CHAPTER II

REVIEW OF RELATED LITERATURE
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An essential aspect of a research is the review of the related literature. In the word of Good, “The key to the vast store house of published literature may open the doors to sources of significant problems and explanatory hypothesis, and provide helpful orientation for definition of the problem, background for selection of
procedure, and comparative data for interpretation of results. In order to be truly
creative and original, one must read extensively and critically as stimulus thinking”.

For any specific research project to occupy a place in the development of a
discipline, the researcher must be thoroughly familiar with both previous theory and
research. The literature related to any problem helps the scholar to discover what is
already known, which would enable the investigator to have a deep insight, clear
perspective and a better understanding of the chosen problem and various factors
connected with the study. So a number of books, journals, and websites were referred.
In the following pages, an attempt has been made to present briefly a few of the
important researches and studies conducted abroad and in India, as they have
significant bearing on the present study.

The literature in any field forms the foundation upon which all future work
will be built. If we fail to build upon the foundation of knowledge provided by the
review of literature, the researcher might miss some works already done on the same
topic. The reviews of the literatures were classified under the following headings as
chronological order.
1. Studies on Biochemical Variables
2. Studies on Selected Physical Fitness Variables
3. Studies on Selected Physiological Variables
4. Studies on Selected Psychological Variables

2.1 Studies on Selected Biochemical Variables

Oliver et al (2015) the purpose of this study dyslipidemia is one factor cited for increased risk of cardiovascular disease (CVD) in American football players. This study inspected if the physical activity of an American football session is associated with changes in lipids and if a bone exists between lipids and body composition. Samples Fourteen division I freshmen American football players had blood drawn preceding to summer training (T1), end of competition (T2), and end of spring training (T3). Samples were investigated for total cholesterol (TCHL) HDL-C, LDL-C, and triglycerides (TG). National cholesterol education was used to contributors. Person correlation were computed relationship. However result is the physical activity related with a session of football effects in little changes in blood lipids and cardiovascular disease.

Pilch et al (2015) in this study entitled “The aim of the work was to assess the effects of a program of physical activity applied to postmenopausal women regarding enhancement of their body composition and biochemical indices of lipid and carbohydrate eminence”. The program of physical activity limited 12-week trainings of Nordic walking (NW) and gymnastic-dance classes (G-D). The intensity of effort during the NW training was at the level of 60% HRmax, however intensity of G-D exercises was selected based on a subjective valuation of Sports Medicine. The applied 12-week program of physical activity without changes of dietary habits contributed to
an improvement in plasma lipid profile and an increased insulin sensitivity, but it did not significantly affect body composition.

_Udhayashankar (2014)_ Determined the study was to investigate the effect of selected gymnastics trampoline skills training programme on lipid profiles of adolescents. It was hypothesized that there would be a significant effect of six weeks specific selected gymnastics trampoline skills training on selected lipid profiles of adolescents. For The present study the subjects were 30 male college students from Periyar University College of arts and science, Mettur, Salem, Tamilnadu were selected as subjects at random and their age ranged from 18 to 25 years. For The present study pre test – post test randomized group design which consists of control group and experimental group was used. The subjects were randomly assigned to two equal groups of fifteen each and named as Group ‘A’ and Group ‘B’. Group ‘A’ underwent specific selected gymnastics trampoline skills training and Group ‘B’ underwent no training. The data was collected before and after six weeks of training. The data was analyzed by applying Analysis of Co-Variance (ANCOVA) technique to find out the effect of selected gymnastics trampoline skills training programme on lipid profiles of adolescents. The level of significance was set at 0.05. The findings of the present study have strongly indicated that specific selected gymnastics trampoline skills training of six weeks have significant effect on selected lipid profiles i.e., HDL and LDL of college men. Hence the hypothesis earlier set that specific selected gymnastics trampoline skills training would have significant effect on selected lipid profiles in light of the same the hypothesis was accepted.
Cramer et al (2014) the presentation of this research article review was to systematically assess and meta-analyze the effects of yoga on modifiable biological cardiovascular disease risk factors in the general population and in high-risk disease groups. The Cochrane Library and Ind MED were screened through August 2013 for randomized controlled trials (RCTs) on yoga for predefined cardiovascular risk factors in healthy participants, participants with type 2 diabetes mellitus. Relative to usual care or no intervention, yoga improved systolic (mean difference (MD)=-5.85 mm Hg; 95% confidence interval (CI)=-8.81, -2.89) and diastolic blood pressure (MD=-4.12 mm Hg; 95%CI=-6.55, -1.69), heart rate (MD=-6.59 bpm; 95%CI=-12.89, -0.28), respiratory rate (MD=-0.93 breaths/min; 95%CI=-1.70, -0.15), waist circumference (MD=-1.95 cm; 95%CI=-3.01, -0.89), waist/hip ratio (MD=-0.02; 95%CI=-0.03, -0.00), total cholesterol (MD=-13.09 mg/dl; 95%CI=-19.60, -6.59), HDL (MD=2.94 mg/dl; 95%CI=0.57, 5.31), VLDL (MD=-5.70 mg/dl; 95%CI=-7.36, -4.03), triglycerides (MD=-20.97 mg/dl; 95%CI=-28.61, -13.32), HbA1c (MD=-0.45%; 95%CI=-0.87, -0.02), and insulin resistance (MD=-0.19; 95%CI=-0.30, -0.08). Relative to exercise, yoga improved HDL (MD=3.70 mg/dl; 95%CI=1.14, 6.26). This meta-analysis revealed evidence for clinically important effects of yoga on most biological cardiovascular disease risk factors.

Apostolidis et al (2014) conducted the study the lipid profile of elite basketball and soccer athletes was evaluated and compared with that of inactive individuals. Total cholesterol (T-C), low and high density lipoprotein cholesterol (LDL-C and HDL-C), and triglyceride (TG) concentration were measured in the morning and after a soccer or a basketball match. All parameters of lipid profile measured at a fasted and resting state, except HDL-C, were lower in the athletes compared with the controls (p < 0.01).
The soccer match resulted in a greater decrease in TG (78.3 ± 6.7 to 70.7 ± 6.3, p < 0.01), T-C (179.3 ± 10.7 to 171.6 ± 9.6, p < 0.01), LDL-C (110.9 ± 8.9 to 103.5 ± 7.5, p < 0.01) compared with the basketball match that resulted only in a decrease in LDL-C (126.8 ± 9.5 to 117.3 ± 9.1, p < 0.01) and an increase in HDL-C that was similar to that observed after the soccer match (9-12%).

Miles et al (2013) opined Yoga is qualitatively different from any other mode of physical activity in that it consists of a unique combination of isometric muscular contractions, stretching exercises, relaxation techniques, and breathing exercises. In particular, yoga postures consist of systemic isometric contractions that are known to elicit marked increases in mean blood pressure that are not observed during dynamic exercise. Stretching can also induce increases in blood pressure and sympathetic nerve activity in the muscles. Currently, not much is known about changes in blood pressure and other cardiovascular responses to yoga practice. Thirty-six apparently healthy, nonobese, sedentary, or recreationally active individuals from the community participated in the study. The intervention comprised one session of yoga practice, in which participants followed a custom made instructional video providing a yoga routine that consisted of a series of 23 Hatha-based yoga postures. Prior to arriving at the laboratory, each participant completed a research health questionnaire, a training-status questionnaire, and a yoga-experience questionnaire. Prior to the yoga practice, each participant's height, body fat percentage, trunk or lumbar flexibility, and arterial stiffness as assessed by carotid femoral Pulse Wave Velocity (cfPWV) were measured., the study continuously measured systolic blood pressure and diastolic blood pressures, heart rate, stroke volume, and cardiac output during each postures. Systolic blood pressure and diastolic blood pressures increased significantly during the yoga practice. Heart rate
and cardiac output increased significantly during yoga practice, especially with standing postures. The results was that a variety of Hatha yoga postures, especially standing postures, evoked significant increases in blood pressure.

**Huang et al (2012)** The purpose of this quasi-experimental study was to determine the efficacy of Five-Element Gymnastics (FEG) in controlling glycosylated hemoglobin (HbA1C), total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and triglycerides (TG) at the 8th and the 16th weeks of intervention for patients with type 2 diabetes in Taiwan. FEG consolidates several traditional Chinese exercises including Qigong, Xiang Gong, and martial arts with gymnastics. The experimental group (n = 31) practiced FEG at home for 16 weeks. The control group (n = 35) maintained usual activities. FEG was associated with decrease of HbA1C, TG, and LDL-C levels at the 8th week and continuous decrease of HbA1C through the 16th week. FEG could be an exercise choice for patients with type 2 diabetes.

**Madanmohan et al (2012)** Determined the effective study was undertaken to evaluate the effect of yoga therapy on reaction time, biochemical parameters and wellness score of pre and post-menopausal diabetic patients.15 pre and post-menopausal patients receiving standard medical treatment for type 2 DM were recruited and reaction time and biochemical investigations were done before and after a comprehensive yoga therapy program comprising of three times a week sessions, for six weeks. A post-intervention, retrospective wellness questionnaire compiled by ACYTER was used to evaluate the comparative feelings of the patients after the therapy program. Yoga training reduced Auditory Reaction Time (ART) from right as well as left hand, the decrease being statistically significant ($P<0.05$) for ART from the right
hand. There was a significant ($P<0.01$) decrease in fasting and postprandial blood glucose levels as well as low density lipoprotein. The decrease in total cholesterol, triglycerides, and very low density lipoprotein and increase in high density lipoprotein was also statistically significant ($P<0.05$). All the lipid ratios showed desirable improvement with a decrease ($P<0.01$) of TC/HDL and LDL/HDL ratios and increase ($P<0.05$) in the HDL/LDL ratio. Shortening of RT implies an improvement in the information processing and reflexes and is the first such report in diabetic patients. This has clinical significance and is worth further exploration with wider, well controlled, randomized studies in the diabetic population. Changes in blood glucose levels may be due to improved insulin sensitivity, decline in insulin resistance and increased sensitivity of the pancreatic β cells to glucose signals. Yoga improved the ‘heart friendly’ status of lipid profile in our subjects and as our participants were pre and post-menopausal, the decrease in cardiovascular risk profile is of greater significance. A comprehensive yoga therapy program has the potential to enhance the beneficial effects of standard medical management of diabetes mellitus and can be used as an effective complementary or integrative therapy program.

Seo et al (2012) The purpose of The present study was to test the effect of an 8-week of yoga-asana training on body composition, lipid profile, and insulin resistance (IR) in obese adolescent boys. Twenty volunteers with body mass index (BMI) greater than the 95th percentile were randomly assigned to yoga (age 14.7±0.5 years, n=10) and control groups (age 14.6±1.0 years, n=10). The yoga group performed exercises three times per week at 40–60% of heart-rate reserve (HRR) for 8 weeks. IR was determined with the homeostasis model assessment of insulin resistance (HOMA-IR). After yoga training, body weight, BMI, fat mass (FM), and body fat % (BF %) were significantly decreased, and fat-
free mass and basal metabolic rate were significantly increased than baseline values. FM and BF % were significantly improved in the yoga group compared with the control group (p<0.05). Total cholesterol (TC) was significantly decreased in the yoga group (p<0.01). HDL-cholesterol was decreased in both groups (p<0.05). No significant changes were observed between or within groups for triglycerides, LDL-cholesterol, glucose, insulin, and HOMA-IR. Our findings show that an 8-week of yoga training improves body composition and TC levels in obese adolescent boys, suggesting that yoga training may be effective in controlling some metabolic syndrome factors in obese adolescent boys.

