti-G suit increased the ANF level above control values (60±13.6 pg • ml$^{-1}$ and 53±13 pg • ml$^{-1}$): anti-G suit inflation had no significant effect. PRA increased after rest in an upright posture and during Physical exercise; anti-G suit inflation abolished this increase in both conditions. PAC was not influenced by postural change but significantly increased in all exercise tests. ACTH increased to the same extent in both exercise tests. The plasma catecholamine level increased during upright posture and both Physical exercise procedures. These results indicate that enhanced venous return during anti-G suit inflation increases ANF secretion at rest in an upright posture and that physical exercise greatly increases plasma ANF level independently of the anti-G suit inflation. They suggest that ANF release during exercise could be influenced by factors other than haemodynamic stimuli. The comparison between ANF and PRA changes during arm-cranking indicates that PRA is influenced more than ANF by blood volume displacement. The ANF increase during exercise does not inhibit aldosterone secretion.
Petrides, John S. (1997) compared profiles of hypothalamic-pituitary-adrenal (HPA) responsiveness, healthy, moderately trained men (n = 15) were classified as high (n = 7) or low responders (n = 8) on the basis of plasma adrenocorticotropic hormone (ACTH) responses to strenuous treadmill exercise 4 h after 4 mg of dexamethasone (Dex). These groups were then evaluated to compare 1) HPA and growth hormone responses to exercise at 90% maximal oxygen uptake 4 h after placebo, Dex (4 mg), and hydrocortisone (100 mg); 2) pituitary-adrenal responses to infusion of arginine vasopressin (AVP); 3) plasma cortisol after a Dex suppression test (1 mg); and 4) behavioral characteristics. In comparison to low responders, high responders exhibited significantly 1) higher plasma ACTH responses to exercise after placebo and Dex; 2) higher plasma AVP secretion with exercise after placebo and marked Dex- and hydrocortisone-induced enhancement of exercise-induced AVP secretion; 3) lower Dex-induced increases in basal and stimulated growth hormone secretion; 4) higher plasma ACTH responses to infusion of AVP; and 5) a trend (P = 0.09) for higher trait anxiety ratings. Similar suppression of plasma cortisol was noted after 1 mg Dex. We conclude that subgroups of healthy male volunteers exhibit unique profiles of HPA responsiveness. We also believe that glucocorticoid pretreatment combined with strenuous exercise allows functional HPA responsiveness to be distinguished between subgroups of healthy controls and may be useful in the determination of susceptibility to disorders characterized by hyper- and hypo-HPA activation.

Atko, V and Tonis, M, (1985) studied the adrenocortical activity in rats during three weeks of swimming exercise with the training load being increased each week. Adrenocortical activity increased during the first set of every new
level of exercise. A high level of activity remained present both at rest and after exercise during the next few days’ exercise at this new level. Further exercise found subtotal depletion of adrenocortical reserve levels with the eventual restoration of normal levels of adrenocortical levels without any further response to the same exercise load.

Theintz, G, et al. (1995) distinguished the hormonal response to a short but intense session of physical exercise from the endocrine adaptation to systematic physical conditioning. The normal child was perfectly equipped to handle stress situations such as those generated by leisure sport; the training increase in stress hormone has no negative effect on growth and puberty. In young elite athletes as for adults, the alterations of the endocrine system result form an inappropriate physical conditioning programme for the individual level of tolerance, whereas the gonadal function was predominantly affected. Alterations of growth hormones have also been reported.

Buono, M.J. (1986) determined the intensity threshold needed to elicit increase in plasma aldosterone and cortisol during graded exercise in human. Seven male volunteers performed a maximal oxygen uptake (Vo2 max) test on a cycle ergometer, plasma level of aldosterone, cortisol, angiotensin II, ACTH and potassium were measured at rest and at each 50 w workload of the exercise test. The results showed that aldosterone significantly increased from a mean of 231 ± 22 p mol. 1-1 at rest to 464 ± 22 p mol. 1-1 at exhaustion. Cortisol significantly increased from 284 ± 38 n mol. 1-1 at rest to 311 ± 39 n mol. 1-1 at exhaustion. Cortisol was only significantly increased at exhaustion.
Interestingly, postassium, ACTH and angiotensin II were all significantly correlated with aldosterone during exercise.

