Chapter II

REVIEW OF RELATED LITERATURE

The related literature reviewed for better understanding of the problem and to interpret the results systematically, they are presented in this chapter. The reviews were collected from various sources like books, journal, and periodicals and provide back ground information to the study and help us to understand various concepts of yogic practices and physical exercises on health related fitness, BMR and lipid profile.

The literature in any field forms the foundation upon which all future work will be built. If one builds upon the foundation of knowledge provided by the review of literature, the investigator might not miss some similar work already done on the same topic. The reviews of the literature have been classified under the following headings:

1. Studies on physical exercise training on selected variables.
2. Studies on yogic practice on selected variables.
3. Summary of the literature.

1. Studies on physical exercise training on selected variables

*Padmanathan, (2011)*, conducted a study on the effect of low impact aerobic exercises on selected health related physical fitness variables such as muscular endurance, cardio respiratory endurance, flexibility and Bodymass index of male adolescents. Their age ranged from 12 to 15 years. They were divided in to two groups and designed as
Experimental group ‘A’ and Control group ‘B’ The Experimental group-A was given aerobic and calisthenics exercises for a period of twelve weeks, both morning and evening for five days in a week, whereas control group-B is not involved any specific exercise programme other than their regular physical activities programme as per their school curriculum. The result of this study indicated that muscular endurance and cardio respiratory endurance were significantly improved and also it was observed that Body mass Index significantly reduced.

Ramesh and Subramaniam (2010), suggested that effect of physical activity and aerobic fitness on health related physical fitness variables of overweight and obese adolescents. The selected variable includes muscular endurance flexibility, cardio-respiratory endurance, and body composition (body mass index). For the purpose of the study thirty obese boys in the age groups of 12 to 15 years and they were selected at random from Tirunelveli district higher secondary schools. They were divided into two equal groups and assigned as experimental group and control group. The experimental groups were given physical activity and aerobic exercise for a period of twelve weeks, both morning and evening on five days a week. Control group did not participate in physical activity and aerobic exercise training programme. The collected data was statistically analyzed by using analysis of covariance (ANCOVA). The Experiment group had a significant Improvement on the health related physical fitness variables of overweight and obese children than the control group. The authors conclude that the
experimental group has achieved significant improvement on muscular endurance, flexibility, cardio-respiratory endurance, and body mass index in significantly on due to the physical activity and aerobic exercise training programme.

Rajkumari et al. (2010) studied a cross-sectional study among 3356 school children of classes VIII to XII in Imphal West district, Manipur between September 2005 and August 2006. The characteristics of the respondents and related variables such as parental build, watching television, eating habits, playing of video/computer games and outdoor games, dietary pattern and knowledge of obesity were assessed using a questionnaire. Height, weight, waist circumference, hip circumference, fat percentage, fat mass and fat-free mass were measured. Body mass index (BMI) and waist–hip ratio for each student were calculated. The BMI of the sampled students was lower than the corresponding WHO and International Obesity Task Force standards. Using the WHO standard, the prevalence of overweight was 4.2% and of obesity 0.8%. Using multivariate logistic regression, mother being reported to be obese (OR 1.9, 95% CI 1.4–2.6), watching television for >2 hours a day (OR 2.052, 95% CI 1.191–3.536), higher family income (OR 5.844, 95% CI 2.135–15.99), not eating other type of vegetables in the past 1 week (OR 2.338, 95% CI 1.04–5.24) and waist–hip ratio (OR 7.737, 95% CI 4.429–13.51) were found to be independent predictors of a higher BMI. Mother’s literacy below class X (OR 0.6, 95% CI 0.378–0.997) and eating between major meals (OR 0.447, 95% CI
0.293–0.681) were significant predictors of a lower BMI. The prevalence of overweight and obesity among schoolchildren in the Imphal West district of Manipur is low. The possible reasons for this include a more traditional low-fat diet, less exposure to sedentary past-times and a greater time spent playing outdoors.

**Ramesh and Subramaniam (2011)** conducted a study on the effect of aerobic and calisthenics exercise on health related physical fitness variables such as muscular strength, muscular endurance, flexibility, cardio respiratory endurance and body mass index (BMI) of obese adolescents. Their age ranged from 12 to 18 years. They were divided into two groups and designed as the experimental group and control group. The Experimental group was given aerobic and calisthenics exercise for a period of three months, both morning and evening for five days in a week. However, the control group was not allowed to participate in aerobic and calisthenics exercise training programme. The result of this study indicated that muscular strength, muscular endurance, cardio respiratory endurance were significantly improved, and also it was observed that Body mass Index significantly reduced.

**Saremil et al. (2010)** examined the effects of 12 weeks of aerobic training on serum chemerin levels in association with cardiovascular risk factors in overweight and obese males. Twenty-one overweight and obese subjects [44.3 (±4.1 yrs, body mass index (BMI) ≥25 kg/m2) were assigned to exercise training (obese EX, n= 11) and control (obese CON,
groups. The obese EX group participated in 12 weeks of progressive aerobic training 5 days a week. Serum chemerin, insulin resistance, lipid profiles, blood pressure, and body composition were all measured before and after the training. After the aerobic training, waist circumference (P=0.009), fat percent (P=0.03), visceral fat (P=0.03), subcutaneous fat (P=0.01), fasting glucose (P=0.01), insulin resistance (P=0.03), triglyceride (P=0.05), total cholesterol (P=0.04), low-density lipoprotein cholesterol (P=0.05) and systolic blood pressure (P=0.04) of participants were significantly decreased. Concurrently, serum chemerin concentrations were significantly decreased after aerobic program (P=0.02). Aerobic training caused an improvement in cardiometabolic risk factors in obese subjects, and this improvement was accompanied by decreased chemerin levels.

**Chaudhary et al. (2010)** evaluated the effects of aerobic and strength training on cardiac variables such as blood pressure, heart rate (HR), and metabolic parameters like cholesterol, high density lipoprotein (HDL), triglycerides and anthropometric parameters of obese women of Punjab. This study was performed as an experimental study, in which subjects were randomly selected. There were thirty obese women, aged between 35-45yrs with body mass index (BMI) of above 30. Subjects were grouped into control (n=10), aerobic training (n=10) and resistance training (n=10). Aerobic training was given for three days a week at 60-70% of maximum HR for 6 weeks. Resistance training (Delorme and Watkins Technique) was given for alternate days for 6
weeks. HR and blood pressure were measured before and after the exercise. Recovery HR was also measured. The findings of the study indicate statistically significant differences in recovery heart rate [Pre-exercise: 97.40±5.378 (mean ± standard deviation (SD)), post-exercise: 90.70±4.599, t=8.066, P<0.001] and in post-diastolic blood pressure [Pre-exercise: 85±3.265, post-exercise: 86.20±2.820, P<0.001] in aerobic training and in systolic blood pressure [Pre- and post-exercise] in both training groups (P<0.001). Significant differences were observed in very low-density lipoprotein [pre-exercise: 28.10±1.415, post exercise: 26.86±0.760, t=5.378] and HDL [pre-exercise: 45.40±3.533, post-exercise: 53.60±3.134, t=6.318] levels in aerobic training group with P<0.001. BMI and body fat percentage showed significant improvements in both training groups. Aerobic training is more beneficial and can be used as a preventive measure in patients who are at risk of developing cardiovascular diseases due to obesity.

Habibzadeh et al. (2010) examined the obesity has been identified as a risk factor for the development of bulimia nervosa (BN) in those who try to lose weight. The purpose of the present study was to examine the effect of walking exercise in order to provide a method for overcoming bulimia nervosa in obese young women suffering from bulimia nervosa. Twenty obese women with bulimia nervosa (body mass index [BMI]>30) and a mean age of 22.00 ± 1.50 years volunteered to participate in this study. They were randomly assigned to exercise (n=10) and control (n=10) groups. Both groups underwent
anthropometric measurements and blood analysis before and after the training program. Exercise program included 30-minute walking sessions at 50-75% of maximal heart rate, 3 days per week and for 2 months. After 2 months significant changes were observed in all anthropometric variables (P<0.001). Percent body fat, fat mass, BMI, body weight and lean mass changes in response to training were significant in the exercise group (P<0.001). This study demonstrated that moderate aerobic exercises such as moderate walking are suitable behavior therapies for overcoming bulimia nervosa in obese young women.

**Ramesh and Subramaniam (2011)** conducted study on the effects of physical exercise training at different intensities on Body Mass Index (BMI), Basel metabolic rate (BMR) and body fat percentage (BF%) of obese adolescents. The present study has undertaken the survey method for identifying obese of the school going students. The researcher evaluated the existing data from school survey in Triunelveli town (6,732 boys) to measure the height and weight of the students (BMI). To achieve the purpose of this study thirty nine school boys were selected from St.Johns higher secondary school, and Sri Manthiramoorthy higher secondary school, in Tirunelveli town. Their age ranged from 12 to 18 years. They were divided in to three groups and designed as Experimental group ‘A’ Experimental group ‘B’ and Control group ‘C’. The Experimental group-A was given aerobic and calisthenics exercises, Experimental group-B underwent yogic exercise
such as Asanas and Pranayama (breathing exercises) for a period of three months, both morning and evening for five days in a week, whereas control group-C is not involved any specific exercise programme other than their regular physical activities programme as per their school curriculum. The data were collected before and after the exercises programme and statistically analyzed by using analysis of covariance (ANCOVA). The result of study report that has significantly reduction on body mass index and body fat percentage after three month of aerobic exercise training programme. Basel metabolic rate has significant increased exercise in burning capacity for calories reduce in aerobic exercise for three month period. There was no significant reduction in the performance of selected BMI, BMR and BF% after three months yogic exercise training programme when compared with aerobic exercise as well as control group.

**Leite et al. (2009)** examined the effects of physical exercise and nutritional guidance on body composition, physical fitness, lipid profile and insulin resistance among obese adolescents with and without metabolic syndrome. Sixty-four obese adolescents (26 boys), 10-16 years of age, were divided into two groups: with metabolic syndrome (n=29) and without metabolic syndrome (n=35). They were classified as having metabolic syndrome if they met three or more criteria for age and sex according to the Adult Treatment Panel III (ATP III). Blood pressure, waist circumference, maximum oxygen uptake (VO2peak), blood glucose, blood insulin, homeostatic model assessment (HOMA-IR),
quantitative insulin sensitivity check index (QUICKI) and lipid profile were assessed at baseline and after 12 weeks of intervention. Both groups participated in 12 weeks of physical education and two nutritional guidance sessions. Each physical education session consisted of 50 min indoor cycling, 50 min of walking/running and 20 min of stretching, three times a week. Results: Fifty-five participants (with metabolic syndrome=25; without metabolic syndrome=30) completed the treatment. After 12 weeks, both groups showed reductions in body weight, BMI z-score, waist circumference, fat mass and triglycerides; and increases in height, HDL-C and VO2peak (p<0.05). In addition, the group with metabolic syndrome presented reduced systolic blood pressure and increased insulin sensitivity (p<0.05). The risk factors for metabolic syndrome decreased by 72% Following the multidisciplinary intervention, the risk factors decreased, with improvements in physical fitness and metabolic profile. The multidisciplinary intervention was effective in reducing metabolic syndrome.