**Kamal Mansi et al (2008)** the presentation of research article was carried out to assess the lipid pattern in gymnasts of the Jordan National Team. Twelve athletes representing the National Gymnastics team (4 males and 8 females, mean age 18±1 year) were included in this study. The training period for them is not less eight years during which they trained 18 hours weekly at least. A group of healthy males and females matched for age and gender was included as control group (n = 20). No subject had evidences of cardiovascular disease, diabetes and blood pressure. The body mass index (BMI) of the female was significantly (p<0.5) lower than that of the control (22.5±3.21, 18.9±0.9 respectively). It was found that the majority of the males had lower total cholesterol, triglycerides, and great decreasing in LDL cholesterol and significantly (p<0.5) rising in HDL cholesterol, (164.3±19.8, 85.9±34.3, 49.8±6.5, 80.4±30.8 respectively) comparing to the control group (186.6±20.7, 171.6±34.3, 44.5±5.7, 127.2±18.2 respectively). In female a similar fashion of lipid profile was also found with a great reduction in LDL-C level. Our result suggest that gymnastics exercise affect blood cholesterol and other lipids in a positive way, by regulating the metabolism of all lipids in the blood and increasing fat oxidation during training results in an adaptive mechanism.
for body weight maintenance. Also increasing HDL-C level in male and female gymnasts has protective value against cardiovascular diseases such as ischemic stroke and myocardial infarction by carrying cholesterol from the body's tissues and remove cholesterol from atheroma within arteries and transport it back to the liver for excretion or re-utilization.

Kishli et al (2005) The aim of this study was to compare plasma lipid and lipoprotein concentrations of male and female subjects in different training levels and to examine the risks of cardiovascular diseases. For this purpose, 20 male athletes from the National Turkish Wrestling Team (age 23.5 +/- 1.25 years) and 44 male and 51 female students (ages 21.7 +/- 1.72 and 20.20 +/- 1.68 years, respectively) from physical education and sports department and 40 sedentary females (ages 21.14 +/- 1.72 years) participated in this study. Triglyceride (TG), total cholesterol (TC), HDL-C and LDL-C levels were determined by a Hitachi 717 Autoanalyser. Apo A-I, Apo B, and Lp(a) levels were determined by Behringer Nephelometer 100. Maximum Oxygen Consumption (VO(2) max) values were determined by 12-min run test and the anaerobic power values were measured by Jump Meter Instrument. Energy consumption of basal metabolic rates were for males 1 kcal for an hour and 0.9 kcal for females. There were no significant differences in plasma TC, TG, and small lipoprotein a (Lp(a)) values between four groups (p > .05). No significant differences were found in HDL-C, LDL-C, apolipoprotein Al (Apo-Al), and apolipoprotein B100 (Apo-B) values between wrestlers and male students, and between female students and sedentary females (p > .05). HDL-C values of female students and sedentary females were significantly higher when compared with the same values of wrestlers and male students (41.52 and 40.93 mg/100 ml versus 51.92 and 50.10 mg/100 ml). However, LDL-C
values were found to be lower in females than males (121.83 and 101.10 mg/100 ml as opposed to 97.7 and 98.4 mg/100 ml) but only significantly lower than in wrestlers (p < .05). Although the wrestlers' training levels were always higher than male students, the lipid and lipoprotein values were not different. These variables were not different between female groups either. But the lipid and lipoprotein profile of female subjects was found to be better than that of males. These results showed that medium and high level of exercises did not cause significant differences in lipid and lipoprotein levels, but the sex differences were very pronounced. Lipid and lipoprotein values of the four groups have indicated that the individuals in these groups would not be exposed to danger of cardiovascular diseases.

Ohtani et al (2005) administered the various athletic performance affected by the individual amino acid supplementation. However, little information on combinations of amino acids is currently available. This study evaluated an amino acid mixture containing L-leucine, L-isoleucine, L-valine, L-arginine, and L-glutamine to 3.6 g of total amino acids per dose. Twenty-three rugby players were given 3.6 g, twice, daily of the amino acid mixture for 90 days (June-August 1994) and blood samples were collected for analyses in September 1993, March 1994, September 1994, and September 1995. After 90 days of supplementation, almost all of the athletes reported improvement in vigor and earlier recovery from fatigue. Significant increases (P<0.05) were observed in hemoglobin, RBC count, hematocrit, and serum iron by amino acid supplementation. Significant increases (P<0.05) were also noted in total cholesterol and low-density lipoprotein along with decreased (P<0.05) alkaline phosphatase. All values reverted to original levels when measured after one year of continued training without supplementation.
Evelson et al (2002) Even if physical activity constitutes a well-known antiatherogenic factor, the precise mechanisms underlying this protective effect are not completely clear. Lipid and antioxidant profiles were evaluated in 15 well-trained rugby players and 15 sedentary controls. Lipoprotein fractions were separated by sequential ultracentrifugation and alpha-tocopherol content was determined in each fraction by high-performance liquid chromatography. Susceptibility to in vitro oxidation was also measured in intermediate and low density lipoproteins isolated from both groups of subjects as the production of conjugated dienes. Although the sportsmen were not receiving any special diet or vitamin supplementation they showed a slightly improved lipoprotein profile, mainly represented by increased high density lipoprotein-cholesterol levels ($P < 0.05$), and an enhanced antioxidant status. The latter was evidenced by an increment in total radical antioxidant potential ($P < 0.001$), higher ascorbic acid ($P < 0.005$) and alpha-tocopherol ($P < 0.05$) plasma concentrations, and elevated activities of superoxide dismutase ($P < 0.001$) and arylesterase ($P < 0.01$). Moreover, only the fraction of intermediate and low density lipoproteins from rugby players presented higher alpha-tocopherol content in comparison with sedentary controls (484 +/- 67 vs. 377 +/- 123 microg dL(-1), respectively; $P < 0.01$). Nevertheless, the susceptibility to in vitro oxidation of this lipoprotein fraction was not different between both groups. Given that intermediate density and low density lipoproteins represent the most atherogenic fraction, this finding, in combination with the improved lipid and antioxidant status, would add to the link between regular physical activity and protection against cardiovascular disease.
The aim of the present study is to evaluate the lipid profile and some parameters of oxi-redox status in a group of teenage female athletes. All gymnasts of the Portuguese National Team of Rhythmic (n=20) were included in the study. A group of untrained healthy female adolescents, matched for age, was also included (n=28). Auxology, nutritional status and body composition were evaluated as well as biological parameters, dietary and training habits. Statistics included descriptive analysis, t-Student and Mann-Whitney for comparative study, and Pearson and Spearman correlations, according to variable distribution. Chronological age was 14.3±1.7 and 14.6±1.7 years, respectively for gymnasts and untrained adolescents. Gymnasts showed lower body mass index (p<0.001) and fat mass (p<0.001) and also a hypoenergetic diet, with higher supply in protein (p<0.05) and saturated fat (p<0.01). Lipid profile showed higher HDL-cholesterol (p<0.01) and lower apo B values (p<0.001) in gymnasts, compared to untrained. Red blood cell's enzymes studied were higher for transmembrane NADH reductase of ferricyanide (TMR), (p<0.01), methaemoglobin reductase (MetHbRed), (p<0.01), and low-molecular weight protein tyrosine phosphatase (LMW-PTP), (p<0.0001) in untrained adolescents. Susceptibility of LDL to peroxidation (LDL-TBARS) were higher in gymnasts (76.3±20.3 microM/l versus 35±21.7 microM/l), (p<0.001). Correlations were positive and significant in both gymnasts and untrained, between LDL-TBARS and LDL-cholesterol (r=0.674, p<0.01 and r=0.544, p<0.05 respectively) and apolipoprotein B (r=0.721, p<0.001 and r=0.659, p<0.01, respectively). LDL-TBARS were negative and significantly correlated to TMR (t=-0.608; p<0.01) only in gymnasts. The authors conclude that the practice of intense physical exercise in rhythmic gymnasts induces a compromise of nutritional status and unbalanced food habits. The intensive exercise induces not only

**Guerra et al (2001)**
a protective lipid profile, but also a higher lipid peroxidation. Further prospective studies are important to evaluate the influence of intensive training on atherosclerosis development.

**Guerra et al (2000)** Physical exercise may in vivo promote an increase of free radical formation. Low-density lipoproteins (LDL) are highly susceptible to oxidation, probably because of their high polyunsaturated fatty acid content, since lipid oxidation is an important factor in the genesis and development of atherosclerosis. The aim of The present study is to evaluate the effect in a group of adolescent gymnasts, of intense and regular physical exercise on lipid profile and redox status. All members of the Portuguese National Team of Rhythm Gymnastics (1996) (n = 20). Clinical evaluation, Anthropometric evaluation: weight, height, triceps, biceps, subcapular and supra- and supra-iliac skinfolds. NCHS were used as the standard of reference for weight and height, and Frisancho for the sum of skinfolds; Evaluation of nutritional status (Quetelet body mass index) and body composition (Durnin and Siri). Evaluation of biological parameters: a blood sample was collected after 12 hours fasting and 24 hours detraining, to evaluate Lipid profile: total cholesterol, high (HDL) and low (LDL) density lipoproteins, triglycerides, apolipoproteins A1 and B, were measured using internationally recommended laboratory methods; Plasma trace elements: zinc, copper and selenium, by atomic absorption; Red blood cell enzymes; transmembranar reductase (TMR), metahemoglobin reductase (MethaHbRed) and acid phosphatase, by spectrophotometry; Redox status: MDA and MDA-LDL were evaluated by spectrophotometry. Evaluation of eating habits: 24 hr recall. Chronological age is 14.3 +/- 1.7 years. Nutritional assessment shows a mean value for height near the 50th percentile (99% +/- 3.8), and low mean values respectively for BMI (89.3% +/- 9)
and sum of triceps and subscapular skinfolds (51.9% +/- 14). Study of lipid profile shows low mean values for total cholesterol (162.3 mg/dl +/- 27.7) LDL-cholesterol (87.6 mg/dl +/- 22.6) and Apo B (64.4 mg/dl +/- 11.5), but high values for HDL-cholesterol (61.3 mg/dl +/- 14.5) and Apo A1 (173.1 mg/dl +/- 25.1). We observe higher values for total cholesterol and LDL-cholesterol in those with lower Cu plasmatic levels. We also observe a negative significative correlation between MDA-LDL and Zn (r = -0.469), Cu (r = -0.524) and RTM (r = -0.608). The AA concluded that in this group of gymnasts intense physical exercise induces, a favorable lipid profile, but a clear susceptibility to LDL peroxidation in those with lower plasma Cu and Zn values. It is possible that the negative correlation observed between MDA-LDL and TMR is caused by higher consumption of TMR induced by the action of exercise on the oxidative system.