Shi. X. (1990) conducted a study on eight well-trained male and female cyclists to determine the effect of sodium and/or water intake on plasma aldosterone during six hours of cycling in a warm environment. Each subject randomly completed three trials (water-W; saline-S and no fluid-NF) at one-week intervals. Venous blood samples were obtained before dehydration, at 2, 4, 5 and 6 hours during exercise and also after dehydration. Plasma samples were collected for hemoglobin, sodium, potassium, aldosterone and osmolality. Sweat and urine samples were also collected and analysed for sodium consent. Plasma volume based on hemoglobin decreased significantly at 15 min in all these three trials. Plasma sodium increased in trial no fluid due to plasma volume loss. Significant differences in sodium were found between trial NF and trial W or trial S. Average total sodium content or plasma decreased by 125.9 mEq during trial S, 223.1 mEq during trial W and 147.1 mEq during trial NF. Plasma potassium increased significantly at 2 hours in all trials. Plasma aldosterone increased significantly during exercise and decreased after exercise.

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Montain, Scot J. et al., (1997) examined the separate and combined effects of hypohydration level and exercise intensity on aldosterone (ALD) and arginine vasopressin (AVP) responses during exercise-heat stress. Nine heat acclimated men performed 50 min of treadmill exercise in a warm room (30°C dry bulb (DB), 50% relative humidity (RH) at 25%, 45% and 65% \(\dot{\text{VO}}_2\text{max}\) when euhydrated and when hypohydrated by 3% and 5% of body weight. Blood samples were drawn at rest and at 20 min of exercise. ALD and AVP increased (\(P < 0.05\)) in a graded manner with hypohydration level, and this effect persisted during exercise-heat stress. High intensity exercise produced greater ALD and AVP increases than low intensity exercise. ALD responses during exercise were independent of hypohydration level. AVP responses were closely related to osmolality (\(N = 6\) of 7 subjects; \(r = 0.51\) to \(r = 0.98\); average \(r = 0.84\)) despite varying hydration, exercise intensity, or core temperature. We conclude that: 1) ALD and AVP increase in a graded manner with hypohydration, and this effect persists during exercise-heat stress; 2) ALD and AVP increases elicited by exercise are greater during high intensity than low intensity exercise; 3) Hypohydration and exercise intensity have additive effects on ALD; and 4) AVP responses are closely coupled to osmolality.