Sulayma et al. (2009) studied the effects of overweight and leisure-time activities on maximal aerobic capacity (VO2max) in urban and rural Omani adolescents. A total of 529 (245 males, 284 females) adolescents, aged 15–16 years were randomly selected from segregated urban and rural schools. Maximal aerobic capacity was estimated using the multistage 20-meter shuttle-run test. The body mass index (BMI) of urban boys and girls was significantly higher than that of rural boys
and girls. Urban boys and girls spent significantly less weekly hours on sports activities and significantly more weekly hours on TV/computer games than their rural counterpart. Urban boys and girls achieved significantly less VO2max than rural boys and girls (44.2 and 33.0 vs. 48.3 and 38.6 mL/kg/min, respectively). Maximal aerobic capacity was negatively correlated with BMI in urban boys. Overweight and inactivity had significant negative effects on cardiorespiratory fitness in urban boys and girls as compared to their rural counterparts. Weight gain in adolescence requires early intervention.

Leite et al., (2009) studied on the effects of physical exercise and nutritional guidance on metabolic syndrome in obese adolescents. For the purpose the lipid profile test and the height and weight were measure the calculated BMI, body weight, but mass and blood pressure were analysed. It was concluded that metabolic syndrome had a reduce the factor through the development of physical fitness and lipid profiles after twelve weeks training programme the effects of multidisciplinary involvement are important as blocking measures and remedial procedures for obese adolescents in order to improve their physical fitness and metabolic profiles regular physical activity need to be promoted in obese paediatric populations.

Volpe et al. (2008) investigated the effect of diet alone (D), exercise alone (E), and a combination of diet and exercise (DE) on body weight, body composition, energy intake, blood pressure, serum lipid and leptin levels, and fitness levels in mildly obese sedentary women
and men. The three interventions were compared in a randomized longitudinal study design. The exercise programs were supervised for six months, after which participants in E and DE were provided with exercise equipment to take home. 90 adult overweight women and men (age: 44.2 +/- 7.2 years; BMI = 30.5 +/- 2.7 kg/m(2)). Body weight, body composition, waist and hip circumferences, blood pressure, serum lipid levels, and fitness levels were evaluated at 0, 3, 6, 9, and 12 months. Serum leptin concentrations were measured at 0 and 6 months only. A combination of diet and exercise resulted in a significant decrease in body weight in women and men; but this decrease was not maintained at one year follow-up. Serum leptin concentrations showed significant within-group decreases, but were not different among groups. A supervised diet and exercise program is effective for weight loss; however, once intensive participant-investigator and participant-participant contact is discontinued, weight regain ensures.

**Benounis et al. (2008)** studied effects of two month physical – endurance and diet – restriction programmes on lipid profiles and insulin resistance in obese adolescent boys. A sample of 24 obese adolescent boys participated in an eight week physical endurance and diet-restriction programme. The authors concluded that moderate physical endurance, combination of and dietary restriction training programmed significant decrease, in body mass index, plasma triglycerides, LDL and total cholesterol and cardiovascular risk factors
in obese adolescent bodies. However, HDL cholesterol to triglycerides was significantly increased in obese adolescent boys.

**Bhutkar et al. (2008)** conducted on 78 subjects, (48 males and 30 females). It was observed that 6 months of suryanamaskar practice decreases resting pulse rate and blood pressure. At the same time it increases cardio-respiratory efficiency and respiratory capacity as evaluated by bicycle ergometry and various lung functions tests, in both male and female subjects. From this study we conclude that suryanamaskar practice can be advocated to improve cardio-respiratory efficiency for patients as well as healthy individuals.

**Wong et al. (2008)** studied the effects of a 12-week twice weekly additional exercise training, which comprised a combination of circuit-based resistance training and aerobic exercises, in addition to typical physical education sessions, on aerobic fitness, body composition and serum C-reactive protein (CRP) and lipids were analysed in 13- to 14-year-old obese boys contrasted with a control group. Both the exercise group (EG, n = 12) and control group (CG, n = 12) participated in the typical 2 sessions of 40-minute physical education (PE) per week in schools, but only EG participated in additional 2 sessions per week of 45 to 60 minutes per session of exercise training, which comprised a combination of circuit-based resistance training and aerobic exercises maintained at 65% to 85% maximum heart rate (HRmax = 220 - age). Body composition was measured using dual energy X-ray absorptiometry (DEXA). Fasting serum CRP and blood lipids was
analysed pre- and postexercise programme. Aerobic fitness was measured by an objective laboratory submaximal exercise test, PWC170 (Predicted Work Capacity at HR 170 bpm). Exercise training significantly improved lean muscle mass, body mass index, fitness, resting HR, systolic blood pressure and triglycerides in EG. Serum CRP concentrations were elevated at baseline in both groups, but training did not result in a change in CRP levels. In the CG, body weight increased significantly at the end of the 12-week period. This study supports the value of an additional exercise training programme, beyond the typical twice weekly physical education classes, to produce physiological benefits in the management of obesity in adolescents, including prevention of weight gain.

Huang et al. (2007) investigated the effect of a twelve-week heart health education and physical activity program on body weight and risk factors for type 2 diabetes and cardiovascular disease. Subjects were 120 obese fifth graders (65 boys and 55 girls, aged 10-13 years (mean 10.6 yrs), body mass index (BMI) at the 95th percentile or more) and were randomly assigned to an intervention group (n=60) or control group (n=60). The intervention group received a twelve-week heart health education and physical activity program, while the control group did not. In both groups, a series of examinations were done at baseline and post-test, including height, weight, BMI, body fat, blood pressure (BP), physical fitness (800-meter running test), heart health knowledge, and serum biochemistry. Differences for baseline and post-test data
were compared between both groups. Mean changes in the intervention group versus control group were significant for weight ($P = 0.024$), BMI ($P = 0.047$), percentage body fat ($P = 0.008$), physical fitness (800-meter running test) ($P = 0.025$), heart health knowledge ($P = 0.006$), total cholesterol ($P = 0.027$), triglycerides ($P = 0.018$), high-density lipoprotein cholesterol (HDL-C) ($P = 0.009$), low-density lipoprotein cholesterol (LDL-C) ($P = 0.041$), sugar ($P = 0.035$), insulin ($P = 0.007$), and insulin resistance (HOMA-IR) ($P = 0.028$). At post-test, weight, BMI, body fat, total cholesterol, triglycerides, LDL-C, sugar, insulin and HOMA-IR had decreased, but HDL-C had increased in the intervention group. A classroom-based weight-control intervention provides educational programs to promote cardiovascular health in children. This intervention is simple, practical, and beneficial for elementary school children.

*Liu et al. (2007)* evaluated the effect of Happy 10 program on the promotion of physical activity, physical growth and development of primary-school students, and on obesity control and prevention. Two similar primary schools from one district of Beijing, China were selected, one as an intervention school and the other as a control school. Happy 10 program was implemented at least once every school day in the intervention school for two semesters, whereas no intervention was adopted in the control school. The information on energy expenditure and duration of physical activity was collected by a validated 7-day physical activity questionnaire. Height and weight were
measured by trained investigators following the standardized procedure. Energy expenditure and intensity of each Happy 10 session was measured by a physical activity monitor. The average energy expenditure and duration of total physical activity per day among students in the intervention school increased significantly from 15.0 to 18.2 kcal/kg, and 2.8 to 3.3 h respectively, whereas the figures significantly decreased in the control school. There was a significant difference in change of weight and BMI between girls in the intervention and control school (2.4 kg vs 4.6 kg, -0.47 kg/m2 vs 0.66 kg/m2). The prevalence of overweight and obesity in the intervention school decreased by 0.4%-5.6%, as compared to the increase by 0.6%-4.5% in the control school. The average energy expenditure and intensity per 10-minute session ranged from 25.0-35.1 kcal, 4.8-6.2 kcal/kg/h respectively in grades 1-5. Happy 10 program provides a useful strategy to promote physical activity among school children and also plays a positive role in building up physical growth and development of girls.

Hansen et al. (2007) studied the dietary restriction combined with endurance exercise training represents an effective strategy to promote weight loss and reduce fat mass in obese patients. Exercise programmes without dietary restriction are less efficient. However, addition of exercise to a dietary restriction programme does not induce a greater fat-mass loss than dietary restriction alone. The latter is likely attributed to a compensatory reduction in daily physical activity following the implementation of exercise training. Nonetheless, inclusion
of an exercise training programme is important to prevent a decrease in fat-free mass, increase relative visceral fat-mass loss, improve dietary compliance and eventually maintain long-term weight control. Obese male patients with the highest fat mass are most likely to lose the largest amount of fat mass in such lifestyle intervention programmes.

Influences of training modalities during energy intake restriction on fat-mass loss are reviewed. The relationship between total energy expenditure during exercise training and overall fat-mass loss has been firmly established. The amount of training forms a more important predictor of fat-mass loss than training intensity. The sort of exercise (e.g. walking, cycling, swimming) plays another important predictor of fat-mass loss in intervention programmes. The implementation of resistance training in such programmes does not augment fat-mass loss but improves body composition by increasing fat-free mass. Further studies are needed to define the optimal interventional programme for obese patients.

*Stiegler and Cunliffe (2006)* studied the fat-free mass (FFM) represents a key determinant of the magnitude of resting metabolic rate (RMR), it follows that a decrease in lean tissue could hinder the progress of weight loss. Therefore, with respect to long-term effectiveness of weight-loss programmes, the loss of fat mass while maintaining FFM and RMR seems desirable. Diet intervention studies suggest spontaneous losses in bodyweight following low-fat diets, and current data on a reduction of the carbohydrate-to-protein ratio of the diet show
promising outcomes. Exercise training is associated with an increase in energy expenditure, thus promoting changes in body composition and bodyweight while keeping dietary intake constant. The advantages of strength training may have greater implications than initially proposed with respect to decreasing percentage body fat and sustaining FFM. Research to date suggests that the addition of exercise programmes to dietary restriction can promote more favourable changes in body composition than diet or physical activity on its own. Moreover, recent research indicates that the macronutrient content of the energy-restricted diet may influence body compositional alterations following exercise regimens. Protein emerges as an important factor for the maintenance of or increase in FFM induced by exercise training. Changes in RMR can only partly be accounted for by alterations in respiring tissues, and other yet-undefined mechanisms have to be explored. These outcomes provide the scientific rationale to justify further randomised intervention trials on the synergies between diet and exercise approaches to yield favourable modifications in body composition.

Carrel et al. (2005) determined whether a school-based fitness program can improve body composition, cardiovascular fitness level, and insulin sensitivity in overweight children. Fifty overweight middle school children with a body mass index (BMI) above the 95th percentile for age were randomized to lifestyle-focused, fitness-oriented gym classes (treatment group) or standard gym classes (control group) for 9
months. Children underwent evaluation of fasting insulin and glucose levels, body composition by means of dual energy absorptiometry, and maximum oxygen consumption (V\(_{O(2)}\)max) treadmill testing at baseline (before the school year) and at end of the school year. Rural middle school and an academic children's hospital.