**Levchenko KP and Fruentov Nk (1976)** Control of forty six sportmen-wrestlers determined that the loss in weight accounting for 3.5% leads to a certain reduction of no esterified fatty acids (NEFA) in venous blood and to a significant increase in the content of esterified fatty acids (EFA), beta-lipoproteids, phospholipids and cholesterol. Analogous as to the trend (excluding NEFA) but a little less pronounced changes these values occur after physical load on sportmen who did not undergo dehydration. Under conditions of dehydration a 40-minute work on veloergograph caused additional changes in the values under study. An hour after finishing the physical work the total level of lipids as well as of their fractions such as beta-lipoproteids, EFA and cholesterol remains considerably higher than that in the control. Thus, the loss in weight itself as to the character of the changes arising in the
lipid metabolism is to some extent similar to physical load suffered by a sportsman organism and therefore may exert unfavorable effect on the working capacity.

2.2 Studies on Selected Physical Fitness Variables

Amit Anurag (2015) investigated this study was the comparison of physical & physiological variables between Gymnast and Mallakhamb players. Physical fitness variables consists of grip strength & abdominal strength whereas physiological variables consist of vital capacity and maximum breath holding capacity. The results of this study as far as differences are concerned the significant differences are found in grip strength and abdominal strength and Gymnast were observed better in both components. It is recommended that elite players may be undertaken for further study, it will also be helpful for identification of talents for sports.

Pion et al (2015) This study investigated the link between the anthropometric, physical and motor characteristics assessed during talent identification and dropout in young female gymnasts. 3 cohorts of female gymnasts (n=243; 6-9 years) completed a test battery for talent identification. Performance-levels were monitored over 5 years of competition. Kaplan-Meier and Cox Proportional Hazards analyses were conducted to determine the survival rate and the characteristics that influence dropout respectively. Kaplan-Meier analysis indicated that only 18% of the female gymnasts that passed the baseline talent identification test survived at the highest competition level 5 years later. The Cox Proportional Hazards Model indicated that gymnasts with a score in the best quartile for a specific characteristic significantly increased chances of survival by 45-129%. These characteristics being: basic motor skills (129%), shoulder strength (96%), leg strength (53%) and 3 gross motor coordination items (45-73%). These results suggest that tests batteries commonly used for talent identification in young female gymnasts may
also provide valuable insights into future dropout. Therefore, multidimensional test batteries deserve a prominent place in the selection process. The individual test results should encourage trainers to invest in an early development of basic physical and motor characteristics to prevent attrition.

**Bordalo (2015)** The present study aimed to assess the effects of two different sports training methods - traditional and maturational - on the flexibility of female rhythmic gymnasts at different levels of biological maturation. The sample consisted of 120 children, randomly divided (by draw) into six groups of 20 children (eight and nine-years old): traditional training group (TG); maturational training group (MG); and the control group (CG). These were subdivided into early, normal and late, based on biological maturation assessment by hand/wrist X-ray examination. Flexibility was evaluated by angle goniometer testing, applying the LABIFIE protocol. A Lafayette Goniometer Set and Hoorn-Brasil exercise mat were used and the following exercises were performed: external shoulder rotation (ESR) and lumbar flexion (LF). Both the TG and MG participated in twice-weekly, 45-minute rhythmic gymnastics classes over 16 weeks. The TG used the traditional sports training method while the MG executed sporting activities according to biological maturation. The CG received no special treatment. The results showed a significant improvement (P<0.001) in the subgroups (late, normal and early) for both variables (ΔESR=7.54° and ΔLF=7.51°) in the eight and nine-year age groups. Moreover, in relation to division by biological maturity, better results were recorded in the early subgroups. Thus, it can be inferred that, due to the changes in important physical parameters as a result of maturation, selecting children for physical education should not be based solely on chronological, but primarily on biological maturation.
Dallas et al (2014) the purpose of this study was to investigate the acute effects of 3 different warm up methods of stretching, on flexibility and legs power-jumping performance in competitive artistic gymnasts. Eighteen competitive artistic gymnasts were recruited to participate in this study. Subjects were exposed to each of 3 experimental stretching conditions: static stretching (SS), proprioceptive neuromuscular facilitation stretching (PNF), and stretching exercises on a Vibration platform (S+V). Flexibility assessed with sit and reach test (S & R) and jumping performance with squat jump (SJ) and counter movement jump (CMJ) and were measured before, immediately after and 15 min after the interventions. Significant differences were observed for flexibility after all stretching conditions for S+V (+1.1%), SS (+5.7%) and PNF (+6.8%) (P=0.000), which remained higher 15 min after interventions (S+V (1.1%), SS (5.3%) and PNF (5.5%), respectively (P=0.000). PNF stretching increased flexibility in competitive gymnasts, while S+V maintained jumping performance when both methods were used as part of a warm-up procedure.

Hiley and Yeadone (2014) The upstart is a fundamental skill in gymnastics, requiring whole body coordination to transfer the gymnast from a swing beneath the bar to a support position above the bar. The aim of this study was to determine the solution space within which a gymnast could successfully perform an upstart. Examine this study, data were collected on a senior gymnast and a computer simulation model of a gymnast and bar was used to determine the solution space for maximizing success while operating in a noisy environment. The solution space for the senior gymnast was relatively large. Decreasing strength and increasing movement execution noise reduced the size of the solution space.
Donti, Tsolakis and Bogsanis (2014) This study examined the effects of baseline flexibility and vertical jump ability on straight leg raise range of motion (ROM) and counter-movement jump performance (CMJ) following different volumes of stretching and potentiating exercises. ROM and CMJ were measured after two different warm-up protocols involving static stretching and potentiating exercises. Three groups of elite athletes (10 male, 14 female artistic gymnasts and 10 female rhythmic gymnasts) varying greatly in ROM and CMJ, performed two warm-up routines. One warm-up included short (15 s) static stretching followed by 5 tuck jumps, while the other included long static stretching (30 s) followed by 3x5 tuck jumps. Three-way ANOVA showed large differences between the three groups in baseline ROM and CMJ performance. However, all athletes, irrespective of group, responded in a similar fashion to the different warm-up protocols for both ROM and CMJ, as indicated from the lack of significant interactions for group (condition x group, time x group or condition x time x group). In the short warm-up protocol, ROM was not affected by stretching, while in the long warm-up protocol ROM increased by 5.9% ± 0.7% (p = 0.001) after stretching. It is concluded that the initial levels of flexibility and CMJ performance do not alter the responses of elite gymnasts to warm-up protocols differing in stretching and potentiating exercise volumes. The initial levels of flexibility and vertical jump ability have no effect on straight leg raise range of motion (ROM) and counter-movement jump performance (CMJ) of elite gymnasts following warm-up protocols differing in stretching and potentiating exercise volumes. Stretching of the main leg muscle groups for only 15 s has no effect on ROM of elite gymnasts. In these highly-trained athletes, one set of 5 tuck jumps during warm-up is not adequate to increase CMJ performance, while 3 sets of 5 tuck jumps result in a relatively large
increase in CMJ performance (by 4.6% above baseline), despite a 5.9% increase in flexibility due to the 30 s stretching exercises.

Sekulic et al (2013) The quick change of direction agility is an important athletic ability in numerous sports. Because of the diverse and therefore hardly predictable manifestations of agility in sports, studies noted that the improvement in speed, power, and balance should result in an improvement of agility. However, there is evident lack of data regarding the influence of potential predictors on different agility manifestations. The aim of this study was to determine the gender-specific influence of speed, power, and balance on different agility tests. A total of 32 college-aged male athletes and 31 college-aged female athletes (age 20.02 ± 1.89 years) participated in this study. The subjects were mostly involved in team sports (soccer, team handball, basketball, and volleyball; 80% of men, and 75% of women), martial arts, gymnastics, and dance. Anthropometric variables consisted of body height, body weight, and the body mass index. Five agility tests were used: a t-test (T-TEST), zig-zag test, 20-yard shuttle test, agility test with a 180-degree turn, and forward-backward running agility test (FWDBWD). Other tests included 1 jumping ability power test (squat jump, SQJ), 2 balance tests to determine the overall stability index and an overall limit of stability score (both measured by Biodex Balance System), and 2 running speed tests using a straight sprint for 10 and 20 m (S10 and S20, respectively). A reliability analysis showed that all the agility tests were reliable. Multiple regression and correlation analysis found speed and power (among women), and balance (among men), as most significant predictors of agility. The highest Pearson's correlation in both genders is found between the results of the FWDBWD and S10M tests (0.77 and 0.81 for men and women, respectively; p < 0.05). Power, measured using the SQJ, is significantly (p <
related to FWDBWD and T-TEST results but only for women (-0.44; -0.41). The balance measures were significantly related to the agility performance for men but not for women. In addition to demonstrating a known relationship between speed and agility in both genders, and a small but statistically significant relationship between power and agility in women, these results indicate that balance should be considered as a potential predictor of agility in trained adult men.

**Janarthanan (2010)** the purpose of the study was to find out the relationship between selected physical fitness variables and mallakhamb performance of state level mallakhamb performers. To achieve the purpose of the study thirty mallakhamb performers were selected from TamilNadu Mallakhamb Association, Villupuram as subjects. The age groups of the subjects were ranged from 15 to 24 years. Among physical fitness variables only strength endurance, balance and flexibility were selected as independent variables. The mallkhamb performance was selected as dependent variables. The following test items were selected for the study to collect relevant data. The strength was assessed by conducting bend knee sit ups, balance was assessed through stork stand and flexibility was measured by sit and reach test respectively. The mallakhamb performance was assessed by adopting the subjective rating method. The person product moment correlation was used to find out the relationship between the selected physical fitness variables and mallakhamb performers for each variable separately. On the basis of the results obtained by statistically analysing the data on selected physical fitness variables strength endurance, balance, flexibility was significant relationship between mallakhamb performances of mallakhamb performers.

**Satbir Singh Sanga (2010)** The purpose of the study was to determine and compare physical fitness level and personality traits among male wrestlers, across their
level of participation. A random sampling of 150 male wrestlers was selected from colleges and universities of Haryana, at different level of participation, ie., inter-college, inter-district and inter-university/ national level, between the age group of 18 to 25 years. The data were collected through AAHPER fitness test revised (1976) and Cattell’s 16 personality factor questionnaire 91968) it has been observed and concluded that all the three groups significantly differ on six variables/ components of physical fitness namely pull up, sit up, shuttle run, standing broad jump, 50 yard dash and 600 yard run. Dimensions of personality traits were found at significant level, MONG ll the three groups, at various level of confidence. It was found that physical fitness and performance were too much –co-related with each other. Personality traits of tough mindedness, ego, strength, assertiveness, emotional stability, intelligence, willpower and self-confidence are helpful in better performance of wrestles. It has been observed that high achiever wrestler need management strategies, along with consideration of individuality, in team composition, physical fitness and psychological systematic training and their knowledge is essential for sports behaviors, which add in optimum level of performance.