Jennifer Michelle Jones (2004) stated that Aldosterone influences the kidney’s normal regulation of blood pressure (BP), but if consistently elevated, aldosterone may contribute to hypertension. BP is decreased with aerobic exercise training (AEX), but the extent to which plasma aldosterone (PA) levels change is unclear. The CYP11B2 -344C/T polymorphism has been associated with hypertension and may contribute to the change in BP and PA with AEX. The purpose of this study was to determine if 6 months of AEX changed PA
levels, 24-hour Na+ excretion and BP in middle-aged to older prehypertensives, and whether the -344C/T polymorphism was associated with changes in these primary outcome variables. Forty (23 Caucasians, 14 African descents (AD), 2 Asian/Pacific Islanders and 1 of other ethnicity) disease free sedentary prehypertensives completed AEX. All participants followed the AHA Step I diet. Blood samples were collected under fasting and supine conditions and PA was measured by RIA. In the total sample, PA levels decreased after AEX (p=0.04). The reduction in PA levels in Caucasians (-37±15 pg/ml, p=0.02) tended to be greater (p=0.07) than the reduction in PA levels in AD (-2±8 pg/ml, p=0.77). Among AD, PA levels tended to decrease when controlling for baseline PA levels (p=0.09). The change in systolic BP (SBP) in Caucasians (-3±1 mm Hg, p=0.05) was significantly different (p=0.03) than the change in SBP in AD (4±3, p=0.28). In the AD, 24-hour Na+ excretion tended to increase when controlling for baseline 24-hour Na+ excretion (p=0.06). Among the Caucasians, the TC+CC genotype group tended to decrease PA levels (-39±21 pg/ml, p=0.09) and significantly decreased SBP (-4±2 pg/ml, p=0.03). Among AD, the TT genotype group significantly decreased PA levels when controlling for baseline PA levels (-17±7 pg/ml, p=0.04). The AD TC+CC genotype group tended to increase SBP when controlling for the change in 24-hour Na+ excretion (11±2 mm Hg, p=0.09) and 24-hour Na+ excretion significantly increased when controlling for the change in BMI (14±11 mmol/d, p=0.03). BP and PA levels appear to be more responsive to AEX in Caucasians compared to AD. The CYP11B2 -344C/T gene appears to influence the responses of hypertensive phenotypes to AEX.
Wolf, J.P, et al., (1986) studied the influence of posture on plasma renin and aldosterone changes during exercise performed at a constant relative work load (40%–50% maximal oxygen uptake) was studied in eight healthy men. Each subject carried out two 20-min exercises on an ergocycle at an interval of 8 days; the first exercise was performed in the normal sitting position (upright exercise), the second in a comfortable supine position (supine exercise). In both cases, heart rate and blood pressure were measured as well as plasma renin activity (PRA), aldosterone (ALDO) and osmolality, before and immediately after exercise, and 15 min following the end of exercise. An increase in heart rate, blood pressure, PRA, ALDO and osmolality was noted at the end of each exercise. This increase was greater in the supine exercise than when upright for PRA and ALDO; plasma osmolality and blood pressure showed identical increases for both types of exercise; increase in heart rate was greater when supine than when upright. PRA and ALDO were still elevated 15 min after the upright activity, but had regained their base values in that time after the supine exercise. Our results show that moderate, relatively brief periods of exercise stimulate the production of renin and aldosterone, but the response is less when supine than in the normal upright position.

Maresh, C.M, et al., (1985) stated that the effect of maximal treadmill exercise on plasma concentrations of vasopressin (AVP); renin activity (PRA); and aldosterone (ALDO) was studied in nine female college basketball players before and after a 5-month basketball season. Pre-season plasma AVP increased (p<0.05) from a pre-exercise concentration of 3.8±0.5 to 15.8±4.8 pg • ml⁻¹ following exercise. Post-season, the pre-exercise plasma AVP level averaged 1.5±0.5 pg • ml⁻¹ and increased to 16.7±5.9 pg • ml⁻¹ after the exercise test.
PRA increased \( (p<0.05) \) from a pre-exercise value of \( 1.6\pm0.6 \) to \( 6.8\pm1.7 \) ngAI \( \cdot \) ml\(^{-1} \cdot \) hr\(^{-1} \) 5 min after the end of exercise during the pre-season test. In the post-season, the pre-exercise PRA was comparable \( (2.4\pm0.6 \) ngAI \( \cdot \) ml\(^{-1} \cdot \) hr\(^{-1} \)\), as was the elevation found after maximal exercise \( (8.3\pm1.9 \) ngAI \( \cdot \) ml\(^{-1} \cdot \) hr\(^{-1} \)\). Pre-season plasma ALDO increased \( (p<0.05) \) from \( 102.9\pm30.8 \) pg \( \cdot \) ml\(^{-1} \) in the pre-exercise period to \( 453.8\pm54.8 \) pg \( \cdot \) ml\(^{-1} \) after the exercise test. In the post-season the values were \( 108.9\pm19.4 \) and \( 365.9\pm64.4 \) pg \( \cdot \) ml\(^{-1} \), respectively.

Thus, maximal exercise in females produced significant increases in plasma AVP, renin activity, and ALDO that are comparable to those reported previously for male subjects. Moreover, this response is remarkably reproducible as demonstrated by the results of the two tests performed 5 months apart.