Baseline test results for cardiovascular fitness, body composition, and fasting insulin and glucose levels. At baseline, there were no differences between groups before intervention (values for age, 12 +/- 0.5 years [all results, mean +/- SD]; BMI [calculated as weight in kilograms divided by the square of height in meters], 31.0 +/- 3.7; percentage of body fat, 36.5% +/- 4.6%; lean body mass, 41.4 +/- 8.6 kg; and V\(_{O(2)}\)max, 31.5 +/- 5.1 mL/kg per minute). Compared with the control group, the treatment group demonstrated a significantly greater loss of body fat (loss, -4.1% +/- 3.4% vs -1.9% +/- 2.3%; P = .04), greater increase in cardiovascular fitness (V\(_{O(2)}\)max, 2.7 +/- 2.6 vs 0.4 +/- 3.3 mL/kg per minute; P<.001), and greater improvement in fasting insulin level (insulin level, -5.1 +/- 5.2 vs 3.0 +/- 14.3 microIU/mL [-35.4 +/- 36.1 vs 20.8 +/- 99.3 pmol/L]; P = .02). Children enrolled in fitness-oriented gym classes showed greater loss of body fat, increase in cardiovascular fitness, and improvement in fasting insulin levels than control subjects. The modification to the school physical education curriculum demonstrates that small but consistent changes in the amount of physical activity has beneficial effects on body composition, fitness, and insulin levels in children. Partnering with school districts should be a part of a public health approach to improving the health of overweight children.
Langer and Houlay (2005) determined if RMR of overweight and sedentary subjects consuming $\beta$-blockers can be increased following an aerobic exercise training program. Twenty-four subjects participated in the study; 11 (6 women, 5 men) were treated with $\beta$-blockers for hypertension and 13 (9 women, 4 men) were non medicated (control group). Body composition, RMR, and peak oxygen uptake (VI O2peak) were assessed for all subjects before and after a 12-week aerobic exercise training program. Weekly exercise energy expenditure equaled 83.68 kJ (20 kcal) per kg of body weight while exercise intensity was maintained between 60% and 70% of the VI O2 reserve. Body composition, RMR, and VI O2peak did not differ among groups at the beginning of the study. Body weight (j1.4 kg for $\beta$-blockers, P G .05; j2.5 kg for control, P G .05) and VI O2peak (+2.2 mLIkgj1Iminj1 for $\beta$-blockers, P G .05; +4.1 mLIkgj1Iminj1 for control, P G .001) were significantly improved in both groups, whereas RMR (j272 kJIdayj1 for $\beta$-blockers, NS; +573 kJIdayj1 for control, P G .05) was increased only in the control group after the aerobic exercise training program. These results suggest that $\beta$-blockers limit the increase in RMR normally observed following an aerobic exercise training program. Consequently, obtaining a negative energy balance in an attempt to lose weight may be more difficult.

Sabia et al. (2004) compared the effect of continuous aerobic and intermittent anaerobic physical exercise associated with nutritional orientation on weight reduction, body composition, biochemical
measures and physical capacity of obese adolescents. 28 adolescents between 12 and 14 years old were studied, whose body mass index (BMI) is above percentile 95 for age and gender. The volunteers were randomly distributed into 2 groups: continuous walking exercise (GEC; n = 13) and running intermittent exercise (GEI; n = 15) and underwent a physical training program 3 times a week during 16 weeks, with duration from 20 to 40 minutes. Nutritional orientation occurred once a week, in 60-minute group sessions, throughout the entire experiment. In the initial and final periods, weight and height were measured so as to calculate the BMI, as well as subcutaneous fold, arm (AC) and arm muscle circumferences (AMC), body composition by means of electric bioimpedance, biochemical serum analyses (glycemia and lipids), and direct determination of maximum oxygen intake (VO2max) and anaerobic threshold (LAn). In both groups (GEC and GEI), anthropometric findings, BMI and subcutaneous folds, were significant decreased. In biochemical evaluation, a significant decrease occurred in GEC with respect to HDL, LDL and total cholesterol serum levels, although still within normal values. Values of HDL and triglycerides presented significant decrease in GEI. VO2max values increased significantly in both groups. We concluded that the physical activity proposed for both GEC and GEI was sufficient and satisfactory, promoting weight loss, better body composition and lipid levels, as well as an increase in the adolescents’ aerobic capacity.
Adkins et al. (2004) examined the measurements of girls' physical activity and associations with BMI, parent's reported self-efficacy and support for helping daughters be active, girl's perceived support from parents for physical activity, parent's and girl's perceived neighborhood safety and access to facilities, and family environment. Fifty-two 8- to 10-year-old African-American girls and their primary caregiver in the Minneapolis/St. Paul area participated in the Girls Health Enrichment Multisite Studies pilot intervention to prevent weight gain by promoting healthy eating and physical activity. Data collected included height, weight, physical activity level, and physical activity-related psychosocial measures from girl and parent. Girls wore an activity monitor for three days to assess an activity level. Correlations were computed among the average minutes per day of moderate to vigorous activity between 12 pm and 6 pm and BMI and psychosocial measures. BMI was inversely correlated with moderate to vigorous activity ($r = -0.35$, $p < 0.01$), whereas parent's self-efficacy for supporting daughter to be active was positively correlated with activity ($r = 0.45$, $p < 0.001$). There was a trend for parent's reported support of daughter's activity level to be associated with activity ($r = 0.26$, $p < 0.06$). Girl's perception of parent's support for physical activity, perceived neighborhood safety and access to facilities, and family environment was not associated with girl's activity levels. Interventions to increase physical activity among preadolescent African-American girls may benefit from a parental component to encourage support and self-efficacy for daughters' physical activity.
Mohan et al. (2004) conducted a study to evaluate the prevalence of sustained hypertension and obesity in apparently healthy school children in rural and urban areas of Ludhiana using standard criteria. A total of 2467 apparently healthy adolescent school children aged between 11-17 years from urban area and 859 students from rural area were taken as subjects. Out of total 3326 students, 189 were found to have sustained hypertension; in urban areas prevalence of sustained hypertension was 6.69% (n=165) and in a rural area it was 2.56% (n=24). Males outnumbered females in both rural and urban areas. The mean systolic and diastolic blood pressure of hypertensive population in both urban and rural population was significantly higher than systolic and diastolic blood pressure in their normotensive counterparts (urban normotensive systolic blood pressure: 115.48+/−22.74 mmHg, urban hypertensive systolic blood pressure: 137.59+/−11.91 mmHg, rural normotensive systolic blood pressure: 106.31+/−19.86 mmHg, rural hypertensive systolic blood pressure: 131.63+/−10.13 mmHg, urban normotensive diastolic blood pressure: 74.18+/−17.41 mmHg, urban hypertensive diastolic blood pressure: 84.58+/−8.14 mmHg, rural normotensive diastolic blood pressure: 68.84+/−16.96 mmHg, rural hypertensive diastolic blood pressure: 79.15+/−7.41 mmHg). Overweight population was significantly higher in urban area. There were 287 (11.63%) overweight students and 58 (2.35%) were obese. In rural population overweight and obese students were 44 (4.7%) and 34 (3.63%) respectively. There was a significant increase in prevalence of hypertension in both rural and urban population with increased body
mass index in urban students; those with normal body mass index had prevalence of hypertension of 4.52% (n=96), in overweight it was 15.33% (n=44) and in obese it was 43.10% (n=25). In a rural area, the overweight students showed prevalence of sustained hypertension in 6.82% (n=3) and in an obese group it was 61.76% (n=21). None of the students with normal body mass index in a rural area were found to be hypertensive. The mean body mass index of hypertensive population in both rural and urban areas was significantly higher than respective normotensive population (mean body mass index in an urban normotensive group: 20.34+/−3.72 kg/m², hypertensive group: 24.91+/−4.92 kg/m²; mean body mass index in a rural normotensive group: 18.41+/−3.41 kg/m², hypertensive group: 21.37+/−3.71 kg/m², p<0.01). Prevalence of sustained hypertension is on the rise in urban area even in younger age groups. Blood pressure is frequently elevated in obese children as compared to learn subjects. This is possibly related to their sedentary lifestyle, altered eating habits, increased fat content of diet and decreased physical activities.

*Molnar et al. (2004)* examined the lack of physical activity is associated with increased risk of overweight and cardiovascular disease, conditions associated with lower socioeconomic status (SES). Associations between activity levels of urban youth and limited access to safe recreation areas in their neighborhoods of residence were investigated. Analyses of data from the Project on Human Development in Chicago Neighborhoods, a multilevel longitudinal study of families
and communities, are reported. Individual-level data were obtained from 1378 youth 11 to 16 years old and caregivers living in 80 neighborhood clusters. Neighborhood-level data were collected from 8782 community residents and videotapes of 15,141 block faces. Parental estimates of hours youth spent in recreational programming were used to estimate physical activity. A scale of residents’ assessment of neighborhood safety for children’s play was created; disorder measures came from videotaped observations. Physical activity averaged 2.7 hours/week (SD = 5.0), varying significantly across neighborhoods. Using hierarchical linear regression, SES, age, and male gender, but not body mass index, were independently associated with physical activity. Lower neighborhood safety and social disorder were significantly associated with less activity, controlling for demographics. One mechanism for reduced physical activity among youth may be the influence of unsafe neighborhoods. Neighborhood interventions to increase safety and reduce disorder may be efficacious in increasing physical activity, thereby reducing risk of overweight and cardiovascular disease.

**Stettler et al. (2004)** studied the cross-sectional study of children (grades one to three) from four communities in the Greater Zurich Area (Switzerland). Obesity was defined as a combination of overweight (BMI) and over fat (skinfold thicknesses). Environmental factors were assessed by questionnaire. The children's physical activity was estimated by their teacher (scale 0 to 10). Results: Of 922 eligible subjects, 872 (94.6%) took part in the study. Use of electronic games
[odds ratio (OR)=2.03 per hour per day, 95% confidence interval (CI): 1.57 to 2.61, \( p<0.001 \), television (OR=2.83 per hour per day, 95% CI: 2.08 to 3.86, \( p<0.001 \), physical activity (OR=0.80 per unit, 95% CI: 0.72 to 0.88, \( p<0.001 \), maternal work (OR=1.93, 95% CI: 1.13 to 3.29, \( p=0.02 \), and paternal smoking (OR=1.78, 95% CI: 1.07 to 2.96, \( p=0.03 \) were independently associated with obesity. Further adjustment for socioeconomic status, when available, did not change these results. Discussion: In this sample of children living in Switzerland, the use of electronic games was significantly associated with obesity, independently of confounding factors. The association of obesity with television use and lack of physical activity confirms results from other populations and points to potential strategies for obesity prevention.

_Trudeau and Shephard (2005)_ analysed the effects of school physical education (PE) programmes on: (i) the physical activity (PA) levels of participants as children and adults; and (ii) attitudes toward PE and PA in the same groups. Based on the literature analysed, it can be suggested that a sufficient quantity of a quality PE programme can contribute significantly to the overall amount of moderate-to-intense PA of the school-age child. Schools also have the potential to influence the habitual PA of children by encouraging increased participation in extracurricular sports activities, by favouring active commuting to school and by providing exercise equipment and supervision for youth in their neighbourhoods. Most young children have a very positive
attitude towards PE. However, as they grow older, their perception of PE as a positive experience seems to become more ambiguous. From the few studies available, it seems likely that quality PE programmes help to maintain initial positive perceptions. Future research should address factors influencing the change of perceptions as a child matures. In addition to offering a quality PE programme, schools should ensure that the total weekly amount of PE is sufficient not only to maintain but also to enhance a child’s physical fitness. More research is needed to determine the ability of school PE programmes to influence PA behaviour in adult life and to evaluate strategies that will make optimal use of the curricular time allocated to PE.