**Bernasconi et al (2009)** The support scale at ring height, the swallow, is a difficult strength element, usually performed in gymnastics. Coaches try to simulate the swallow position during training to strengthen muscles, specifically in the position used for competition. However, the real effect of this position's simulation on muscle force and coordination and consequently on the muscle activity has not been determined. The purpose of the study was to compare muscle activity and coordination during a swallow performed on the rings, using a counterweight and during 2 training exercises using dumbbells or barbells, respectively. Six top-level gymnasts participated in the study.
Electromyograms from the biceps brachii, triceps brachii, deltoideus (clavicular part), pectoralis major, serratus anterior, infraspinatus, trapezius (middle part), and latissimus dorsi in the right shoulder were collected during the 4 exercises and analyzed using root mean square (RMS) and mean power frequency (MPF). The RMS were normalized to the maximal voluntary contraction, and a co-activation index was also determined between biceps and triceps brachii. Our results show specific shoulder muscle coordination for each exercise. As compared with the swallow on the rings, the pectoralis major participates less in shoulder flexion during the counterweight exercise, whereas the deltoideus is more activated during the dumbbells exercise (p < 0.05). The barbell exercise reduces the participation of the serratus anterior in stabilizing the scapula (p < 0.05). Training exercises must therefore be chosen with knowledge of the specific muscle coordination induced by each. The counterweight exercise preserves the pectoralis major. The barbell exercise reduces participation of the serratus anterior. The dumbbells exercise may be useful to prepare the rotator cuff muscles carefully for use.

Escamilla and Andrews (2009) Understanding when and how much shoulder muscles are active during upper extremity sports is helpful to physicians, therapists, trainers and coaches in providing appropriate treatment, training and rehabilitation protocols to these athletes. This review focuses on shoulder muscle activity (rotator cuff, deltoids, pectoralis major, latissimus dorsi, triceps and biceps brachii, and scapular muscles) during the baseball pitch, the American football throw, the windmill softball pitch, the volleyball serve and spike, the tennis serve and volley, baseball hitting, and the golf swing. Because shoulder electromyography (EMG) data are far more extensive for overhead throwing activities compared with non-throwing upper extremity sports, much of this review focuses
on shoulder EMG during the overhead throwing motion. Throughout this review shoulder
kinematic and kinetic data (when available) are integrated with shoulder EMG data to help
better understand why certain muscles are active during different phases of an activity, what
type of muscle action (eccentric or concentric) occurs, and to provide insight into the shoulder
injury mechanism. Kinematic, kinetic and EMG data have been reported extensively during
overhead throwing, such as baseball pitching and football passing. Because shoulder forces,
torques and muscle activity are generally greatest during the arm cocking and arm
deceleration phases of overhead throwing, it is believed that most shoulder injuries occur
during these phases. During overhead throwing, high rotator cuff muscle activity is generated
to help resist the high shoulder distractive forces approximately 80-120% bodyweight during
the arm cocking and deceleration phases. During arm cocking, peak rotator cuff activity is 49-
99% of a maximum voluntary isometric contraction (MVIC) in baseball pitching and 41-67%
MVIC in football throwing. During arm deceleration, peak rotator cuff activity is 37-84%
MVIC in baseball pitching and 86-95% MVIC in football throwing. Peak rotator cuff activity
is also high is the windmill softball pitch (75-93% MVIC), the volleyball serve and spike (54-
71% MVIC), the tennis serve and volley (40-113% MVIC), baseball hitting (28-39% MVIC),
and the golf swing (28-68% MVIC). Peak scapular muscle activity is also high during the arm
cocking and arm deceleration phases of baseball pitching, with peak serratus anterior activity
69-106% MVIC, peak upper, middle and lower trapezius activity 51-78% MVIC, peak
rhomboids activity 41-45% MVIC, and peak levator scapulae activity 33-72% MVIC.
Moreover, peak serratus anterior activity was approximately 60% MVIC during the windmill
softball pitch, approximately 75% MVIC during the tennis serve and forehand and backhand
volley, approximately 30-40% MVIC during baseball hitting, and approximately 70% MVIC
during the golf swing.
In addition, during the golf swing, peak upper, middle and lower trapezius activity was 42-52% MVIC, peak rhomboids activity was approximately 60% MVIC, and peak levator scapulae activity was approximately 60% MVIC.

Baudry et al (2009) The movement amplitude is a key component of numerous elements in gymnastics. The purpose of The present study is to highlight the most pertinent amplitude variable of the circle performed on the pedagogic pommel horse. Twelve gymnasts (6 expert gymnasts vs. 6 nonexpert gymnasts) performed 10 circles on this event. A Vicon 512 system was used to record the 3-dimensional position of 11 markers fixed on the gymnasts. Our results revealed than 4 amplitude variables permitted us to significantly discriminate the levels of performance of the gymnasts (p < 0.05): shoulder extension in front phase, body alignment, shoulder diameter, and ankle diameter. In a training perspective, this result could help coaches focus their advice and pedagogic situations on the pertinent technical criteria. Then, a stepwise discriminant analysis performed on the 4 previously selected variables showed that 2 variables allowed us to accurately discriminate the circle amplitude: ankle diameter and body alignment. These 2 variables can be used by coaches as a specific index to objectively determine the performance levels of gymnasts and to measure improvement in movements after specific training.

Siva Muthu (2008) The purpose of the study was to find out the effect of selected mallakhamb exercise on the performance of javelin throw among physical education men student. The subject for the study were forty men student from Alagappa University College of Physical Education Karaikudi they were divided into two groups of twenty each and they were assigned as control group and experimental group. Experimental treatment was applied only to the experimental group for a period of six
weeks. The control group was not given any fitness training initial and final javelin throw performance was taken before and after training. The ‘t’ ratio was calculated from the analysis of the data and interpretation of result. The following conclusions were drawn that significantly improve javelin throw performance and mad possible to increase shoulder strength, muscular power and speed improving.

Sands et al (2008) Serious stretching in many sport involves discomfort and is often an early ceiling on improvements. The continue investigation of the use of vibration to enhance an acute range of motion while assessing the influence of vibration and stretching on pressure-to-pain threshold perception. 10 young men gymnasts were evaluated for split range of motion. One side split was randomly assigned as the investigational condition, and the other side split was assigned as the control. Both side splits were completed on a vibration device; the experimental condition had the device turned on and the control condition was performed with the device turned off. In addition, the athletes were assessed for pressure-to-pain transition using an algometer on the biceps femoris (stretched muscle) and vastus lateralis (nonstretched muscle) bilaterally. Pre-post difference scores between the vibrated split (most improved) and the nonvibrated split were statistically different (P=.001, 95% CI of the difference 2.3 to 5.8 cm). Following the stretching procedure, the force values for the pressure-to-pain threshold likening the vibrated and nonvibrated biceps femoris muscle were not statistically different. The nonstretched vastus lateralis muscle also showed no statistical difference in pressure-to-pain threshold between the vibration and nonvibration conditions. This study showed that vibration improved split range of motion over stretching alone, but did not show a difference in pressure-to-pain perception in either the stretched or nonstretched muscles.
**Kinser et al (2008)** Effects of simultaneous vibration-stretching on flexibility and explosive strength in competitive female gymnasts were examined. 22 female athletes (age = 11.3 +/- 2.6 yr; body mass = 35.3 +/- 11.6 kg; competitive levels = 3-9) composed the simultaneous vibration-stretching (VS) group, which performed both tests. Suppleness testing inactive groups were stretching-only (SF) (N = 7) and vibration-alone (VF) (N = 8). Explosive strength- inactive groups were stretching-only (SES) (N = 8) and vibration-only (VES) (N = 7). Vibration (30 Hz, 2-mm displacement) was applied to four sites, four times for 10 s, with 5 s of rest in between. Right and left forward-split (RFS and LFS) suppleness was measured by the distance between the ground and the anterior suprailiac spine. A force plate (sampling rate, 1000 Hz) noted countermovement and static jump characteristics. Explosive strength variables included flight time, jump height, peak force, rapid forces, and rates of force increase. Data were analyzed using Bonferroni adjusted paired t-tests. VS had statistically increased suppleness (P) and large effect sizes (d) in both the RFS (P = 1.28 x 10(-7), d = 0.67) and LFS (P = 2.35 x 10(-7), d = 0.72). VS had statistically different results of favored (FL) (P = 4.67 x 10(-8), d= 0.78) and nonfavored (NFL) (P = 7.97 x 10(-10), d = 0.65) legs. VF resulted in statistical increases in suppleness and medium d on RFS (P = 6.98 x 10(-3), d = 0.25) and statistically amplified flexibility on VF NFL flexibility (P = 0.002, d = 0.31). SF had no statistical difference between measures and small d. For explosive strength, there were no statistical differences in variables in the VS, SES, and VES for the pre- versus post treatment tests. Concurrent vibration and stretching may greatly increase suppleness though not changing explosive strength.

**Cools et al (2007)** throughout gymnastic exercises, considerable force output is required in the shoulder girdle muscles. Isokinetic performance of the scapular muscles in young, elite gymnasts has not been examined. To compare the isokinetic muscle...
performance of the scapular muscles between elite adolescent gymnasts and nonathletic adolescents to identify differences in strength, endurance, and muscle balance based on high-level sport participation. Single-session, repeated-measures design. University of human research laboratory. Sixteen young, elite gymnasts and 26 age-matched nonathletic subjects participated in the study. Linear protraction-retraction movement in the scapular plane at 2 velocities (12.2 cm/s and 36.6 cm/s). Isokinetic strength and endurance values and protraction to retraction strength ratios. Best gymnasts confirmed upper values for the protraction top force/body mass than the control group demonstrated (P < .05), and they demonstrated advanced protraction to retraction ratios on the nondominant side than on the dominant side (P < .05 at low velocity, P < .001 at high velocity). Work/body mass and fatigue index values were not statistically different among the groups. Side differences (P = .003) for retraction strength with lower protraction to retraction ratios (P < .001) were seeming in the gymnast group on the dominant side. Scapular muscle show in elite, young gymnasts is characterized by increased protraction strength and altered muscular balance around the scapula associated through nonathletic adolescents.

Zetaruk (2000) Examined the effects gymnastics training develops strength, flexibility, concentration, balance, grace, and speed in young athletes. In terms of hours per week and intensity of practice, the dedication to training at a young age, is unparalleled in most other youth sports. With this dedication comes the risk of injury to the immature musculoskeletal system, and it is our duty to ensure that these risks are minimized. Through adequate safety equipment, supervision, and spotting of difficult techniques, a number of acute injuries may be prevented. Maintenance of balanced flexibility and strength, modification of training to limit pain, and taping or splinting of wrists and ankles may
reduce the risk of overuse injuries. Physicians who deal with young gymnasts must have an understanding of the inherent risks of the sport to provide prompt diagnoses and appropriate management of injuries. The gymnastics can be a healthy environment as long as the health and safety of the child takes precedence over the success of the gymnast.

**Faria and Faria (1989)** To evaluate the structural characteristics concomitant to excellence in gymnastics performance, body composition, anthropometric measurements, power, strength, and flexibility were determined in Junior Olympic gymnastics competitors. Physical parameter measurements were performed on 65 male Class I and II all-around gymnasts. National team qualifiers, top 10 Class I and II, were compared to those who were placed 11th to 34th in the all-around scoring at the 1987 U.S. Gymnastics Federation Junior Olympic National Championships. The mean percent body fat, 7.1 +/- 1.6%, compared favorably with European gymnasts (7.07 +/- 1.7%). Top Class II gymnasts were significantly leaner (6.1 +/- 0.8% fat) than Class I (6.9 +/- 1.5% fat) and Class II (8.8 +/- 3.2% fat). The mean strength to body ratio was 138.8 +/- 16.8% while the Top Class I exhibited the highest ratio of 148.2 +/- 21.1%. Class II recorded a significantly higher absolute jump and reach (66.8 +/- 19.3 cm) and polyometric (66.2 +/- 6.4 cm) than the other classes. Class I and Top Class II gymnasts exhibited the greatest shoulder rotation while Top Class I exhibited the greatest hip flexion. Grip strength was low for all groups. To Class I and Top Class II when compared to other classes were characterized as shorter in stature, stronger in both relative and absolute strength, possessed greater flexibility through the hip region, shoulder girdle, were leaner, and possessed more muscle mass.