Tamara Hew-Butler, et al., (2010) stated that the maintenance of fluid homeostasis during periods of heightened physical stress can be best evaluated in humans using exercise as a model. Although it is well established that arginine vasopressin (AVP), aldosterone and atrial natriuretic peptide (ANP) are the principle hormones regulating fluid balance at rest, the potential contributions of other related endocrine factors, such as oxytocin (OT) and brain natriuretic peptide (BNP), have not been well described during exercise. Seven endurance-trained runners completed three separate running trials: a maximal test to exhaustion (high intensity), a 60-min treadmill run (steady state), and a 56 km ultramarathon (prolonged endurance exercise). Statistically significant pre-to post-run increases were found only following the ultramarathon in [AVP]\(^{p}\) (1.9 vs 6.7 pg/ml; \( P<0.05 \)), [OT]\(^{p}\) (1.5 vs 3.5 pg/ml; \( P<0.05 \)), [NT-proBNP]\(^{p}\) (23.6 vs 117.9 pg/ml; \( P<0.01 \)), [interleukin 6]\(^{p}\) (4.0 vs 59.6 pg/ml; \( P<0.05 \)), [cortisol]\(^{p}\) (14.6 vs 32.6 µg/ml; \( P<0.01 \)), [corticosterone]\(^{p}\) (652.8 vs 3491.4
ng/ml; P<0.05) and [11-deoxycortisol]p (0.1 vs 0.5 μg/ml; P<0.05) while a significant post-run increase in [aldosterone]p was documented after high-intensity (4.9 vs 12.5 ng/ml; P<0.05), steady-state (6.1 vs 16.9 ng/ml; P<0.05) and prolonged endurance running (2.6 vs 19.7 ng/ml; P<0.05). Similarly, changes in fluid balance parameters were significantly different between the ultramarathon versus high-intensity and steady-state running with regard to plasma volume contraction (less % contraction), body weight loss (increased % weight loss), plasma [Na+] (decreased from baseline), and urine osmolality (increase from baseline). Hypothetically driven relationships between [OT]p and [AVP]p (r=0.69; P<0.01) and between [NT-proBNP]p and plasma [Na+] (r=−0.79; P<0.001) – combined with the significant and unexpected pre- to post-race increases after prolonged endurance exercise – allows for possible speculation that OT and BNP may assist their better known companion hormones (AVP and ANP) in the regulation of fluid balance during conditions of extreme physical stress.

Gilles Guillon, et al., (1995) stated that the autoradiographic experiments using iodinated vasopressin analog revealed the presence of specific vasopressin-binding sites in the human adrenal cortex (zona glomerulosa and zona fasciculata). These receptors exhibited a good affinity for a nine vasopressin (3.3 nM), with classical V₁ pharmacolom and densities of 65 and 135 fmol/mg protein-enriched membranes FFbm zona glomerulosa and fasciculata respectively. Vasopressin receptors present in both glomerulosa and fasciculate cell-enriched primary cultures were coupled to phospholipase C (ED₅₀, 0.9 and 1.8 nM; maximal stimulation, 4.3- and 5.8-fold, respectively). Vasopressin also stimulated an increase in intracellular calcium through at least
two distinct mechanisms: the mobilization of intracellular pools via vasopressin-stimulated inositol phosphate accumulation and the activation of calcium influx. In glomerulosa cell-enriched primary cultures, vasopressin increased aldosterone secretion (ED₅₀, 0.4 nM; maximal stimulation, 2.5fold) and was found to be as potent as angiotensin-II in stimulating aldosterone secretion, phosphoinositide turnover, and calcium mobilization. In fasciculata cells, vasopressin and angiotensin-II were also able to stimulate cortisol secretion and inositol phosphate accumulation. Moreover, perifusion experiments demonstrated that vasopressin was released from the adrenal medulla. Together, these results indicate that vasopressin can be considered a potent paracrine modulator of adrenal steroid secretion in man.