Monyeki et al. (2005) determined the relationships between the body composition characteristics, body mass index (BMI), sum of skinfolds (SSF), % body fat (%BF), fat-free mass (FFM) and waist-to-hip ratio (WHR), and nine physical fitness items in undernourished rural primary school children in Ellisras, South Africa. A cross-sectional study. The study consisted of 462 boys and 393 girls who were aged 7-14 y. Five body composition measures were assessed: BMI, SSF, %BF, FFM and WHR. Nine physical fitness test items were assessed: standing long jump, bent arm hang, sit-ups, 10 x 5 m shuttle run, 50 m sprint, 1600 m run, flamingo balance, sit and reach, plate tapping. BMI was highly correlated with FFM (r = 0.7, P < 0.001). In line with findings from Western countries, regression coefficients (B) showed that children with higher BMI or SSF performed worse in bent arm hang (girls, B = -
0.84, P < 0.001, and B = -0.06, P = 0.02, respectively) and in 1600m run (B = 6.68, P < 0.001). BMI was significantly associated with flamingo balance (B = 0.26, P = 0.04). WHR was positively associated with bent arm hang (B = 9.37, P = 0.03), and inversely with sit and reach (B = -7.48, P = 0.01). In contrast, significant relationships were found between BMI and standing long jump (B = 0.74, P = 0.04), sit and reach (B = 0.51, P < 0.001), flamingo balance (B = 0.26, P = 0.04) and plate tapping (B = -19, P = 0.01). SSF was significantly associated with sit and reach (B = 0.04, P = 0.03). Significant inverse associations were found between FFM and bent arm hang (girls, B = -0.06, P = 0.05), 1600 m run (girls, B = -2.33, P = 0.003) and 50 m run (boys, B = -0.11, P = 0.006). FFM was significantly associated with standing long jump (boys, B = 0.99, P < 0.001; girls, B = 0.73, P < 0.001), flamingo balance (B = 0.17, P < 0.001), and with sit and reach (boys, B = 0.59, P = 0.03). In the present study in undernourished children, body composition was significantly related to physical fitness, but not always in the expected direction. It is therefore important to note that in this population, BMI should not be interpreted as a measure of fatness/overweight, but rather as an indicator of muscle mass.

**Saar and Jurimae (2007)** studied the associations of sports participation with perceived and actual physical fitness, and total physical activity for 525 10- to 17-yr.-old boys and girls in groups of 10-11-yr. (56 boys and 64 girls), 12-13-yr. (68 boys and 68 girls), 14-15-yr. (70 boys and 71 girls), and 16-17-yr. (68 boys and 60 girls) was based
on the Physical Activity Index derived from a questionnaire by Telama, Leskinen, and Young, and self-perceived endurance, strength, flexibility, and body composition. Questions about satisfaction with physical activity, participation in organized physical activity and competitions, or watching competitions were asked. Two EUROFIT tests were used, the 20-m endurance shuttle-run and sit-and-reach, plus the sum of 9 skinfold thicknesses. Children who participated in organized physical activity and in competitions had a higher Physical Activity Index. Passive watching of competitions was not related to children’s physical activity or their perceived or measured motor abilities.

*Husu et al. (2008)* investigated whether PA modifies the predictive value of health-related fitness (HRF) tests on difficulty in walking 2 km (WD). PA was assessed by self-reported questionnaires in 1990 and 1996. Subjects age 55 to 69 years and free of self-reported WD participated in assessment of HRF in 1996. Occurrence of WD was assessed by questionnaire in 2002 (n=537). There were no statistically significant interactions between PA and HRF tests; thus, PA and HRF were both independent predictors of WD. Regardless of the PA level, the subjects in the poorest performing third in each HRF test had higher risk of WD than the subjects in the best performing third. PA and HRF seemed to be independent predictors of WD, although the association of PA with WD was weaker than the association of HRF. Thus, PA did not modify the predictive value of HRF on WD.
**Thomas et al. (2007)** examined relationships between aerobic fitness (AF), fatness, and coronary-heart-disease (CHD) risk factors in 12- to 13-year-olds. The data were obtained from 208 schoolchildren (100 boys; 108 girls) ages 12.9 +/- 0.3 years. Measurements included AF, indices of obesity, blood pressure, blood lipids and lipoproteins, fibrinogen, homocysteine, and C-reactive protein. An inverse relationship was found between AF and fatness (p <or= .05). Fatness was related to a greater number of CHD risk factors than fitness was (p <or= .05). Further analysis revealed fatness to be an independent predictor of triglyceride and blood-pressure levels (p <or= .05). Our findings indicate that, for young people, fatness rather than fitness is independently related to CHD risk factors.

**Nassis et al. (2005)** examined the influence of cardiorespiratory fitness on total and truncal fatness in children. It was hypothesised that high cardiorespiratory fitness would result in lower total and central obesity. Observational cohort study. Primary and secondary schools in Athens, Greece. A total of 1362 healthy children aged 6-13 y (742 boys and 620 girls). Anthropometric data (height, body mass, four skinfolds thickness) were collected and per cent body fat was calculated. Body mass index (BMI) sex- and age-specific cutoff points were used for overweight and obesity definition and children were placed in two groups: overweight/obese and nonoverweight. Cardiorespiratory fitness (CRF) was assessed with the endurance shuttle-run test. Participants were grouped into high (upper two quintiles) and low (lower two
quintiles) CRF based on age and sex distributions. T-test and Mann-Whitney test were used for comparisons between fit and unfit children within each BMI category. Sum of skinfolds, subscapular and truncal skinfold thickness, BMI and per cent body fat were lower in overweight and obese youths with high CRF in comparison with youths at the same BMI category with low CRF (P<0.01). The beneficial effect of high CRF was also presented in nonoverweight children (P<0.01). The influence of CRF on body composition remained even after correcting body fatness for BMI. Central and total obesity were lower in overweight and obese children with high CRF. This is the first study to show that a high CRF may reduce the hazards of obesity in children.

DeStefano et al. (2000) studied the fifteen obese boys (aged 9–12 yr, body mass index (BMI) 31.8±6.5, average percent body fat (%BF) 41±4.2) underwent a supervised aerobic and resistance training program (12 wk, 2 days/wk for 30 min/session), to investigate the effects on weight and body composition. After the 3-month training period, weight loss averaged only 1.5±1.0 kg (not significant), but total body fat decreased by 4.1±1.8 kg (p<0.05) and fat-free mass (FFM) increased by 2.6±1.1 kg (p<0.05) based on hydrostatic weighing. As a result, %BF fell by 10% (p<0.01). There was a 5.8±2.8 mL/kg/min (p<0.05) increase in peak volume of oxygen uptake (VO₂), along with a 248±120 kcal/d (p<0.05) increase in resting energy expenditure (REE). Activity questionnaires showed a significant increase in high intensity recreational activities (6.5±1.5 vs 3.5±0.5 h physical activity/wk;
p<0.01) in the home and a significant decrease in low intensity activities (7±2.0 vs 12±3.5 h TV viewing/wk; p<0.01). Vigorous supervised aerobic training in obese boys has beneficial effects on body composition, fitness and leisure time activities that are not apparent by measurement of changes in body weight alone.

Burdette and Whitaker (2005) studied the preschool children have a higher prevalence of obesity, spend less time playing outdoors, and spend more time watching television (TV) when they live in neighborhoods that their mothers perceive as unsafe. In a cross-sectional survey in 20 large US cities, mothers reported the average daily time of outdoor play and TV viewing for their 3-year-old children, and the children’s BMI was measured. Maternal perception of neighborhood safety was assessed with the Neighborhood Environment for Children Rating Scales; the scale score was used to divide children into tertiles of neighborhood safety. Of the 3141 children studied, 35% lived in households with incomes below the US poverty threshold. After adjustment for socio demographic factors (household income and mothers' education, race/ethnicity, age, and marital status), obesity prevalence (BMI > or =95th percentile) did not differ in children from the least safe to the safest neighborhood safety tertile (18% vs 17% vs 20%) or in weekday (160 vs 151 vs 156 minutes/day) or weekend (233 vs 222 vs 222 minutes/day) outdoor play time. Children who lived in neighborhoods that were perceived by their mothers as the least safe watched more TV (201 vs 182 vs 185 minutes/day) and were more likely
to watch >2 hours/day (66% vs 60% vs 62%). TV viewing and outdoor play minutes were not significantly correlated to each other or to BMI. In a national sample of preschool children, mothers' perception of neighborhood safety was related to their children's TV viewing time but not to their outdoor play time or risk for obesity.

_Heelan et al. (2005)_ examined the increase the level of physical activity among children. However, the impact of walking, bicycling or skating (active commuting) to and from school on the prevalence of overweight is unknown. Body mass index (BMI) was measured for 320 children (age 10.2+/−0.7 years) in September. Over 5 months, an active commuting index (SI) and daily physical activity were estimated via questionnaire. In April, BMI and body fat were measured. A significant positive association was found between April BMI and SI adjusting for September BMI (partial r=0.03, P<0.05). Positive associations were found between SI and physical activity before school (r=0.17, P<0.05) and daily moderate intensity physical activity (r=0.13, P<0.05). There were no significant association between SI and BF (P>0.05). This preliminary data suggests that active commuting does not appear to provide sufficient amounts of physical activity to attenuate BMI; however, it may contribute to the attainment of physical activity recommendations. Future research is needed to objectively measure the impact of active commuting on the prevalence of overweight.
Tsimeas (2005) investigated physical fitness in relation to fatness in urban and rural Greek children by means of allometric scaling. The sample consisted of 360 (189 urban and 171 rural; age 12.3 +/- 0.42 years) boys and 247 (125 urban and 122 rural; age 12.3 +/- 0.43 years) girls. The sample was highly representative (32 - 64%) of all 12 year old children registered in the prefecture of Trikala, Greece. All volunteers were assessed for BMI and % body fat, as well as sit and reach, basketball throw (BT), vertical jump (VJ), handgrip strength (HG), 40 m sprint, agility run, and 20 m shuttle run. To correct for possible associations between fatness and fitness, a single cause allometric scaling was employed using the natural logarithms (ln) of fitness parameters that were significantly correlated with the ln body fat. Independent-samples t tests revealed that VJ (p< 0.05) was significantly higher in boys living in urban settings compared to their rural counterparts. Similarly, BT was found to be significantly better (p< 0.05) in urban girls, whereas HG was significantly higher (p< 0.05) in rural girls. Considering that (a) only three out of the 14 possible cases (seven fitness parameters for boys and seven for girls) were significantly different between urban and rural children, and (b) these differences were not uniformly distributed in children living in either urban or rural environments, it is concluded that the place of residence has no clear impact on physical fitness as studied herein.