**Cofield and Simonet (1984)** Many sports activities that involve the upper extremity entail similar patterns of movement. Analysis of these activities, a better
understanding of the throwing motion, and an awareness of shoulder diseases or injuries have led to a rational plan for investigation and management of shoulder problems. Evaluation must be based on information obtained from an analysis of sports mechanics, a review of training methods, and a physical examination directed at determination of flexibility, strength, endurance, and the presence of inflammation. Three common sports injuries are damage to the acromioclavicular joint (shoulder separation), instability of the glenohumeral joint, and a spectrum of pathologic changes in the rotator cuff. Sports that are commonly associated with shoulder problems include swimming, baseball, tennis, football, and gymnastics. Treatment may comprise rest, changes in training methods, an alteration of technique, and a physical rehabilitation program. Surgical treatment has a well-defined role, but it is usually optional.

2.3 Studies on Selected Physiological Variables

Wegmann et al (2016) Veteran football players above 40 years have rarely been subject to scientific investigations. This is worrisome because their number is considerable and their cardiovascular risk probably increased. Therefore, a cross-sectional study was conducted in 100 football players between 40 and 63 years of age. This included a medical history and physical examination, venous blood sampling, measurement of resting blood pressure, a resting electrocardiogram (ECG), an exhaustive cycle ergometry and a multistage field test. Also, measurements of heart rate and blood lactate concentration were carried out during one typical training session and one match. Participants trained 1.0 ± 0.6 sessions per week and played 27 ± 8 matches per season. Of them, 19% were smokers. Resting blood pressure was 138 ± 15/88 ± 8 mmHg. Hypertension prevalence (WHO definition) was 66%. Total cholesterol averaged 220 ± 41 mg . dl(-1), HDL 46 ± 13 mg . dl(-1) and LDL 134 ± 33 mg . dl(-1). The average 10-year risk for cardiovascular events
(Framingham score) was 6%. Mean maximal power output on the cycle ergometer was $2.8 \pm 0.6 \text{ W} \cdot \text{kg}^{-1}$, mean $\text{VO}_2\text{peak} = 40.0 \pm 7.3 \text{ ml} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$. Comparing training and competition, no significant differences in cardiovascular and metabolic load were found. In summary, their cardiovascular risk was similar to age-adjusted reference values. However, they showed slightly better ergometric performance. More frequent training stimuli might be necessary to reach more favourable risk factor profiles. Training and competition lead to similar cardiocirculatory and metabolic stress which is considerably high and might put players into danger who have pre-existing cardiac disease.

Neto (2015) the effects of low-intensity resistance exercise (RE) combined with blood flow restriction (BFR) on blood pressure (BP) are an important factor to be considered because of the acute responses imposed by training. The aim of this study was to compare the hypotensive effect of RE performed with and without BFR in normotensive young subjects. After 1 repetition maximum (1RM) tests, 24 men (21.79 $\pm$ 3.21 years; 1.72 $\pm$ 0.06 m; 69.49 $\pm$ 9.80 kg) performed the following 4 experimental protocols in a randomized order: (a) high-intensity RE at 80% of 1RM (HI), (b) low-intensity RE at 20% of 1RM (LI), (c) low-intensity RE at 20% of 1RM combined with partial BFR (LI + BFR), and (d) control. Analysis of systolic blood pressure (SBP) and diastolic blood pressure (DBP) was conducted over a 60-minute period. The 3 RE protocols resulted in hypotensive SBP (HI = -3.8%, LI = -3.3%, LI + BFR = -5.5%) responses during the 60 minutes ($p \leq 0.05$). The LI + BFR protocol promoted hypotensive (-11.5%) responses in DBP during the 60 minutes ($p \leq 0.05$), and both the HI and LI + BFR protocols resulted in mean blood pressure (MBP) hypotension between 30 (-7.0%, -7.7%) and 60 minutes (-3.6%, -8.8%), respectively. In conclusion, postexercise hypotension may occur after all 3 exercise protocols with greater
reductions in SBP after HI and LI + BFR, in DBP after LI + BFR, and in MBP after HI and LI + BFR protocols.

Patil, Aithala and Das (2015) determine the study of yoga on arterial function in elderly with amplified pulse pressure (PP). Randomized measured training with two parallel groups. Elderly subjects with PP≥60 mmHg (n=60). Yoga group (n=30) was allotted for yoga training and brisk-walking (BW) group (n=30) for brisk-walk with stretching exercise for 1h in the morning for 6 days in a week for 12 weeks. Arterial stiffness measures: (baPWV), (c-f PWV), aortic augmentation index (Aix 75), arterial stiffness guide at brachial (bASI) and tibial arteries (aASI). Total serum nitric oxide concentration (NOx) as an directory of endothelial function. Heart rate variability (HRV) measures: Low incidence and high occurrence in normalized units (LFnu, HFnu) and LF/HF ratio. The mean between-group alteration (with 95% CI) in arterial stiffness: c-f PWV(m/s) [1.25(0.59-1.89); p<0.001], baPWV(m/s) [1.96(0.76-3.16), p<0.01], AIX@75 [3.07(0.24-5.89), p=0.066], aASI [8.3(4.06-12.53), p<0.001]; endothelial function index: NO(μmol/L) [-9.03(-14.57 to -3.47), p<0.001]; SBP(mmHg) [14.23(12.03-16.44), p<0.001], DBP(mmHg) [0.1(-1.95-2.15), p=0.38], PP(mmHg) [14.07(11.2-16.92), p<0.001], MAP(mmHg) [4.7(3.08-6.32), p<0.001]; and cardiac autonomic function: LF(nu) [4.81(1.54-8.08), p<0.01], HF(nu) [-4.13(-7.57 to -0.69), p<0.01], LF/HF ratio [0.84(0.3-1.37), p<0.001], indicate important change in effects of two interferences on arterial stiffness, endothelial purpose, BP and cardiac autonomic action. There was significant change within-yoga group in vascular function, BP and autonomic function, while no important change within-BW group was observed. Our results suggest that yoga package presented was more effective than
brisk-walk in dipping arterial stiffness along with BP in elderly persons with augmented PP. Yoga can also meaningfully decrease concerned movement.

**Sawane, Gupta (2015)** Resting heart rate variability (HRV) is a degree of the inflection of autonomic nervous system (ANS) at rest. Improved HRV achieved by the workout is good for the cardiovascular fitness. However, potential studies with contrast of the effects of yogic movements and those of other endurance exercises like walking, running, and swimming on resting HRV are conspicuous by their absence. Study was designed to assess and compare the effects of yogic training and swimming on resting HRV in normal healthy young volunteers. Training was directed in Branch of Physiology in a medical college. Training design was future randomized comparative trial. 100 inactive volunteers were arbitrarily ascribed to either yoga or swimming group. Pretest score of digital electrocardiogram were done for all the subjects in cohorts of 10. After yoga training and swimming for 12 weeks, assessment for resting HRV was done again. Ratio change for each parameter with yoga and swimming was associated using unpaired t-test for data with normal supply and using Mann-Whitney U test for data without normal delivery. Most of the HRV parameters better statistically significantly by both modalities of exercise. However, some of the HRV parameters presented statistically better development with yoga as likened to swimming. Active yoga seems to be the mode of workout with improved improvement in autonomic purposes as optional by inactive HRV.

**Natarajan (2013)** The purpose of the study was effects of mallakhamb and tai chi training on selected health related physical fitness physiological and psychological variables among inter collegiate kabaddi players. The subjects was represented for their intercollegiate kabaddi players participated in kabaddi competition. Those subjects
were selected for ninety subjects in total were selected. These subjects were randomly selected as following group’s Experimental group-I, Experimental group-II Control group were given training for 12 weeks. The age of the subjects ranged from 18 to 25 years. Selected variables for this study were: health related physical fitness physiological and psychological variables i) cardiovascular endurance, ii) muscular strength, iii) flexibility, and iv) muscular endurance. Physiological variables namely, i) mean arterial blood pressure, ii) resting pulse rate, iii) breath holding time, and iv) VO₂ max. Psychological variables namely, i) self confidence, ii) sports achievement motivation, iii) self esteem, and iv) anxiety. The differences between the initial and final scores in selected health related physical fitness physiological and psychological variables were subject to statistical treatment, using Analysis of Covariance (ANCOVA) to find out whether the mean differences were significant or not. In all the cases, 0.05 level of confidence was fixed to test the significance, which was considered as appropriate. The mallakhamb group had achieved significant improvement on health related physical fitness physiological and psychological variables than the Tai Chi training group.

Miles et al (2013) Yoga is qualitatively dissimilar from any other manner of physical activity in that it involves of a unique grouping of isometric muscular contractions, widening exercises, relaxation techniques, and living exercises. In specific, yoga carriages involve of systemic isometric contractions that are known to elicit marked increases in mean blood pressure that are not observed throughout dynamic exercise. Stretching can also induce surge in blood pressure and sympathetic nerve activity in the muscles. Now, not much is known about changes in blood pressure and other cardiovascular responses to yoga practice. The training intended to determine
the serious effects of one session of hatha yoga practice on blood pressure and other cardiovascular responses. To gain insight into the long-term effects of yoga training, both novice (n = 19) and advanced (n = 18) yoga practitioners were studied. The 2 groups were matched for age, gender, BMI, and BP. The setting was a study laboratory at a university. 36 apparently healthy, nonobese, inactive or recreationally active persons from the community contributed in the study. Participation, the interference comprised one session of yoga training, in which members followed a custom made instructional video providing a yoga routine that consisted of a series of 23 Hatha-based yoga postures. Prior to new at the laboratory, each participant completed a investigation health questionnaire, a training-status questionnaire, and a yoga-experience questionnaire. Prior to the yoga practice, each member's height, body fat percentage, trunk or lumbar suppleness, and arterial stiffness as assessed by carotid femoral pulse wave velocity (cfPWV) were measured. For each carriage during the yoga practice, the training unceasingly measured systolic, mean, and diastolic blood pressures, heart rate, stroke volume, and cardiac output. Systolic, mean, and diastolic blood pressures better significantly during the yoga practice. The magnitude of these rises in blood pressure was greatest with standing postures. Heart rate and cardiac output improved significantly during yoga practice, especially with standing postures. Overall, no changes existed in cardiovascular responses among the novice and advanced practitioners during the yoga testing period; cfPWV velocity was significantly and inversely associated with lumbar flexion but not with sit-and-reach test scores. The research team decided that a variety of Hatha yoga postures, particularly standing postures, evoked significant rises in blood pressure. The elevation in blood pressure due to yoga training was linked with rises in cardiac output and heart rate, which are replies parallel to those observed in isometric
exercise. The lack of obvious changes in blood pressure and other circulatory responses between novice and progressive yoga practitioners proposes that long-term yoga practice does not attenuate acute yoga retorts.