Krystyna Nazar, et al. (1989) observed that ten healthy male subjects took part in the study. They performed three consecutive bouts of static handgrip at 30% of maximal voluntary contraction (MVC), using two hands alternately and without rest intervals. Blood pressure was measured every 30 s and ECG was recorded continuously. Blood samples for arginine vasopressin (AVP), growth hormone (GH), adrenocorticotropic hormone (ACTH) and cortisol determinations were taken at rest, after each exercise bout, as well as at 10 and 30 min after the last one. During the whole period of exercise (9 min) blood pressure and heart rate were elevated. The effort caused a significant increase in the plasma AVP concentration. In the majority of subjects the peak values occurred after the first or second exercise bout and were followed by a rapid decline of the hormone concentration. Changes in GH, ACTH and cortisol concentrations were insignificant; however, in seven of the ten subjects,
considerably elevated plasma GH levels were found at the end of the third exercise bout and/or 10 min after its cessation.

Margaret Altemus, et al., (2001) observed the accumulating evidence indicated that gonadal steroids modulate functioning of the hypothalamic-pituitary-adrenal (HPA) axis, which has been closely linked to the pathophysiology of anxiety and depression. However, the effect of the natural menstrual cycle on HPA axis responsivity to stress has not been clearly described. In nine healthy women, metabolic and hormonal responses to treadmill exercise stress during the early follicular phase of the menstrual cycle, when gonadal steroid levels are low, were compared with responses in the midluteal phase of the cycle, when both progesterone and estrogen levels are relatively high. Exercise intensity was gradually increased over 20 min to reach 90% of each subject’s maximal oxygen consumption during the final 5 min of exercise. Basal plasma lactate, glucose, ACTH, vasopressin, oxytocin, and cortisol levels were similar in the two cycle phases. However, in response to exercise stress, women in the midluteal phase had enhanced ACTH (P < 0.0001), vasopressin (P < 0.01), and glucose (P < 0.001) secretion. These findings suggest that relatively low levels of gonadal steroids during the early follicular phase of the menstrual cycle provide protection from the impact of stress on the HPA axis. Clinical observations suggest that fluctuations in reproductive hormones influence the course of depression and anxiety disorders, but the biological mechanisms that may mediate the effects of reproductive hormones on emotional regulation have not been identified. Accumulating evidence suggests that gonadal steroids modulate functioning of the hypothalamic-pituitary-adrenal (HPA) axis, which has been closely linked to the
pathophysiology of anxiety and depression. On the one hand, HPA axis responses to acute stress can reflect the sensitivity of the individual to a physical or emotional stress. On the other hand, glucocorticoids secreted during stress may, in turn, act in the central nervous system to regulate mood and other mental processes. Glucocorticoids are also the primary endocrine feedback signal for suppression of the HPA axis and noradrenergic responses to stress. Alterations in glucocorticoid secretion and glucocorticoid receptor sensitivity are postulated to play a role in the development of psychiatric disorders and the mechanism of action of antidepressant medication.

Krystyna Nazar et al., (1989) in their study observed that ten healthy male subjects took part in the study. They performed three consecutive bouts of static handgrip at 30% of maximum voluntary contraction (MVC), using two hands alternately and without rest intervals. Blood pressure was measured every 30 s and ECG was recorded continuously. Blood samples for arginine vasopressin (AVP), growth hormone (GH), adrenocorticotrophic hormone (ACTH) and cortisol determinations were taken at rest, after each exercise bout, as well as at 10 and 30 min after the last one. During the whole period of exercise (9 min) blood pressure and heart rate were elevated. The effort caused a significant increase in the plasma AVP concentration. In the majority of subjects the peak values occurred after the first or second exercise bout and were followed by a rapid decline of the hormone concentration. Changes in GH, ACTH and cortisol concentrations were insignificant; however, in seven of the ten subjects, considerably elevated plasma GH levels were found at the end of the third exercise bout and/or 10 min after its cessation.
Patricia (2011) study of Increase Run Speed: Therefore, in order to increase running speed in the right way, it is important to first build strength and stamina, through regular running sessions. Once you are comfortable running for about 30 to 45 minutes at a stretch, without getting yourself exhausted, you can start timing yourself during every session, to see if your running speed has improved or not. Apart from daily timed-running sessions, there are certain exercises that can also help increase the running speed. Athletes that belong to different fields of sports are often seen practicing exercises like hip joint flexions, hip joint extensions, step ups, hamstring curls, heel raises and lunges, to increase movement speed. Running in deep sand is also a way of utilizing the bulky calf muscles for additional running speed.