Deforche et al. (2003) assessed different aspects of physical fitness and physical activity in obese and non-obese Flemish youth. A
random sample of 3214 Flemish schoolchildren was selected and divided into an "obese" and "non-obese" group based on body mass index and sum of skinfolds. Physical fitness was assessed by the European physical fitness test battery. Physical activity was estimated by a modified version of the Baecke Questionnaire. Obese subjects had inferior performances on all tests requiring propulsion or lifting of the body mass (standing-broad jump, sit-ups, bent-arm hang, speed shuttle run, and endurance shuttle run) compared with their non-obese counterparts ($p < 0.001$). In contrast, the obese subjects showed greater strength on handgrip ($p < 0.001$). Both groups had similar levels of leisure-time physical activity; however, non-obese boys had a higher sport index than their obese counterparts ($p < 0.05$). Results of this study show that obese subjects had poorer performances on weight-bearing tasks, but did not have lower scores on all fitness components. To encourage adherence to physical activity in obese youth, it is important that activities are tailored to their capabilities. Results suggest that weight-bearing activities should be limited at the start of an intervention with obese participants and alternative activities that rely more on static strength used.

Van et al. (2002) investigated the effect of exercise training at different intensities on fat oxidation in obese men. Twenty-four healthy male obese subjects were randomly divided in either a low- [40\% maximal oxygen consumption ($\text{VO}_2 \text{ max}$)] or high-intensity exercise training program (70\%$\text{VO}_2 \text{ max}$) for 12 wk, or a non-exercising
control group. Before and after the intervention, measurements of fat metabolism at rest and during exercise were performed by using indirect calorimetry, [U-13C] palmitate, and [1,2-13C]acetate. Furthermore, body composition and maximal aerobic capacity were measured. Total fat oxidation did not change at rest in any group. During exercise, after low-intensity exercise training, fat oxidation was increased by 40% (P < 0.05) because of an increased non-plasma fatty acid oxidation (P < 0.05). High intensity exercise training did not affect total fat oxidation during exercise. Changes in fat oxidation were not significantly different among groups. It was concluded that low intensity exercise training in obese subjects seemed to increase fat oxidation during exercise but not at rest. No effect of high-intensity exercise training on fat oxidation could be shown.

Dorien et al. (2002) examined the relationship we reviewed studies of BMR in children, adolescents, adults, semistarved non-obese, anorexics, and weight-reducing obese. The relationship between BMR and fat-free mass (FFM) of children, lean adolescents, and lean and obese adults consuming sufficient energy could be described by a single line, BMR (MJ/d) = 2.44 + 0.084 FFM (SEE = 0.63, $R^2 = .80$). Obese adolescents demonstrated BMRs greater than predicted and semistarved lean individuals demonstrated BMRs less than predicted by this relationship. Obese individuals demonstrated a reduced BMR during underfeeding, but less so than semistarved lean individuals. The reduction in BMR relative to FFM in semistarved lean individuals could
not be explained by disproportionate reductions in body cell mass (BCM).

**Gutin et al. (2002)** determined the effects of physical training intensity on the cardiovascular fitness, percentage of body fat (%BF), and visceral adipose tissue (VAT) of obese adolescents. Obese 13–16-y-olds ($n = 80$) were assigned to 1) biweekly lifestyle education (LSE), 2) LSE + moderate-intensity physical training, or 3) LSE + high-intensity physical training. The intervention lasted 8 mo. Physical training was offered 5 d/wk, and the target energy expenditure for all subjects in physical training groups was 1047 kJ (250 kcal)/session. Cardiovascular fitness was measured with a multistage treadmill test, %BF with dual-energy X-ray absorptiometry, and VAT with magnetic resonance imaging. The increase in cardiovascular fitness in the high intensity physical training group, but not in the moderate-intensity group, was significantly greater than that in the LSE alone group ($P = 0.009$); no other comparisons of the 3 groups were significant. Compared with the LSE alone group, a group composed of subjects in both physical training groups combined who attended training sessions ≥2 d/wk showed favorable changes in cardiovascular fitness ($P < 0.001$), %BF ($P = 0.001$), and VAT ($P = 0.029$). We found no evidence that the high-intensity physical training was more effective than the moderate-intensity physical training in enhancing body composition. The cardiovascular fitness of obese adolescents was significantly improved by physical training, especially high intensity physical training. The
physical training also reduced both visceral and total-body adiposity, but there was no clear effect of the intensity of physical training.

Ledoux et al. (1997) determined the mathematic formula for weight, height and waist and hip circumference that is most closely correlated to cardiovascular disease risk factors. Population-based, cross-sectional surveys. Five Canadian provinces, between 1990 and 1992. Participants: A probability sample of 16,007 men and women aged 18 to 74 years was selected using health insurance registration files in each province. Anthropometry was performed on 10,054 (63%) of these adults. The power of height in the body mass index (BMI, kg/m$^2$) and of hip circumference in the ratio of waist to hip circumference (WC/HC) was varied from 0 to 3. Simple linear regression analysis for each age-sex group was used to examine the relation of each index to systolic and diastolic blood pressure (SEP and DBP), levels of total cholesterol (TC), low-density lipoprotein cholesterol (LDL) and high-density lipoprotein cholesterol (HDL), triglycerides (TRIG) and the ratio of TC to HDL. Values for the coefficient of determination ($r^2$) were used to compare the fits of the models. The $r^2$ values were generally low (< 0.27), but were greatest in the younger age groups (18-24 and 35-54 years) and in women. Waist circumference alone (WC/HC$^0$) showed the best fit with SEP and DBP, whereas WC/HC$^{0.5}$ was most closely related to HDL, TC/HDL and TRIG. None of the indices was closely associated with TC or LDL. Whatever the power of height used, the weight-height ratios showed weaker associations with the risk factors than the waist-
hip ratios. WC and BMI correlate most closely with blood pressure and plasma lipid and may be the best simple anthropometric indices to include in the routine clinical examination of adults.

\textit{McKenzie et al. (1996)} examined the Schools can promote public health objectives by increasing physical activity among youth. The Child and Adolescent Trial for Cardiovascular Health (CATCH) was a multicenter, randomized trial to test the effectiveness of a cardiovascular health promotion program in 96 public schools in four states. A major component of CATCH was an innovative, health-related physical education (P+) program. For 2.5 years, randomly assigned schools received a standardized PE intervention, including curriculum, staff development, and follow-up. Systematic analysis of 2,096 PE lessons indicated students engaged in more moderate-to-vigorous physical activity (MVPA) in intervention than in control schools (P = 0.002). MVPA during lessons in intervention schools increased from 37.4% at baseline to 51.9%, thereby meeting the established Year 2000 objective of 50%. Intervention children reported 12 more min of daily vigorous physical activity (P = 0.003) and ran 18.6 yards more than control children on a 9-min run test of fitness (P = 0.21). The implementation of a standardized curriculum and staff development program increased children's MVPA in existing school PE classes in four geographic and ethnically diverse communities. CATCH PE provides a tested model for improving physical education in American schools.
Gutin et al. (1995) determined the effect of supervised physical training without dietary intervention, on body composition of obese girls. The subjects were 25 obese 7- to 11-year-old black girls, divided into physical training and lifestyle education groups which were comparable on baseline body composition; 22 girls finished all aspects of the study. Twelve girls engaged in aerobic training (10 weeks, 5 days/week) while 10 engaged in weekly lifestyle discussions without formal physical training. Total body and regional body composition were measured with dual energy x-ray absorptiometry, skinfolds and circumferences. Aerobic fitness was measured by heart rate response to submaximal treadmill exercise. The physical training group attended 94% of scheduled sessions and kept their heart rates at an average of 163 bpm for 28 minutes/session. The lifestyle group attended 95% of their sessions; they remained stable in aerobic fitness and most body composition measurements. The physical training group showed a significant improvement in aerobic fitness and a significant decline of 1.4% body fat. Skinfold and circumference indices of fatness also declined significantly in the training group. We conclude that controlled physical training, without dietary intervention, improved the fitness and body composition of obese black girls.

Katzel et al. (1995) compared the effects of weight loss vs aerobic exercise training on coronary artery disease risk factors in healthy sedentary, obese, middle-aged and older men. A total of 170 obese (body mass index, 30 +/- 1 kg/m2 [mean +/- SEM]), middle-aged
and older (61 +/- 1 years) men. A 9-month diet-induced weight loss intervention, 9-month aerobic exercise training program, and a weight-maintenance control group. Change in body composition, maximal aerobic capacity (VO2 max), blood pressure, lipoprotein concentrations, and glucose tolerance. Forty-four of 73 men randomized to weight loss completed the intervention and had a 10% mean reduction in weight (-9.5 +/- 0.7 kg; P < .001), with no change in VO2 max. Forty-nine of 71 men randomized to aerobic exercise completed the intervention, increased their VO2 max by a mean of 17% (P < .001), and did not change their weight, whereas the 18 men who completed in the control group had no significant changes in body composition or VO2 max. Weight loss decreased fasting glucose concentrations by 2%, insulin by 18%, and glucose and insulin areas during the oral glucose tolerance test (OGTT) by 8% and 26%, respectively (P < .01). By contrast, aerobic exercise did not improve fasting glucose or insulin concentrations or glucose responses during the OGTT but decreased insulin areas by 17% (P < .001). In analysis of variance, the decrement in fasting glucose and insulin levels and glucose areas with intervention differed between weight loss and aerobic exercise when compared with the control group (P < .05). Similarly, weight loss but not aerobic exercise increased high-density lipoprotein cholesterol levels (+13%) and decreased blood pressure compared with the control group. In multiple regression analyses, the improvement in lipoprotein and glucose metabolism was related primarily to the reduction in obesity. These results suggest that
weight loss is the preferred treatment to improve coronary artery disease risk factors in overweight, middle-aged and older men.

Van et al. (1994) evaluated the effects of endurance exercise on fat-free mass and nitrogen balance, with energy restriction or with energy intake to meet non-exercise needs in obese women. The study was a 14-week metabolic control study with a 2-week baseline period for dietary stabilization followed by a 12-week period of exercise (E) with or without energy restriction (D), E or D+E. Ten obese women between the ages of 19 and 37 years volunteered as subjects. Body weight ranged from 19% to 41% IBW and body fat was 31-40% of body weight. Women were assigned to either an energy-restricted or energy-'adequate' group so that group means for weight, body fat, FFM, predicted VO2max and RMR were similar. Data were polled for the 2-week baseline period and in 3-week intervals during the intervention period. The data indicated that E had a slower rate of weight loss and a lower loss of FFM than D+E. Nitrogen balance was more positive in E than D+E. Negative N balance occurred in the D+E group when blood was drawn. There was no decrease in N excretion to compensate for blood losses. N balance for E was positive throughout the study. Changes in FFM, assessed by total body electrical conductivity, were different from the results obtained by classic nitrogen balance. This suggests that losses were due to fluid losses, which were confirmed by deuterium dilution procedures. This study demonstrated that body protein stores remained intact during
periods of increased energy expenditure and dietary restriction in obese women.

*Broeder et al. (1992)* investigated that effect of aerobic fitness on resting metabolic rate. The objective of this study was to find the relationship between resting metabolic rate and aerobic fitness. Body composition, resting metabolic rate, and a three-day dietary recall were collected from the subjects. The subjects were placed in low, moderate, or high fitness levels aerobic exercise of their tests. The results of the significantly different among the groups were fat free mass normally positively associated with resting metabolic rate. If the groups were graded on their level of strength, then there could possibly prove to be significant differences between groups.