Osiecki et al (2013) The purpose of this study was to assess the effects of a 12-wk workplace based exercise program on total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein (LDL), triglycerides (TG), anthropometric profile (weight, waist circumference, fat percentage, BMI, and skin-fold thickness), systolic blood pressure (SBP), and diastolic blood pressure (DBP) on female workers. The subjects were placed in two groups: intervention (n = 24; age = 42.50 ± 11.35 yrs) and control (n = 26; age = 48.77 ± 9.27 yrs). The 12-wk intervention group engaged in gymnastics and relaxation for 15 min·d-1 5 times·wk-1. The statistical findings indicate that the intervention group had significant reductions in TC, LDL (P<0.001), HDL, diastolic blood pressure, and body fat (P<0.05), and waist circumference (P<0.01). The findings support the importance of a workplace based physical activity program in the improvement of cardiovascular risk factors.

Sartor et al (2013) In gymnastics, monitoring of the training load and assessment of the psycho physiological status of elite athletes is important for training planning and to avoid overtraining, consequently reducing the risk of injuries. The aim of this study was to examine whether heart rate variability (HRV) is a valuable tool to determine training load and psycho physiological status in young elite gymnasts. 6 elite gymnast in the art often week observation for the study. During this period, beat-to-beat heart rate intervals were measured every training day in weeks 1, 3, 5, 7, and 9. Balance, agility, upper limb maximal strength, lower limb explosive, and elastic power were monitored during weeks 2, 4, 6, 8, and 10. Training load of each training session
of all 10 weeks was assessed by session rating of perceived exertion (RPE) and psychophysiological status by Foster's index. Morning supine HRV (HF% and LF%/HF%) correlated with the training load of the previous day (r = 0.232, r = -0.279, p < 0.05). Morning supine to sitting HRV difference (mean R wave to R wave interval (RR), mean heart rate, HF%, SD1) correlated with session RPE of the previous day (r = -0.320, r = 0.301, p < 0.01; r = 0.265, r = -0.270, p < 0.05) but not with Foster's index. Training day/reference day HRV difference (mean RR, SD1) showed the best correlations with session RPE of the previous day (r = -0.384, r = -0.332, p < 0.01) and Foster's index (r = -0.227, r = -0.260, p < 0.05). In conclusion, HRV, and in particular training day/reference day mean RR difference or SD1 difference, could be useful in monitoring training load and psychophysiological status in young male elite gymnasts.

**Natarajan and Lillypushpam (2012)** The purpose of the study was to find out the effect of Suryanamaskar and rope mallakhamb training on heart rate, cardiovascular endurance and anaerobic capacity among college women students. To achieve this purpose forty five college women students were selected randomly as subject from government arts and sciences college, Tindivanam, Villupuram (DS) Tamilnadu. Their age ranged between 18 to 22 years. They were divided into three equal groups. Experimental group I underwent Suryanamaskar training, Experimental Group II underwent rope mallakhamb training and Control group was not exposed to any training. The experimental group was given training for a period of 6 weeks of six day. After 6 weeks of training the post-test were taken for the subjects of the three groups. Test was conducted for heart rate, cardiovascular endurance and anaerobic capacity at the end each session and data were recorded. Analyses of Covariance (ANCOVA) were used to test significance. Wherever a significant difference were found Scheffe’s post
hoc test was used. The study revealed that the above said criterion variables were significantly improves due to the effect of rope mallakamb training than the Suryanamaskar training among group.

Manos Mihaela, Grigore Vasilica and Popescu Lavinia (2012) Determining the effort functional demands in the rhythmic gymnastics activity, in order to optimize the relation between the training stage requirements and the female athletes’ specific individual support; drawing up a model focused on the competitive situation characteristics, starting from the involved energetic processes and the achieved specific technical actions. The experiment was conducted on a group of 10 female gymnasts, components of the Romanian national squad. The used methods aimed at measuring/assessing the oxygen consumption and the other physiological indicators, under lab, training and simulated competitive conditions. The obtained results emphasize the following aspects: the team gymnasts present relatively homogeneous aerobic capacities (VO2 max 52.7 ± 2.29), by having in view their morphological characteristics and their age (15 to 17 years old); the mean lactate and its peak, registered after 1 minute of effort, confirm the fact that, in competitions, gymnasts work under conditions close to their maximal aerobic power; the registered lactacidemia highlights the same hierarchy within the team in both of the group events, except for the substitute gymnasts, who are in difficulty to supply the requested effort; the lactic acid higher concentration explains the important exertion of the lactacyd anaerobic system; a higher lactacidemia is registered in the group titular gymnasts performing with 2 hoops and 3 ribbons (x = 11. 1 ± 1.5 mmol.l ) and in the rope individual event (x 11. ± 2. 7 mmol.l ), as compared to the values obtained in the 5-ball group event (x 1 . ± 1. 5 mmol.l ). This might result from the requirements imposed by the FIG Code
of Points as for the number, the degree of technical difficulties and the corporal group specific to each apparatus. The repeated analysis of the heart rate evolution registered during the training lesson, in different preparatory stages, enabled us to objectively determine the characteristics of the demands and of the supplied effort. To accomplish the top-level technical-artistic content in group events, gymnasts must cope with higher energy expenditure, therefore with a strong exertion of the lactacyd anaerobic system, which can become the source of technical errors and can influence both coordination and emotional balance. To lessen this part of the metabolic process in the energy input needed by the effort sustaining in rhythmic gymnastics, it would be necessary to develop first of all gymnasts’ aerobic potential, so that they become able to cope with the training effort, to increase their recovery possibilities and delay the lactic acid production.

Karunakaran and Ramesh (2009), conducted study on effect of raja yoga and pranayama on selected physical and physiological variable of adults. The objectives of this study were to find out the physical and physiological variable. The selected variables of Flexibility in measure the sit and reach box. For this study thirty boys in the age group of 23 to 27 years were selected form Pondicherry University, Pondicherry. The subjects were divided into two groups namely control group and experimental group. The experimental group was yogic pranayama and meditation for a period of twelve weeks, both morning and evening on five days a week. The control group did not participate in yogic pranayama and meditation training programme. The collected data were statistically analyzed by using analysis of covariance 79 (ANCOVA). Results, the Experiment group had a significant improvement than the control group on the selected physical and physiological variables except systolic and diastolic blood pressure.
Parshad O, Richards A and Asnani M (2011) Yoga improves cardiovascular health in both healthy individuals and those with diagnosed heart disease. This study compares changes in some cardiovascular parameters before and after the practice of Yoga in healthy medical students. Sixty-four healthy medical students (57 females and 7 males), mean age 21.3 +/- 2.6 years, attending a Special Study Module 'Role of Dhyana Yoga in Stress Management', participated in this study. Systolic (SYS) and Diastolic (DIA) blood pressure, Heart Rate (HR), Stroke Volume (SV), Cardiac output (CO), Total Peripheral Resistance (TPR), Interbeat Interval (IBI), Left Ventricular Ejection Time (LVET), Arterial Compliance (Cwk) and Ascending Aorta Impedance (Zao) were measured before and after six weeks of yogic exercises. Various exercises included asanas (Postures), pranayama (Breathing), and dhyana (Meditation). Data were analyzed using Stata for Windows. Two-tailed paired t-test revealed that practice of yoga caused significant increases in HR (p < 0.05), SV (p < 0.01), CO (p < 0.001) and Cwk (p < 0.01) and decreases in TPR (p < 0.001), IBI (p < 0.05) and Zao (p < 0.001) after practising yoga for 6 weeks as compared to before yoga practice. No significant differences were, however observed in SYS, DIA, Mean arterial blood pressure (MAP) and LVET CONCLUSIONS: Practice of yoga even for a short period showed ability to improve most of the cardiovascular functions. Regular practice of yoga for a longer period may further improve these functions and possibly result in improved management of their daily stress.

Ganesh (2010) the purpose of the study was to determine the relative effects of different categories of mallakhamb exercises on selected motor ability components and physiological variables among juvenile. The subjects for this study were from Government children home (juveniles) at Villupuram. The subjects were selected for the studies that recently oriented and took up training. A total of sixty subjects were
selected. These subjects were randomly selected as following group’s Experimental group-I (20), Experimental group-II (20), Control group - (20). The age of the subject ranged from 12 to 16 years. Selected variables for this study were: motor ability components and physiological variables, arm explosive, muscular strength, flexibility, resting pulls rate, breath holding time, blood pressure. Arm explosive was measured by pull-up test. Flexibility was measured by sit and reach test. Muscular strength was measured by sit-up test. Pulse rate was measured by manual method over a period of one minute. Breath holding time was measured by manual method with using nose clip. Blood pressure (systolic and diastolic) was measured with the help of sphygmomanometer. The score was recorded in mmHg. The score was recorded to the nearest tenth of a second. The differences between the initial and final scores in selected physiological variables and motor ability components were subject to statistical treatment, using Analysis of Covariance (ANCOVA) to find out whether the mean differences were significant or not. In all the cases, 0.05 level of confidence was fixed to test the significance, which considered as appropriate. The motor ability components and physiological variables were improved significantly due to relative effect of different categories of Mallakhamb exercise training among juveniles.

Helen et al (2008) the purpose of the study was find out physiological and anthropometric predictors of rhythmic gymnastics presentation, which was defined from the total ranking score of each athlete in a national competition. Thirty-four rhythmic gymnasts were divided into two groups, elite (n = 15) and nonelite (n = 19), and they underwent a battery of anthropometric, physical fitness, and physiological capacities. The main-components examination extracted 6 mechanisms: anthropometric, suppleness, explosive strength, aerobic capacity, body dimensions, and
anaerobic metabolism. These were used in a concurrent multiple-regression procedure to determine which best would explain the variance in rhythmic gymnastics act. Built on the principal-component analysis, the anthropometric component explained 45% of the total variance, flexibility 12.1%, explosive strength 9.2%, aerobic capacity 7.4%, body dimensions 6.8%, and anaerobic metabolism 4.6%. Components of anthropometric ($r = .50$) and aerobic capacity ($r = .49$) were suggestively correlated with performance ($P < .01$). When the model—$y = 10.708 + (0.0005121 \times \text{VO2max}) + (0.157 \times \text{arm span}) + (0.814 \times \text{midthigh circumference}) - (0.293 \times \text{body mass})$—was applied to elite gymnasts, 92.5% of the variation was explained by VO2max (58.9%), arm span (12%), midthigh circumference (13.1%), and body mass (8.5%). Particular anthropometric characteristics, aerobic power, flexibility, and explosive strength are important determinants of fruitful presentation. These results capacity have practical insinuations for both exercise and talent identification in rhythmic gymnastics.

**Raub (2002)** Yoga has develop progressively popular in Western philosophies as a means of exercise and fitness exercise; There is an essential to have yoga healthier recognized by the health care community as a complement to traditional medical care. Over the last 10 years, a growing number of investigation studies have shown that the practice of Hatha Yoga can improve strength and flexibility, and may help control such physiological variables as blood pressure, respiration and heart rate, and metabolic rate to improve overall workout capacity. This appraisal presents a rapid of medically validated data about the health benefits of yoga for healthy persons and for individuals encompassed of by musculoskeletal and cardiopulmonary illness.

**Dane et al (2002)** The study on independent forced nostril living (UFNB) on systolic and diastolic blood pressures and heart rate (HR) were studied in 88 male and 41
woman right-handed subjects. In men, both the right and left independent forced nostril breathings suggestively improved the systolic blood pressure (SBP) and HR, but had no effect on the diastolic blood pressure (DBP). In women, the right UFNB better, but the left UFNB slightly reduced the SBP and DBP. The outcomes optional that there may be a nostril laterality affecting the independent nervous system differentially.