Kanwaljeet Singh et. al., (2010) of their observation and assess the effects of selected meditative asanas on kinesthetic perception and movement speed. Material and methods: Thirty randomly selected male students aged 18 - 24 years volunteered to participate in the study. They were randomly assigned into two groups: A (meditative) and B (control). The Nelson's movement speed and reaction test and horizontal space test (to assess the kinaesthetic ability to determine specific positions along the horizontal line) were applied. The subjects from Group A were subjected to 8-week training of meditative asanas which included Padmasana, Siddhasana, Sukhasana, Vajrasana and Ushtrasana. The kinaesthetic perception and movement speed significantly (p<0.001) improved (by nearly 10%) in Group A compared with the control one. Conclusions of training asanas may be recommended to improve concentration- based performance.
Jessica Zarcone, CYT (2009) study on yoga for athletes, for thousands of years, people have been using yoga to stay “flexible” both physically and mentally, making it ideal for athletes. An athlete’s body and mind must remain in peak condition. Yes, yoga does more, much more, than help you find inner peace.

With yoga spreading like wildfire in the athletic community (approximately 20 million Americans practice today), it is an important regimen with several benefits. Yoga is very gentle, is it practiced at a pace that suit’s you. Most athletes are familiar with the “no pain, no gain” attitude, necessary to build strength and speed. It serves them well and produces results. However if durability and flexibility are ignored, or injury and age are concerns, this aggressive approach can be counter productive. A gentler approach thru yoga is in fact the best way to utilizes strength to increase flexibility, as muscles grow stronger; they become more flexible and speed movement. The saying in yoga goes “If you feel pain, there’s no gain “.

Ryan Allen (2008) study on article “Running into Yoga”, I.S.I. (International Sportsmedicine Institute) in West Los Angeles serves as a training ground for many world-class athletes. Brígita Langerholc, who placed 4th in her 800-meter event in the 2000 Olympics in Sydney, has incorporated yoga into her training on and off over the past six years. Although it has improved her flexibility, she places more value on her yoga practice as a relaxation technique and for heightening awareness of her breath when running. Dr. Christopher
Vincent is one of Langerholc's trainers and a resident physician at I.S.I., specializing in sports medicine. Distance runners, says Dr. Vincent, tend toward tightness in the chest, shoulders and upper neck, as well as weaknesses in the hips and feet. The strengthening influence that yoga has on the feet can be very valuable to runners. When an I.S.I. yoga instructor is informed that a student is a runner, the instructor will pay close attention to the student's feet to make certain they are aligned and working in all the postures. Dr. Vincent also cites yoga as way to help runners with core strengthening since running forces athletes to work the major muscles, while the stabilizers (tendons, ligaments and minor muscles) are often neglected. Through yoga, balance and coordination are developed.

Harinath, K., et al. (2004) investigated their yoga methods. Thirty healthy men were randomly divided in two groups. Group 1 subjects served as controls and performed body flexibility exercises for 40 minutes and slow running for 20 minutes during morning hours and played games for 60 minutes during evening hours daily for 3 months. Group 2 subjects practiced selected yogic (postures) for 45 minutes. RESULTS: Yogic practices for 3 months resulted in an improvement in cardio respiratory performance and psychological profile. The plasma melatonin also showed an increase after three months of yogic practices.