*Dattilo and Kris-Etherton (1992)* examined effects of weight loss by dieting on lipids and lipoproteins through the review method of meta-analysis. Results from the 70 studies analyzed indicated that weight reduction was associated with significant decreases (P ≤ 0.001) and correlations (P ≤ 0.05) for TC (r = 0.32), LDL-C (r = 0.29), VLDL-C (r = 0.38), and TG (r = 0.32). For every kilogram decrease in body weight, a 0.009-mmol/L increase (P ≤ 0.01) in HDL-C occurred for subjects at a stabilized, reduced weight and a 0.007-mmol/L decrease (P ≤ 0.05) for subjects actively losing weight. Our results indicate that weight reduction through dieting can be a viable approach to help normalize plasma lipids and lipoproteins in overweight individuals.
Luke and schoeller (1992) examined the relationship between BMR and fat-free mass (FFM) of adolescents, and weight-reducing obese. Obese adolescents demonstrated BMRs greater than predicted and semi starved lean individuals demonstrated BMRs less than predicted by this relationship. Obese individuals demonstrated a reduced BMR during underfeeding, but less so than semistarved lean individuals. The reduction in BMR relative to FFM in semi starved lean individuals could not be explained by disproportionate reductions in body cell mass.

2. Studies on yogic practices on selected variables

Asai and Rane (2011) conducted an experiment study on asanas and lezium programme on selected physical fitness variables of school boys. The objectives to measure over all physical fitness level of the school boy of age 14 to 16 years. Selected subjects were divided into two equal groups one control group and a experimental group. Seventy male students (n=70) from the secondary section of our lady of Nazareth high school. Bhayandar, Mumbai in India. The health related physical fitness test was considered as dependent variable. The subjects of the experimental group were then put under six weeks of lezium and yogic exercises training programme. The collected data were statistically analyzed by using analysis of variance (ANOVA). The authors conclude that there was significantly changes in health related physical fitness such as, cardio-respiratory endurance, abdominal strength and endurance and flexibility increase the performance. However, the body
fat percentage significantly reduces performance for due the asana and
zezium training programme.

**Elangovan and Babu (2011)** suggested that the effect of yogic practices on selected bio-chemical variables of obese college men with age between 19 to 25 years. The selected subjects were randomly assigned into two equal groups namely experimental group (N: 15) which underwent yogic practices for 12 weeks with 4 sessions per week and control (N:15) which did not undergo any special training. The subjects were tested for Laboratory test prior to and after training on selected variable HDL, and LDL and BMI, the obtained data were statistically assessed for any significant difference using ANCOVA. The author concluded that the significantly increased due to HDL. However LDL cholesterol was significantly decreasing in obese college men.

**Mody (2010)** assessed the cardio-respiratory and metabolic responses of four rounds of Surya Namaskar, a typical amount performed by practitioners, to determine its potential as a training and weight loss tool. Six healthy Asian Indian men and women (18–22 years) who had trained in Surya Namaskar for over two years participated in the study. Testing was completed in a single session lasting about 30 min. To measure heart rate and oxygen consumption while performing the four rounds, participants were connected to a heart rate monitor and the Oxycon Mobile Metabolic System. Participants exercised at 80% of age-predicted maximal heart rate (HRmax) during Round 2, 84% during Round 3, and 90% during Round 4. Average
intensity during the four rounds was 80% HRmax, sufficient to elicit a cardio-respiratory training effect. Oxygen consumption averaged 26 ml/kg/min during each round, resulting in an energy expenditure of 230 kcals during a 30 min session for a 60 kg individual. Regular practice of Surya Namaskar may maintain or improve cardio-respiratory fitness, as well as promote weight management.

_Urdiales et al. (2010)_ analysed the association of objectively assessed physical activity (PA) with muscular strength and fat-free mass in adolescents, and to determine whether meeting the current PA recommendations is associated with higher levels of muscular strength and fat-free mass. The present cross-sectional study comprised 363 Spanish adolescents (180 females) aged 12.5–17.5 years. PA was assessed by accelerometer and expressed as average PA (counts/min), and min/day of inactive, light, moderate, vigorous and moderate to vigorous PA (MVPA). MVPA was dichotomized into <60 min/day and ≥60. Upper body muscular strength was measured with the handgrip strength test, and lower body muscular strength was measured with the standing broad jump, squat jump, counter movement jump and Abalakov tests. Fat-free mass was measured by DXA. We observed positive associations between vigorous PA and all the lower body muscular strength tests except for the counter movement jump in males. PA was not associated with fat-free mass in both males and females. Male adolescents engaged in at least 60 min/day MVPA performed better in the standing broad jump test. In conclusion, the
Windings of the present study suggest that only vigorous PA is associated with muscular strength, particularly lower-body muscular strength in male adolescents.

_Telles et al. (2010)_ studied the effects of yoga and diet change program, emphasizing breathing techniques practiced while seated, was assessed in obese persons. A single group of 47 persons were assessed on the first and last day of a yoga and diet change program, with 6 days of the intervention between assessments. The assessments were: body mass index (BMI), waist and hip circumferences, mid-arm circumference, body composition, hand grip strength, postural stability, serum lipid profile and fasting serum leptin levels. Participants practiced yoga for 5 hours every day and had a low fat, high fiber, vegetarian diet. Last and first day data were compared using a t-test for paired data. Following the 6-day residential program, participants showed a decrease in BMI (1.6 percent), waist and hip circumferences, fat-free mass, total cholesterol (7.7 percent decrease), high density lipoprotein (HDL) cholesterol (8.7 percent decrease), fasting serum leptin levels (44.2 percent decrease) and an increase in postural stability and hand grip strength (p<0.05, all comparisons). A 6-day yoga and diet change program decreased the BMI and the fat-free mass. Total cholesterol also decreased due to reduced HDL levels. This suggests that a brief, intensive yoga program with a change in diet can pose certain risks. Benefits seen were better postural stability, grip strength (though
a 'practice effect' was not ruled out), reduced waist and hip circumferences and a decrease in serum leptin levels.

Dhananjai et al. (2010) studied the effect of a yoga practice for 12 weeks on lipid profiles of 56 obese subjects (32 females and 24 males) age ranged from 20 to 45 yrs were evaluated. Results revealed a significant (p<0.01) decrease in anthropometric variables (weight, body mass index, waist circumference and hip circumference). Further, total cholesterol, triglyceride, very low density lipoprotein, low density lipoprotein and fasting plasma glucose decreased significantly (p<0.01) while high density lipoprotein increase significantly when compare to the basal variables before intervention given (p<0.01). A significant and positive correlation was evident among pretreatment anthropometric variables (p<0.01) while most of the lipid profiles parameters also showed a significant (p<0.05 or p<0.01) positive or negative correlation with each other. The pretreatment weight (r=0.49; p<0.01), waist circumference (r=0.39; p<0.01) and hip circumference (r=0.26; p<0.05) showed significant and positive correlation with pretreatment Triglyceride. The change (improvement) in weight and TG were significantly (r=0.49, p<0.01) associated with each other. However, the improvement in all anthropometric variables and lipid profiles parameters of females and males were found to be similar (p>0.05). This pilot study found yoga practices effective in reducing weight. Further, this weight loss is also found to be associated well with the improvements in lipid profiles. Investigations with large sample size,
different covariates and follow up of outcomes are needed to validate the effect of other yoga exposures.

*Ramesh (2011)* conducted a study on the effect of physical and breathing exercise on fat free mass index (FFM) and basal metabolic rate (BMR) variable of obese adolescence. The present study has undertaken the survey method for identifying obese of the school going students. The researcher evaluated the existing data from school survey in Triunelveli town (4,732 boys) to measure the height and weight of the students (BMI) after which the effect study was conducted. To achieve the purpose of these study forty five school boys were selected from St.Johns higher secondary school, and Sri Manthiramoorthy higher secondary school, in Tirunelveli town. Their age ranged from 13 to 18 years. They were divided in to three equal groups and designed as Experimental group ‘A’, Experimental group ‘B’ and Control group ‘C’. The Experimental group-A was given aerobic and calisthenics exercises, Experimental group-B underwent yogic exercise such as Asanas and Pranayama (breathing exercises) for a period of three months, both morning and evening for five days in a week, whereas control group-C is not involved any specific exercise programme other than their regular physical activities programme as per their school curriculum. The result of this study indicated that fat free mass reduced significantly and also it was observed that basal metabolic (burning capacity) significantly increased.
Ramesh and Subramaniam (2010) conducted a study on the cardio respiratory fitness and body mass index between rural and urban school boys. For the purpose of this study two hundred six (206) boys studying in schools located in Urban area and three hundred ninety seven (397) boys studying in school located in urban and Rural area of Tirunelveli (Tamilnadu) age ranged from 11 to 16 years, were selected as subjects for the study. The cardio respiratory fitness of the subjects was evaluated by conducting six minute run and walk tests and body mass index was determined by dividing weight in kilogram by the square of body height in meters. T-test was applied to determine the significance of mean differences between Urban and Rural school boys on body mass index and cardio-respiratory fitness. It was found that rural boys were better in cardio-respiratory fitness was well as BMI. Urban school boys were heavier than Rural School boys of Tirunelveli. Urban school boys were having grater body mass index (BMI) as compared to Urban School boys. Rural school boys were better in cardio-respiratory fitness than urban school boys of Tirunelveli. The findings of this study suggest that children who have higher body mass index and lower cardio respiratory fitness are likely to have grater BMI gain over time.

Ramesh and Subramaniam (2010) carried out a study on the effect of yogic pranayama and meditation on selected physical and physiological variables in adolescents with age group of 12 to 15 years were selected from Jawaharlal Navodaya Vidyalaya higher Secondary
School Pondicherry. The subjects were divided into two groups namely control group and experimental group. The experimental group was given yogic pranayama and meditation for a period of twelve weeks, both morning and evening an alternative days in a week. The control group did not participate in yogic pranayama and meditation training programme. The collected data were statistically analyzed by using ANCOVA. The author concluded that there was a significant change in flexibility increase performance in adolescents.

*Chen et al. (2009)* investigated the effect of yoga exercise on the health-related physical fitness of school-age children with asthma. The study employed a quasi-experimental research design in which 31 voluntary children (exercise group 16; control group 15) aged 7 to 12 years were purposively sampled from one public elementary school in Taipei County. The yoga exercise program was practiced by the exercise group three times per week for a consecutive 7 week period. Each 60-minute yoga session included 10 minutes of warm-up and breathing exercises, 40 minutes of yoga postures, and 10 minutes of cool down exercises. Fitness scores were assessed at pre-exercise (baseline) and at the seventh and ninth week after intervention completion. A total of 30 subjects (exercise group 16; control group 14) completed follow-up. Results included: 1. Compared with children in the general population, the study subjects (n = 30) all fell below the 50th percentile in all five physical fitness items of interest. There was no significant difference in scores between the two groups at baseline (i.e., pre-exercise) for all five
fitness items. 2. Research found a positive association between exercise habit after school and muscular strength and endurance among asthmatic children. 3. Compared to the control group, the exercise group showed favorable outcomes in terms of flexibility and muscular endurance. Such favorable outcomes remained evident even after adjusting for age, duration of disease and steroid use, values for which were unequally distributed between the two groups at baseline. 4. There was a tendency for all item-specific fitness scores to increase over time in the exercise group. The GEE analysis showed that yoga exercise indeed improved BMI, flexibility, and muscular endurance. After 2 weeks of self-practice at home, yoga exercise continued to improve BMI, flexibility, muscular strength, and cardiopulmonary fitness.