### 2.4 Studies on Selected Psychological Variables

**Abdurrahman et al. (2015)** The aim of present study was to determine assertiveness and aggression level of soccer players in different age groups. Participants were 150 amateur soccer players between ages of 14 to 30 years. Assertiveness and aggression level of participants were measured by Aggression Inventory which was developed by Kiper (1984). The inventory comprised of three dimensions and 30 items (10 items persubscale) comprised the inventory. Subscales of the inventory are called as destructive aggression, assertiveness and passive aggression. Inventory was administered among players in three different categories of amateur soccer league in Antalya (Junior, Youth and Senior). Results of statistical analyses revealed that in destructive aggression there were significant differences between senior groups and both junior and youth groups (p<.05). Senior groups had the highest score in destructive aggression. In passive aggression subscale scores, the senior soccer players significantly had lower score than both junior and youth groups (p<.05). There was no significant differences between youth and junior soccer players (p>.05). An examination of assertiveness subscale showed that there were significant differences between age groups. Follow-up test revealed that junior soccer had significantly lower assertiveness score than both youth and senior players. There was no significant difference between youth and senior soccer player in assertiveness scores.
**Battaglia et al (2014)** The purpose of this study was to find out whether a mental training procedure could increase gymnastic jumping performance. 72 rhythmic gymnasts were arbitrarily divided into an investigational and control group. At pretest, experimental group completed the Movement Imagery Questionnaire Revised (MIQ-R) to assess the gymnast ability to make crusade imagery. A repeated events project was used to associate two different types of training meant at improving jumping performance: (a) video observation and PETTLEP mental training associated with physical repetition, for the training group, and (b) physical practice alone for the control group. Before and after 6 weeks of training, their jumping performance was measured using the Hopping Test (HT), Drop Jump (DJ), and Counter Movement Jump (CMJ). Consequences revealed differences between jumping parameters F(1,71)=11.957; p<.01, and between groups F(1,71)=10.620; p<.01. In the experimental group there were significant correlations among imagery ability and the post-training flight time of the HT, r(34)=-.295, p<.05 and the DJ, r(34)=-.297, p<.05. The request of the procedure described herein was exposed to advance jumping presentation, thereby preserving the elite athlete's liveliness for additional errands.

**Schack et al (2014)** the study was in sports, dance and reintegration has exposed that simple action concepts (BACs) are major building blocks of psychological act representations. BACs are based on chunked body postures related to common purposes for realizing action goals. In this paper, we outline issues in investigation methodology and an untried method, the structural dimensional examination of mental representation (SDA-M), to measure action-relevant figurative structures that reflect the group of BACs. The SDA-M reveals a solid relationship between cognitive picture and performance if complex actions are achieved. display how the SDA-M can improve motor imagery.
training and how it contributes to our understanding of coaching processes. The SDA-M capitalizes on the objective extent of individual mental movement representations before training and the integration of these fallouts into the motor imagery training. Such motor imagery training based on mental representations (MTMR) has been practical absolutely in professional sports such as golf, volleyball, gymnastics, windsurfing, and recently in the therapy of patients who have suffered a stroke.

Ihsan Sarıa et al (2014) The aim of this research was to investigate the role of athletes’ perception of coaches’ leadership behavior as predictor of athletes’ assertiveness in individual sport. 239 individual sport athletes (X age=20.79±3.32) voluntarily participated to the research. The subjects consisted total 239 male and female (170 male (71.1%) and 69 female (28.9%) )athletes from various individual sports such as wrestling, athletics, weightlifting, taekwondo, boxing, karate, badminton etc. The data were collected using a personal information form, Leadership Scale for Sport and Rathus Assertiveness Schedule. Descriptive statistics, Pearson’s correlation analysis and hierarchical multiple regression analysis were used in SPSS 17. p < .05 was determined as the statistical significance value. Results showed that there were positive significant correlations between the subscales of Leadership Scale for Sports (Training and instruction behavior, democratic behavior, social support behavior and positive feedback behavior) and assertiveness. Hierarchical multiple regression analysis was used to assess the ability of leadership behaviors to predict assertiveness scores of the athletes after controlling the influence of age and gender. The model explained an additional 21% variance in assertiveness after controlling age and gender, R square change = .21, F change (5, 231) = 12.833, p < .05). It appeared in the final model that training and instruction behavior (β = .45, p < .05) and autocratic behavior (β = -.17, p < .05) were
statistically significant. The results indicated that training and instruction behavior of sport coaches could positively contribute to assertiveness score whereas autocratic behavior seems to undermine it in individual sport athletes.

Atalay Gacar et al (2013) Assertiveness, which can be described as the way individual expresses himself/herself, is considered as one of the most important determinants for the relations of the individual with his/her environment. Continued anxiety is defined as the proneness of the individual to the anxiety experience. In this context, it can be stated as the predisposition of the individual to perceive or interpret the situations he/she is in as stressful. Based upon these notions, in this study it is aimed to examine assertiveness and anxiety levels of spotters participating in interuniversity volleyball competitions. The subjects 112 spotters were participated in Turkish Inter University 2nd League C group Volleyball Competitions, in that 34 female and 43 male spotters were participated took part in our research voluntarily. As data collection instruments, "Personal Information Form" is used to acquire personal information of volleyball players participating in the research, and Rathus Assertiveness Schedule (Rathus, 1973) assertiveness inventory which is adapted into Turkish is utilized to assess their level of assertiveness; and "Continued Anxiety Inventory" developed by Spielberg et al. (1970) and adapted into Turkish by Oner and Le Compte (1983) is used to determine their Anxiety Level. Data acquired is evaluated by means of SSPS statistics package program and significance level is considered to be (p key words: Spotter, Volleyball, Assertiveness, Anxiety, and Competition.

Acet et al (2012) This study aims at comparing the levels of assertiveness and aggression between amputee and hearing impaired football players. As data collections tools, this study used Aggression Inventory developed by Kiper (1984) and
Assertiveness Schedule developed by Rathus (1973). Research sample included Amputee Football teams played in the Super League during 2011-2012 season and the teams that took part in Hearing-Impaired Football Championships in Turkey. SPSS 15 was used to analyze the data collected for the study. "Kolmogorov-Smirnov" test was used for equality of distribution functions and homogeneity of data was tested using "Anova-Homogeneity of Variance Test". Descriptive statistics was employed for statistical analysis and the mean difference between two independent variables was calculated using independent Sample t-test. Analysis of the data showed higher levels of assertiveness and aggression among hearing-impaired football players compared to those of amputee players. Comparing the levels of assertiveness and aggression between amputee and hearing-impaired football players, this study found a statistically significant difference (p<0.05).

Ahmed Abd El-Hamid Emara (2012) The aim of this study is to identify the relation between the cognitive and motivation imagery and some psychological variables (a) Achievement motivation (b) Competition anxiety (c) Sport confidence of high level players of wrestling. Researcher used the descriptive methodology due to its relevance and suitability to the objectives of study. Research sample included 18 wrestlers chosen deliberately to represent the national team of wrestling (freestyle Greco-Roman). Researcher used the following tools for imagery in sport: questionnaire (siq) and sport orientation questionnaire (soq) and competitive state anxiety inventory and trait sport confidence inventory. Finally, the researcher concluded that there is statistical function, extrusive correlation between both of the specific cognitive imagery competitive approach and target approach for the players of high level in wrestling. There is statistical function; extrusive correlation between both of motivation imagery
of excitation and competitive approach and win approach of high level players wrestling sport. There is statistical function, extrusive correlation between the general motivation imagery and physical anxiety for the high level wrestling players. There is statistical function, extrusive correlation between the general imagery and self confidence case for the high level players in wrestling sport. There is statistical function, extrusive correlation between specific cognitive imagery and sport confidence feature of high level players in wrestling. There is statistical function, extrusive correlation between the general motivation imagery and sport confidence trait for the high level players in wrestling sport.

**Murat Ozsaker (2012)** This study aimed to examine the relationship between assertiveness and self-esteem in adolescents, including both athletes and nonathletic. The participants were adolescents (n=1006) aged 12 to 14 years, residing in Izmir, Turkey. Data were collected using the Rathus Assertiveness Scale and the Coopersmith Self-Esteem Scale. The results showed that there is a significantly stronger relationship between assertiveness and self-esteem among athletic adolescents compared to the sedentary adolescents (p<0.05).

**Lubans and Cliff (2011)** The primary aim of this study was to investigate gender differences in the relationship between muscular strength, body composition, and physical self-perception in adolescents. Participants (n=106, age 15.0±0.7 years, 51% boys) completed the following assessments: height and weight, bio-electrical impedance analysis (body fat %), muscular strength (1RM bench press and leg press), and the Children's Physical Self-Perception Profile. Bivariate correlations were examined and mediation analysis was used to explore if physical self-perception sub-domains mediated the relationship between muscular strength/adiposity and overall physical self-worth.
Among boys, physical self-worth was associated with absolute total strength ($r=0.36$, $p<0.01$), but not with body fat % ($r=-0.11$, $p=0.44$), or relative total strength ($r=0.21$, $p=0.13$). In adolescent girls, physical self-worth was associated with body fat % ($r=-0.42$, $p<0.01$), relative total strength ($r=0.40$, $p<0.01$) but not absolute total strength ($r=0.07$, $p=0.62$). In boys, perceived physical strength mediated the relationship between absolute muscular strength and physical self-worth. Relative muscular strength was not associated with perceived strength ($p>0.05$) in girls and the test of the mediated effect was non-significant ($p>0.05$). Perceived body attractiveness was found to mediate the relationship between body fat % and physical self-worth among boys and girls. Physical self-worth is associated with different components of health-related fitness in adolescent girls and boys. Mediation analysis can be used to provide insights into the complex interrelationships between variables.

**Linwall, Asci and Hagger (2011)** The studied physical self-perception outline (PSPP-R) was built to measure both apparent competence and position linked to domains of the physical self. In the current study, we tested the factorial validity of the PSPP-R, using confirmatory factor analytic approach, on samples of university scholars from three dissimilar countries: Sweden, Turkey, and the UK. Multi-sample covariance construction analyses were also used to test the invariance of the PSPP-R across the three national trials. First-order four-factor models, counting the latent factors of sport competence, physical conditioning, body attractiveness and physical strength, confirmed good-fit with the data both for capability and importance factors. Second-order factor models, joining the second-order latent area factor of physical self-worth also exhibited good-fit with the information. Factor designs and covariance were invariant across samples for both competence and importance scales.
Item intercepts were also invariant for the importance scales, whereas incomplete invariance of interjects was supported for competence scales. The results are deliberated with reference to the validity of the unique physical self-perception outline and multicultural trainings on the physical self-perception.