Telles S., et al., (2000) study on Oxygen consumption and respiration following two yoga relaxation techniques. Two yoga practices, one combining "calming and stimulating" measures and the other, a "calming" technique, were
compared. The oxygen consumption, breath rate, and breath volume of 40 male volunteers were assessed before and after sessions of cyclic meditation (CM) and before and after the sessions. RESULTS: There was a significant decrease in the amount of oxygen consumed and in breath rate and an increase in breath volume after both types of sessions. However, the magnitude of change on all 3 measures was greater after the calming and stimulating session:

1. Oxygen consumption decreased 32% compared with 10%;
2. breath rate decreased 18% versus 15%; and
3. breath volume increased 29% versus 16%. These results support the idea that a combination of yoga postures interspersed with relaxation reduces arousal more than relaxation alone.

**Bera, T.K. and Rajapurkar, M.V (1993)** studied on body composition, cardiovascular endurance and anaerobic power of yogic practitioner. Forty male high school students, age 12-15 yrs, participated in a study on yoga in relation to body composition, cardiovascular endurance and anaerobic power. The Ss were assigned to a yoga group and control group. Body composition, cardiovascular endurance anaerobic power were measured. RESULTS: The results revealed a significant improvement in ideal body weight, body density, cardiovascular endurance and anaerobic power following yoga.

**Madanmohan, et. al., (1992)** study there is evidence that the practice of yoga improves physical and mental performance. The present investigation was undertaken to study the effect of yoga training on visual and auditory reaction
times (RTs), maximum expiratory pressure (MEP), maximum inspiratory pressure (MIP), 40 mmHg test, breath holding time after expiration (BHTexp), breath holding time after inspiration (BHTinsp), and hand grip strength (HGS). Twenty seven student volunteers were given yoga training for 12 weeks. There was a significant (P < 0.001) decrease in visual RT (from 270.0 +/- 6.20 (SE) to 224.81 +/- 5.76 ms) as well as auditory RT (from 194.18 +/- 6.00 to 157.33 +/- 4.85 ms). MEP increased from 92.61 +/- 9.04 to 126.46 +/- 10.75 mmHg, while MIP increased from 72.23 +/- 6.45 to 90.92 +/- 6.03 mmHg, both these changes being statistically significant (P < 0.05). 40 mmHg test and HGS increased significantly (P < 0.001) from 36.57 +/- 2.04 to 53.36 +/- 3.95 s and 13.78 +/- 0.58 to 16.67 +/- 0.49 kg respectively. BHTexp increased from 32.15 +/- 1.41 to 44.53 +/- 3.78s (P < 0.01) and BHTinsp increased from 63.69 +/- 5.38 to 89.07 +/- 9.61 s (P < 0.05). Our results show that yoga practice for 12 weeks results in significant reduction in visual and auditory RTs and significant increase in respiratory pressures, breath holding times and HGS.

*Tran MD, et. al., (2001)* study on Ten healthy, untrained volunteers (nine females and one male), ranging in age from 18-27 years, were studied to determine the effects of hatha yoga practice on the health-related aspects of physical fitness, including muscular strength and endurance, flexibility, cardiorespiratory fitness, body composition, and pulmonary function. Subjects were required to attend a minimum of two yoga classes per week for a total of 8 weeks. Each yoga session consisted of 10 minutes of pranayamas (breath-control exercises), 15 minutes of dynamic warm-up exercises, 50 minutes of asanas (yoga postures), and 10 minutes of supine relaxation in savasana (corpse pose).
The subjects were evaluated before and after the 8-week training program. Isokinetic muscular strength for elbow extension, elbow flexion, and knee extension increased by 31%, 19%, and 28% (p<0.05), respectively, whereas isometric muscular endurance for knee flexion increased 57% (p<0.01). Ankle flexibility, shoulder elevation, trunk extension, and trunk flexion increased by 13% (p<0.01), 155% (p<0.001), 188% (p<0.001), and 14% (p<0.05), respectively. Absolute and relative maximal oxygen uptake increased by 7% and 6%, respectively (p<0.01). These findings indicate that regular hatha yoga practice can elicit improvements in the health-related aspects of physical fitness.