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.
(ANCOVA). The Experiment group had a significant improvement on the selected physical and physiological variables except systolic and diastolic blood pressure than control group.

Petrofsky et al. (2005) studied the yoga and yoga-related training have often been touted as providing good muscle stretching and relaxation, as well as being beneficial for overall stress management. During forceful muscle contractions of yoga, substantial muscle activity can be demonstrated. In the present investigation, the muscle activity of the right and left rectus abdomen’s and of the right and left external oblique muscles was examined to assess the level of muscle activity during one type of yoga maneuver: a breathing exercise performed in the seated position. The results showed that while muscle activity during this yoga breathing exercise was comparable to that seen during the performance of abdominal crunches, the longer duration of the breathing exercises increased the total work on the abdominal muscles up to 5 times greater than the work during crunches. Because of the high muscle activity, this form of exercise would be good for people who cannot easily exercise on the floor such as people with disabilities or obese people.

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

Bezerra et al. (2010) conducted a study on the effects of Yoga on bone biochemical markers (BBM) of formation (osteocalcin) and absorption (carboxy-terminal collagen crosslinks, CTX), and estradiol hormone. Forty eight post-menopausal women (63.9 ± 5.6 years old) were divided into two groups: Yoga Group (YG, n = 24) and Control Group (CG, n = 24). The YG performed yoga three times per week (one hour each session) for six months, while the CG was instructed to do not alter their habitual daily routine. Bone mineral density (BMD), BBM
and estradiol hormone were analyzed before and after Yoga program by standard procedures. A mixed factorial ANOVA was performed to verify intra and inter group differences. A significant decrease in spinal lumbar and total hip BMD for the CG was observed while only spinal lumbar BMD decreased in the YG. Osteocalcin values increased in YG and decreased in CG, while CTX values decreased in both groups. No significant differences were observed for the estradiol hormone. It was concluded that the yoga intervention failed to induce significant improvements in post-menopausal women BMD, however, it was capable of enhancing biochemical marker of bone formation as measured by serum osteocalcin, thus suggesting an increased bone turnover.

Jimenez (2010) evaluated the effect of an intensive HY intervention (IHY) on cardiovascular risk factors in middle-aged and older women from Northern Mexico. In this prospective quasiexperimental design, four middle-aged and nine older CHY practicing females (yoginis) were enrolled into an 11-week IHY program consisting of 5 sessions/week for 90 min (55 sessions). The program adherence, asana performance, and work intensity were assessed along the intervention. Anthropometric [body mass index (BMI), % body fat and \( \sum \) skin folds], cardiovascular fitness [maximal expired air volume (\( \text{VE}_{\text{max}} \)), maximal \( \text{O}_2 \) consumption (\( \text{VO}_{2\text{max}} \)), maximal heart rate (\( \text{HR}_{\text{max}} \)), systolic (BPs) and diastolic blood pressure (BPd)], biochemical [glucose, triacylglycerols (TAG), total cholesterol (TC), high-density
lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C), and dietary parameters were evaluated before and after IHY. Daily caloric intake (~1,916 kcal/day), program adherence (~85%), and exercising skills (asanaperformance) were similar in both middle-aged and older women. The IHY program did not modify any anthropometric measurements. However, it increased VO$_{2\text{max}}$ and VE$_{\text{max}}$ and HDL-C while TAG and LDL-C remained stable in both middle-aged and older groups ($P<0.01$). The proposed IHY program improves different cardiovascular risk factors (namely VO$_{2\text{max}}$ and HDL-C) in middle-aged and older women.

Fillmore et al. (2010) documented the effects of yoga interventions on balance, flexibility, and strength in adolescent girls 14 to 18 years. Quasi-experimental, non-randomized. A convenience sample of 33 female adolescents participated in yoga training 2 times per week and a walking program 3 times per week, for 7 weeks. The instructor-led group received instruction from a registered yoga therapist in person, while the video-led group watched a tape of the instructor-led session. Pre- and post-measurements of weight, hamstring flexibility, body fat, strength, and balance were collected. Means were computed for all variables. Levene's tests for equality of variances were run to determine baseline homogeneity. Histograms with a normal curve superimposed were drawn to check for normal distribution. Repeated-measures general linear model tests were run to test for both within- and between-subjects factors, as well as
interactions between the two. Yoga may be a useful adjunct to therapy programs and provide a method to keep this age group interested in exercise.

*Ruhal et al. (2010)* studied the 30 male students of BPE first year of LNIPE (Deemed University), Gwalior were randomly selected as subjects for this study. Subjects were divided into two groups that is, one experimental group and one control group. The quantitative measurements of each subject were taken with the help of standard equipment, before and after the treatment period of 12 weeks. The selected body composition variables were body fat (%), lean body mass (kg), body water content (%) and basal metabolic rate (KCl) were administered in the Yoga Laboratory of the Institute. Paired ‘t’ test was applied to determine the effect of kapalbhati on selected body composition variables. The paired ‘t’ test revealed that practice of kapalbhati pranayama had significant effect on body fat % (t = 5.47, against required value of 1.761), lean body mass (t = 9.65, against required value of 1.761), body water content (t = 17.24, against required value of 1.761) and basal metabolic rate (t = 9.410, against required value of 1.761) which showed significant effect of practice of kapalbhati pranayama. On the basis of results following conclusions were drawn: (1) significant effect was found on body fat % and no change was found in control group. (2) Significant effect was found on lean body mass and no change was found in control group. (3) Significant effect was found on body water content and no change was found in control group. (4)
Significant effect was found on basal metabolic rate and no change was found in control group.

**Acharya et al. (2010)** Studied the effect of pranayama (voluntary regulated breathing) and yogasana (yoga postures) on lipid profile in normal healthy junior footballers. Twenty male junior footballers younger than 15 years of age, belonging to the Mohun Bagan Athletic Club, Kolkata, were selected for the study at Haridwar. They had to play in a Football Cup organized in UK and they were here to practice yoga sequences taught by Swami Ramdevji. They were of age 14.65±0.58 years and none of them had a history of lipid metabolism disorders. There was a significant reduction in the levels of serum cholesterol, Low-density lipoprotein (LDL) cholesterol, serum triglycerides, and very-low-density lipoprotein (VLDL)-cholesterol at the end of the yogasession. The results indicated that the fasting blood sugar (FBS) level was positively elevated in junior footballers. This demonstrated that Pranayama and Yogasana were helpful in regulating sugar level also. Study demonstrates the efficacy of SRY (Swami Ramdev Yoga)-Pranayama and Yogasana sequences on blood lipid profiles in normal healthy footballers. Pranayama and Yogasana can be used as supportive therapy in patients with lipid disorders, heart diseases, hypoglycemia, and so on. There is a need for conducting the experiments on a larger number of participants, to explore the results and mode of action.
**Farias et al. (2009)** studied the influence of programmed physical activity on body composition among adolescent students during 1 school year. The sample included 383 students (age range: 10 to 15 years) separated into two groups: 186 cases (96 male and 90 female) and 197 controls (108 male and 89 female). This was an intervention study with pre- and post-test assessments in which interventions consisted of programmed physical activity; the control group had conventional school physical education. Body composition was assessed by anthropometric measurements, body mass index (BMI), body fat percentage and fat and lean body mass. In the case group, subscapular skinfold thickness, BMI, body fat percentage and fat body mass remained stable; there were significant reductions in tricipital skinfold thickness and in abdominal perimeter among girls and significant increases in arm, waist and calf perimeters and in lean body mass. In the control group, there were significant increases in BMI, tricipital skinfold thickness, abdominal perimeter and fat body mass among girls. At post-test, overweight and obesity significantly decreased among case group subjects, but not among controls. Programmed physical activity resulted in improvement or maintenance of body composition parameters and in reduction of overweight and obesity in the intervention group.

**Slawta et al. (2008)** studied a Fit Kid is a 12-week program aimed at improving physical activity and nutritional habits in children. The physical activity component of the program emphasized
cardiovascular fitness, flexibility, muscular strength, and bone development through running, yoga, jumping, and strength exercises. All activities were individualized and noncompetitive. The nutrition component focused on current dietary guidelines that emphasize a diet rich in vegetables, fruits, unsaturated fats, and whole grains, and low in saturated fat and sugar. Following the 12-week intervention, significant improvements were observed in body composition, fitness, nutrition knowledge, dietary habits, and in those who participated 75% of the time, significant reductions in total cholesterol and triglyceride levels were observed. Findings from the pilot trial suggest that health promotion programs can be well received by children and may favorably alter overweight and the development of adult lifestyle-related diseases.

McTiernan et al. (2007) studied the effect of national exercise recommendations on adiposity is unknown and may differ by sex. We examined long-term effects of aerobic exercise on adiposity in women and men. This was a 12-month randomized, controlled clinical trial testing exercise effect on weight and body composition in men (N = 102) and women (N = 100). Sedentary/unfit persons, 40 to 75 years old, were recruited through physician practices and media. The intervention was facility- and home-based moderate-to-vigorous intensity aerobic activity, 60 min/d, 6 days/wk vs. controls (no intervention). Exercisers exercised a mean 370 min/wk (men) and 295 min/wk (women), and seven dropped the intervention. Exercisers lost weight (women, -1.4 vs. +0.7 kg in controls, p = 0.008; men, -1.8 vs. -0.1 kg in controls, p = 0.03).
BMI (women, -0.6 vs. +0.3 kg/m(2) in controls, p = 0.006; men, -0.5 kg/m(2) vs. no change in controls, p = 0.03), waist circumference (women, -1.4 vs. +2.2 cm in controls, p < 0.001; men, -3.3 vs. -0.4 cm in controls, p = 0.003), and total fat mass (women, -1.9 vs. +0.2 kg in controls, p = 0.001; men, -3.0 vs. +0.2 kg in controls, p < 0.001).

Exercisers with greater increases in pedometer-measured steps per day had greater decreases in weight, BMI, body fat, and intra-abdominal fat (all p trend < 0.05 in both men and women). Similar trends were observed for increased minutes per day of exercise and for increases in maximal oxygen consumption.

**Scheffler Ketelhut and Mohasseb, (2007)** analyzed body composition, motor development and cardiovascular parameters of preschool-children. In 2001/2002 a longitudinal study started in 17 nursery schools in Berlin. A total of 160 children out of the 264 children participated in a regular exercise programme. After 24 months of training significant differences of body composition, motor skills and cardiovascular parameters between 5 complete year old children of the intervention and the control group were observed. The results show that such an exercise programme is successful as a preventive measure to decrease the risk of obesity.