**Natarajan (2010)** the purpose of the study was effects of rope asanas and mallakhamb exercise on hematological physiological and psychological variables among college men. The subjects for this study were from Annamalai University Department of Physical Education. Selected for sixty subjects in total were selected. These subjects were randomly selected as following group’s Experimental group-I, Experimental group-II Control group and were given training for six weeks. The age of the subjects ranged from 20 to 24 years. Selected variables for this study were: hematological physiological and psychological variables hemoglobin, red blood cells, blood pressure, respiratory rate, assertiveness, mental imagery. The difference between the initial and final scores in selected hematological physiological and psychological variables were subject to statistical treatment, using Analysis of Covariance (ANCOVA) to find out whether the mean differences were significant or not. In all the cases, 0.05 level of confidence was fixed to test the significance, which was considered as appropriate. The mallakhamb group had achieved significant improvement on hematological physiological and psychological variables than the rope Asanas group.

**Bayrakta G and Yilmaz E (2010)** Subjects were chosen from wrestlers, who had the right to take part in Turkey Wrestling Championship in 2006-2007 season, deal with the wrestling sport in various cities and clubs in Turkey. Subjects consist of total 213 wrestlers whose age range from 17 to 40 and participated in Turkey Wrestling championship, and these wrestlers include 169 free-styles and Greco-Roman style male
wrestlers and 44 free-style female wrestlers. It has been aimed in this study to analyze assertiveness level of elite male and female wrestlers' effect on their individual success. Firstly, information related to the aim of the survey has been given systematically by scanning literature. Thus, a theoretical framework about the topic has been established. Secondly, personal identification form created by the researcher, results ruler of athlete and assertiveness inventory developed by Rathus, adapted into Turkish by Voltan, was applied on the male and female wrestlers randomly in order to achieve the object of this study. The statistical analysis of data obtained from the research was used descriptive statistics One Way ANOVA and test t, besides Tukey test was used to determine the differences between the groups. As a result of statistical analyzes, Level of Assertiveness has been observed at a higher level in those wrestlers, who wrestles in Greko-Romen style, who are female, and have liberal families, than those wrestlers who wrestles in free-style, who are male, and have protective parents. As a result, it has been determined that high levels of assertiveness sports have been more successful than the others.

**Munzert et al (2008)** The current brain imaging study compared activation overlap and differential start during mental simulation (motor imagery) with that while observing gymnastic actions. The fMRI combination examination revealed touching activation for both S-states in primary motor cortex, premotor cortex, and the additional motor area as well as in the intraparietal sulcus, cerebellar hemispheres, and shares of the basal ganglia. A direct contrast between the motor imagery and observation conditions revealed stronger activation for imagery in the posterior insula and the anterior cingulate gyrus. The hippocampus, the larger parietal lobe, and the cerebellar areas were differentially activated in the observation condition. In general, this information verify the idea of action-related S-states since of the high overlap in core
motor as well as in motor-related areas. Argue that disparity action between S-states relates to task-specific and modal data processing.

**Bugress Grogan and Burwitz (2006)** Research examining the influence of physical action on body image dissatisfaction and physical self-perceptions has been both limited and vague. The current research examined the belongings of 6-week aerobic dance on these variables with 50 British schoolgirls aged 13-14 years. A cross-over project was used with two equivalent groups taught normal physical education and aerobic dance in a different instruction. The Body Attitude Questionnaire (BAQ) and Children and Youth Physical Self-Perception Profile (CY-PSPP) were administered as pre, mid and post-test to each member in each group earlier the first involvement, at the change over and after 12 weeks. The outcomes of this study exposed that input in 6 weeks of aerobic dance expressively reduced body image displeasure (Attractiveness, Feeling Fat, Salience and Strength and Fitness) and improved physical self-perceptions (Body Attractiveness and Physical Self-Worth), although these developments were not continued. The insinuations and upcoming investigation instructions are debated.

**Irwin, Hanton and Kerwin (2005)** In this study, we examined the methods used and knowledge required by 16 elite men's gymnastic coaches in the development of skill progressions. Following in-depth interviews, a conceptual model representing the process of skill progression development was generated. We found that: (1) elite gymnastic coaches developed skill progressions through experimental practice, reflection and critical inquiry; (2) the development of skill progressions was underpinned by the coaches acquiring a mindset based on four further sub-components (i.e. skill progression refinement, current coaching knowledge, mental imagery and biomechanical understanding); and (3) coaches identified the importance of replication of the spatial and
temporal characteristics of the final skill. The results are consistent with task analysis, reflective practice and the principle of specificity. Practically, these findings suggest the need to develop coaches with a more objective approach to skill progression development and a greater understanding of the controlling mechanisms inherent in such practices.

Chase, Magyar and Drake (2005) The aim to evaluated female gymnasts' fear of injury, their sources of self-efficacy and the psychological strategies used to overcome their fears. The participants were 10 female gymnasts aged 12 - 17 years. They had all taken part in competitive gymnastics and had experienced some type of injury during their careers. Individual interviews were conducted using a structured interview guide. Data were analysed using an inductive content analysis. The results indicated that gymnasts were most fearful of injuries because of the difficulty in returning from an injury and being unable to participate in practices and competitions while injured. Gymnasts described aspects of their past performance experience, such as success, consistency and communication with significant others, as important sources of self-efficacy. Some examples of psychological strategies used to overcome their fear of injury were mental preparation (e.g. imagery, relaxation), just "going for a skill" and the coaches' influence.

Raustorp et al. (2005) the aim of the study is examined the Swedish translation of the Children and Youth--Physical Self-Perception Profile (CY-PSPP) scale and examined the relation between physical self-perception and daily physical activity as well as the relationship between physical self-perception and body mass index (BMI) among Swedish school children. Forty-eight children aged 11-12 years completed the CY-PSPP twice with 2 weeks in between. Test-retest reliability, concurrent and content validity were calculated. Five hundred and one children, aged 10-14 years, were measured for
height and weight and perceived physical self-perception. Activity levels were analyzed using pedometers for 4 consecutive days. Good validity concerning concurrent and content validity was found. Test-retest reliability over a 2-week period was acceptable. In boys a fair and in girls a poor correlation between the sub-domains of the CY-PSPP and physical activity were found and a fair negative correlation between the sub-domains and BMI except for Physical Strength. The CY-PSPP distinguishes between children with low and high physical self-perception. The information is of importance when designing physical activity programs reachable for children with low physical self-esteem. According to the findings it is important to form physical activity programs that support and develop Sport Competence, Physical Condition and sense of Body Attractiveness among children.

Taylor AH and Fox KR (2005) This study investigated the effectiveness of a 10-week primary care exercise referral intervention on the physical self-perceptions of 40-70 year olds. Participants (N=142) were assessed, randomized to an exercise or control group, and reassessed at 16 and 37 weeks. The Physical Self-Perception Profile (PSPP; K. R. Fox, 1990), fitness, physical activity, body mass index, body fat (skinfolds), and hip and waist circumference were assessed. A multivariate analysis of variance revealed significant Group X Time interactions, with the exercise group showing greater physical self-worth, physical condition, and physical health at 16 and 37 weeks. Changes in all PSPP scales at baseline and 37 weeks were related to changes in anthropometric measures and adherence to the 10-week exercise program but not to changes in submaximal fitness parameters.

Newton and others (2004) The relations of success goal theory constructs and physical self-perceptions were explored with 225 students (91 men, 109 women, and 25
nonindicators; M age=23.5 yr., SD=9.2), registered in elementary physical activity classes (aerobics, weight training, modern dance, badminton, yoga, tai chi, basketball, racquetball, gymnastics, bowling, aquatone, and step aerobics) in a university background. Goal directions (Task and Ego Orientation in Sport Questionnaire), perceptions of the motivational climate (Perceived Motivational Climate in Sport Questionnaire-2), and physical self-perceptions (Physical Self-perception Profile) were evaluated. Statistics were analyzed separately by sex. Ego orientation was the only analyst of physical self-perceptions in men, secretarial for between 12 and 15% of the variance in physical self-worth, sport skill, physical conditioning, and body appeal. Hypotheses of achievement goal theory were not predictive of Physical Self-perceptions in the female. The outcomes are conversed in light of achievement goal theory and the wildlife of the sample.

**Lindwall and Hassmen (2004)** The purpose of this study was to investigate how scores on the Physical Self-Perception Profile (PSPP), including scores on the Perceived Importance Profile (PIP), were related to self-reported exercise frequency, duration, and gender in sample of Swedish university students. A total of 164 participants completed the PSPP, PIP, and a questionnaire focusing on frequency and duration of exercise. Exercise frequency, duration, and gender predicted best the PSPP sub-domains of Sport Competence and Physical Conditioning. Exercising added regularly, and for a longer time on each time was related with advanced PSPP and PIP scores. Women usually showed lower PSPP scores than men. These results propose that exercise specialists need to master a range of suitable exercise strategies, since doubts concerning self-presentation may work against establishing a regular exercise routine.
**Roure et al (1999)** It is now well established that mental imagery practice improves motor skills, but performance efficiency depends on many factors: the main one being individual differences. The aim of this study is to evaluate performance improvement with imagery quality estimated during ANS recording. Volleyball training ("receiving serve") afforded us the experimental paradigm. Subjects were required to pass an opponent's serve to a given team mate. The receiver's performance was evaluated from the accuracy of his pass to the targeted team mate. From these first test results, subjects were divided into two equivalent groups: imagers and controls. After mental practice the two groups were submitted to a posttest similar to the first one. During the pretest, posttest actual practice as well as the last session of corresponding mental rehearsal, six autonomic parameters were continuously recorded. Furthermore, and for the first time, a grade obtained from four different aspects of this response permits qualitative evaluation of each subject's mental imagery. This estimation, based on the well-established link between performance and autonomic response, is validated by the fact that good correlation was obtained between this grade and the performance improvement of each of the "imager" group subjects.

**Murphy (1994)** The use of imagery processes in the regulation and enhancement of sports performance is examined in this review paper. Research studies in this area are reviewed and four general categories of research are identified: 1) mental practice, 2) pre competition imagery, 3) comparisons of successful and unsuccessful competitors, and 4) mediating variables. The conclusion is reached that mental practice research has produced equivocal results and the reasons for this are examined. The argument is made that the mental practice model for research into imagery processes in sports is nonproductive.
**Caruso and Gill (1992)** Two studies examined the effects of physical activity/exercise on physical self-perceptions, self-efficacy, body satisfaction, fitness and relationships among these variables. In study 1, 34 female undergraduates participated in a 10-week exercise/activity program. Participants were selected from existing classes forming a weight training, aerobic exercise and activity control group. Results revealed changes in physical self-perceptions, strength, and body composition over the 10-weeks. Improvements in physical self-perceptions and fitness occurred independent of exercise/activity group. Groups differed in the perceived importance attached to physical self-perceptions. Correlations among the measures revealed relationships among physical self-perceptions, body satisfaction, global self-esteem, and fitness. In study 2, we hypothesized that weight training would have a greater effect on physical self-perceptions and body image perceptions than physical education activity classes. Thirty-seven males and 28 females were selected from existing classes forming a weight training and activity group. Results revealed no significant changes in physical self-perceptions, body image, or global self-esteem over the 10-week program, while strength and physical self-efficacy improved. Correlations among measures from both studies offer preliminary support for Sonstroem and Morgan's model for the examination of self-esteem in exercise settings.

### 2.5 Summary of Related Literature

In order to have a comprehensive picture and current status of different types of mallakhamb and isometric exercise, research studies conducted in this area were reviewed. The review of literature summaries that very few mallakhamb and isometric studies were conducted. Keeping in view that similar studies have not been conducted so far in India by using these subjects, the present investigation has been undertaken.