Stan Reents, Pharm, D (2011) study on Yoga enthusiasts participate in this type of exercise in hopes of reaping benefits like improved muscle tone and strength, better balance and greater flexibility. However, according to the Runner's World article, yoga is a great addition to the training program for runners. After 8 weeks, the following improvements were in Muscular Strength: triceps (elbow extension) strength increased by 31%, biceps (elbow flexion) strength increased by 19%, quadriceps (knee extension) strength increased by 28%. In Muscular Endurance: muscular endurance (measured by knee flexion) increased by 57%, muscular endurance (measured by knee flexion) increased by 57%. Flexibility: ankle flexibility increased by 13%, shoulder elevation increased by 155%, trunk extension (leaning backwards) increased by 188%, trunk flexion (bending forward at the waist) increased by 14%.

Lori Newell (2001) study, there are many forms and styles of yoga. There are even more reasons why people start yoga practice. No matter what
form you study the goal of yoga is to create a mind-body connection and increase awareness of how the body is responding to the yoga practice. Yoga can be very gentle or very vigorous. More vigorous forms of yoga can not only connect the body and mind but also build muscular strength.

Sharma, S.N & N.S. Mann (1990) expressed on their studies to compare the effect of yoga and proprioceptive Neuro-muscular Facilitation (PNF) technique in improving the hip joint flexibility. The study was conducted on seventy two boys ranging between 14 to 16 years of age.

They were randomly divided into three groups, consisting of twenty-four subjects each. They were conducted on alternative days per week for each group for eight weeks. They were measured right and left hip joint flexion before and after the experiment. Analysis of variance was carried out to find out the significant difference between the three groups. As the ‘F’- ratio was found significant; the Scheffe’S post-hoc test was applied to find out significant difference the paired means.

Thankamma Ommen (1981) investigate the comparison of isometrics, yogic physical culture and combination training on body composition, and physical fitness status of high school boys. It was shown that all the three exercise groups show a significant increase I “toe-touching” scores. The inter groups differences show that yogic physical culture groups is more helpful in developing flexibility than the isometric and combination group. An in
dynamic flexibility, comparatively, yogic exercises are the best in developing dynamic flexibility.

Mastrangelo, M.A. et. al., (2007) presented in this article a series of six case studies of women who practised Iyengar Yoga for menopausal symptoms. The women ranged in age from 44 to 62; all six were taking non-prescription supplements for symptom reduction, and one was on hormone replacement theory. The women participated in a 70-minute Iyengar Yoga class, taught by a registered Yoga teacher, twice a week for eight weeks with order of all Asanas. The women were also encouraged to practice at home, and were given guidelines for several shorter practices. All six women attended all classes, and five women reported practicing at home.

The researchers measured two main variables before and after the 8-week program. The Menopausal Specific Quality of Life (MSQOL) survey measured vasomotor, psychosocial, physical, and sexual functioning, and the sit-and-reach test assessed hamstring flexibility. (Given the forward-bending emphasis of the asana practice, this seems like a reasonable outcome to assess, although its theoretical relationship to quality of life in menopause is not as clear).

Five participants reported a decrease in menopausal symptoms and an increase in quality of life following the 8-week program. Four participants showed improvement on the sit-and-reach test (one participant injured herself in an activity not related to Yoga practice, and was unable to repeat the test).
The authors acknowledge the limitations of a small case study approach. However, these results do provide support for the funding of larger clinical trials with control groups. The researchers should also be commended for providing a clear description of the Yoga practice, so that other Yoga teachers and researchers can build on this work.

Allen W. Jackson and Alice A. Baker(1986) investigated to determine the relationship of the sit and reach test was measures of back and hamstring flexibility of young female (n=100) with a mean age of 14.80 years. The measurement included the sit and reach test, passive hamstring flexibility and back flexibility. The result indicated that the sit and reach test had an ATTN: Reference: moderate relationship with passive hamstring flexibility. But appears not to provide a valid assessment of back and in particular low back flexibility.