**Sukhee Lee and Kim (2006)** identified the effects of aerobic exercise and yoga on body composition and lipid metabolism in abdominal obese women. Using one-group pretest-posttest design, a convenience sample of 23 women who had abdominal obesity (greater
than 32 inches of waist circumference) was recruited in a local area of P
city and participated in 1 hour of aerobic exercise and yoga program
twice a week for 12 weeks. Body composition was measured by body
mass index, body fat ratio, waist and hip circumference, and waist-hip
ratio; and lipid metabolism was measured with blood pressure, total
cholesterol and triglycerides. At pretest, mean age of the subjects was
48.7(SD=9.5) and body fat ratio was 33%, and waist-hip ratio was .85.
By paired t-tests, waist circumference and waist-hip ratio were
significantly decreased before and after the program but body mass
index, blood pressure, and the level of lipid metabolism did not change.

Chaya et al. (2006) investigated the net change in the basal
metabolic rate (BMR) of individuals actively engaging in a combination
of yoga practices (asana or yogic postures, meditation and pranayama
or breathing exercises) for a minimum period of six months, at a
residential yoga education and research center at Bangalore. The
measured BMR of individuals practicing yoga through a combination of
practices was compared with that of control subjects who did not
practice yoga but led similar lifestyles. The BMR of the yoga
practitioners was significantly lower than that of the non-yoga group,
and was lower by about 13 % when adjusted for body weight (P <
0.001). This difference persisted when the groups were stratified by
gender; however, the difference in BMR adjusted for body weight was
greater in women than men (about 8 and 18% respectively). In addition,
the mean BMR of the yoga group was significantly lower than their
predicted values, while the mean BMR of non-yoga group was comparable with their predicted values derived from 1985 WHO/FAO/UNU predictive equations. This study shows that there is a significantly reduced BMR, probably linked to reduced arousal, with the long term practice of yoga using a combination of stimulatory and inhibitory yogic practices.

Blank (2006) evaluated acute physiological responses to Hatha yoga asanas (poses) practiced in the Iyengar tradition. Preliminary data were collected on the impact of postural alignment on physiological responses. Intermediate/advanced level yoga practitioners (n=15 females) were monitored for heart rate (HR), oxygen uptake (VO2), and brachial arterial blood pressure (n = 9) during a 90 min practice. The subjects, aged 43.5 ± 6.9 yr (average ± SD), had current weekly practice of 6.2 ± 2.4 hr/week and practice history 9.2 ± 7.2 yr. Physical characteristics of the subjects included: height (167.3 ± 4.1 cm), body mass (59.3 ± 7.2 kg), and percent body fat (23.1 ± 3.6 %). The practice included supine, seated, standing, inversions, and push up to back arch asanas maintained for 1-5 min. Physiological responses were significantly (p<0.05) greater in standing asanas, inversions, and push up to back arch versus supine and seated asanas. The average metabolic equivalent (MET) of each pose did not exceed 5 METs. The practice expended 149.4 ± 50.7 Kcal. The cumulative time spent within a HR zone of 55-85% HRmax was 29.7 ± 15.9 min (range = 10.8 – 59.9 min). Asana practice was classified as mild to moderate intensity.
exercise without evidence of a sustained cardiopulmonary stimulus. Intermediate and advanced practitioners maintained poses for up to 5 min without stimulating an undesirable pressure response. However, postural alignment significantly influenced blood pressure responses indicating that adherence to precise alignment has relevant physiological consequences for the yoga practitioner.

*Johnstone et al. (2006)* partitioned the variance in BMR into within- and between-subject effects and explored the roles of FFM, FM, bone mineral content, sex, age, and circulating concentrations of plasma leptin, T3, and T4. This was a cross-sectional study of 150 white adults from northeast Scotland, United Kingdom. Only 2% of the observed variability in BMR was attributable to within-subject effects, of which 0.5% was analytic error. Of the remaining variance, which reflected between-subject effects, 63% was explained by FFM, 6% by FM, and 2% by age. The effects of sex and bone mineral content were not significant (P > 0.05). Twenty-six percent of the variance remained unexplained. This variation was not associated with concentrations of circulating leptin or T3. T4 was not significant in women but explained 25% of the residual variance in men. Our data confirm that both FFM and FM are significant contributors to BMR. When the effect of FM on BMR is removed, any association with leptin concentrations disappears, which suggests that previous links between circulating leptin concentrations and BMR occurred only because of inadequate control for the effects of FM.
Kristal et al. (2005) examined whether yoga practice is associated with lower mean 10-year weight gain after age 45. Participants included 15,550 adults, aged 53 to 57 years, recruited to the Vitamin and Lifestyle (VITAL) cohort study between 2000 and 2002. Physical activity (including yoga) during the past 10 years, diet, height, and weight at recruitment and at ages 30 and 45. All measures were based on self-reporting, and past weight was retrospectively ascertained. Multiple regression analyses were used to examined covariate-adjusted associations between yoga practice and weight change from age 45 to recruitment, and polychotomous logistic regression was used to examine associations of yoga practice with the relative odds of weight maintenance (within 5%) and weight loss (> 5%) compared to weight gain. Yoga practice for four or more years was associated with a 3.1-lb lower weight gain among normal weight (BMI < 25) participants [9.5 lbs versus 12.6 lbs] and an 18.5-lb lower weight gain among overweight participants [-5.0 lbs versus 13.5 lbs] (both P for trend <.001). Among overweight individuals, 4+ years of yoga practice was associated with a relative odds of 1.85 (95% confidence interval [CI] 0.63-5.42) for weight maintenance (within 5%) and 3.88 (95% CI 1.30-9.88) for weight loss (> 5%) compared to weight gain (P for trend .026 and .003, respectively). Regular yoga practice was associated with attenuated weight gain, most strongly among individuals who were overweight. Although causal inference from this observational study is not possible, results are consistent with the hypothesis that regular
yoga practice can benefit individuals who wish to maintain or lose weight.

Sinha et al. (2004) observed critically the energy cost and different cardiorespiratory changes during the practice of SN. Twentyone male volunteers from the Indian Army practiced selected Yogic exercises for six days in a week for three months duration. The Yogic practice schedule consisted of Hatha Yogic Asanas (28 min), Pranayama (10.5 min) and Meditation (5 min). In the Yogic practice schedule 1st they practiced Kapal Bhathi (breathing maneuvers) for 2 min then Yogamudra (yogic postural exercise) for 2 min, after that they took rest until oxygen consumption and heart rate (HR) came to resting value. Subsequently subjects performed SN for 3 min 40 seconds on an average. After three months of training at the beginning of the fourth month subjects performed entire Yogic practice schedule in the laboratory as they practiced during their training session and experiments were carried out. Their pulmonary ventilation, carbon dioxide output, Oxygen consumption, HR and other cardiorespiratory parameters were measured during the actual practice of SN. Oxygen consumption was highest in the eighth posture (1.22 ± 0.073 1 min–1) and lowest in the first posture (0.35 ± 0.02 1 min–1). Total energy cost throughout the practice of SN was 13.91 kcal and at an average of 3.79 kcal/min. During its practice highest HR was 101 ± 13.5 b.p.m. As an aerobic exercise SN seemed to be ideal as it involves
both static stretching and slow dynamic component of exercise with optimal stress on the cardiorespiratory system.

**James and Raub (2002)** examined the yoga has become increasingly popular in Western cultures as a means of exercise and fitness training; however, it is still depicted as trendy as evidenced by an April 2001 *Time* magazine cover story on "The Power of Yoga." There is a need to have yoga better recognized by the health care community as a complement to conventional medical care. Over the last 10 years, a growing number of research 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 exercise capacity. This review presents a summary of medically substantiated information about the health benefits of yoga for healthy people and for people compromised by musculoskeletal and cardiopulmonary disease.

**Shankardayalan (1996)** suggested that a study on effect of yogic exercise on muscular performance and body composition in adult male. He selected fifty male students and divided into two groups of equal number of twenty five subjects each. One group was utilized as control group and the other group as experimental. The experimental period was eight weeks. The data on aerobic capacity, sit-ups, flexibility and percentage body fat were obtained before pre test and after post test the experimental period. The obtained ‘F’ ratio was tested for significance at 05 level of confidence. The found out measure all the variables such as
aerobic capacity, muscular endurance, flexibility and percent body fat in favour of experimental group. He concluded that the aerobic capacity was increased, and the muscular endurance was improved. Flexibility was developed. The significant difference was found in percent body fat of yogasana practice programme.

_Telles et al. (1994)_ aimed at checking whether such changes actually do occur, and whether breathing is consciously regulated. 48 male subjects, with ages ranging from 25 to 48 years were randomly assigned to different groups. Each group was asked to practice one out of three pranayamas (viz. right nostril breathing, left nostril breathing or alternate nostril breathing). These practices were carried out as 27 respiratory cycles, repeated 4 times a day for one month. Parameters were assessed at the beginning and end of the month, but not during the practice. The 'right nostril pranayama' group showed a significant increase, of 37% in baseline oxygen consumption. The 'alternate nostril' pranayama group showed an 18% increase, and the left nostril pranayama group also showed an increase, of 24%. This increase in metabolism could be due to increased sympathetic discharge to the adrenal medulla. The 'left nostril Pranayama' group showed an increase in volar galvanic skin resistance, interpreted as a reduction in sympathetic nervous system activity supplying the sweat glands. These results suggest that breathing selectively through either nostril could have a marked activating effect or a relaxing effect on the sympathetic
nervous system. The therapeutic implications of being able to alter metabolism by changing the breathing pattern have been mentioned.

**Bera and Rajapurkar (1993)** studied the forty male high school students, age 12-15 yrs, participated for a study of yoga in relation to body composition, cardiovascular endurance and anaerobic power. The Ss were placed into two subsets viz., yoga group and control group. Body composition, cardiovascular endurance anaerobic powers were measured using standard method. The duration of experiment was one year. The result of ANCOVA revealed that a significant improvement in ideal body weight, body density, cardiovascular endurance and anaerobic power was observed as a result of yoga training. This study could not show significant change in body fat (midaxillary), skeletal diameters and most of the body circumferences. It was evident that some of the fat-folds (tricep, subscapular, suprailliac, umbilical, thigh and calf) and body circumferences (waist, umbilical and hip) were reduced significantly.

**3. Summary of the Literature**

The reviews are presented under the two sections namely studies on physical exercise training (n=47) and yogic practices (n=32). All the research studies that are presented in this section prove that physical exercise training and yogic practice methods contribute significantly for better improvement in health related and lipid profile variables.
Research studies using yogic practice revealed compatible results (Mody, 2010, Telles et al. 2010, Tran et al. 2001, Chen et al. 2009, Prasad et al. 2006 and Bernardi et al. 2007). There was clear evidence that the use of yogic practice was one of the effective training methods to improve the selected criterion variables among the obese adolescents.

The independent and dependent variable for the current study are physical exercise training and the change of level of selected variables. Physical exercise training has been found to elicit greater change in selected variables than the yogic practices on selected variables. (Volpe et al., 2008, Wong et al. 2008, Saremil et al. 2010, Chaudhary et al. 2010, Sabia et al. 2004, and Leite et al. 2009)

The review of literature helped the researcher from the methodological point of view too. It was learnt that most of the research studies cited in this chapter on analysis and experimental design as the appropriate methods for find out the training. The present study may serve as a foundation and main ingredient for future research and investigate the proper in training methods for changing the health related physical fitness BMR and lipid profile variables of obese adolescents.