Chapter II

REVIEW OF RELATED LITERATURE

An attempt has been made by the scholar to locate literature related to the study. The relevant studies of specific importance are cited in this chapter.

Dowdy et al.\(^1\) conducted a study to determine the effects of aerobic dance on physical work capacity, cardio-vascular function and body composition of 28 young middle aged women of 25 years - 44 years (18 experimental and 10 control). Experimental group participated in 45 min. of aerobic dance, for 10 weeks, 3 days a week at 70-85% of the heart rate reserve. Significant changes in \(V_O^2\) max expressed in \(\% \text{ min}^{-1}\) or relative to body weight or fat free weights (5-7% vs. - 5-8%), heart rate during submaximal stages of the treadmill test (9% vs. .1%) and resting heart rate (8% vs. 2%). Resting systolic and diastolic blood pressure, body weight, \% body fat, fat weight, fat free weight, estimated using underwater

weighing; sum of 7 skinfold and sum of seven circumference did not change significantly in either group. It was concluded that aerobic dance performed 30-45 min., 3 days week for 10 weeks significantly improves cardio-vascular function and physical working capacity, but without dietary control, does not alter body composition in sedentary middle-aged women.

Canon and Gregory\(^2\) studied the responses of pre and post menopausal females to aerobic conditioning. This study sought to determine whether the ability to improve cardio-respiratory endurance and body composition is affected by the menopausal status of females. Twenty pre-menopausal females and 18 post menopausal females participated in a progressive walking programme (4 days/week for 9 weeks) at an intensity of 80% the age adjusted heart rate maximum (80% HRM). Following training both the exercise groups significantly improved submaximal exercise capacity (SEC) as measured by VO\(_2\) max and

treadmill walking time at 80% HRM. The PRE-EX group significantly improved % body fat and lean body weight, while there was no significant change in total body weight. ANCOVA revealed exercise not menopause to be the effective treatment for improving percent body fat and SEC 80/HRM.

There were no significant difference between the PRE-EX and POST-EX groups in their ability to improve SEC 80% HRM or to reduce percent body fat. The POST-EX group had a significantly greater increase in lean body weight. These findings suggests that the ability to favourably alter body composition and cardio-respiratory endurance through the aerobic conditioning of female is independent of menopausal status.

Mass investigated whether aerobic dancing is sufficiently vigorous to elicit a heart rate capable of producing a training effect and to determine whether, the training heart rate level is maintained. The aerobic dance class was incontinuous movement, either in reviewing

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dances already learnt, learning new dances or walking and jogging between dances. She observed that aerobic dance conditioning programme did elicit and did maintain a heart rate which indicated a training effect and did improve the fitness level of the subjects as evaluated by 12 minute run/walk test. The investigator noted that aerobic dancing has brought in progressive work loads that are essential to an effective fitness program.

Michael Jr. and Gallon⁴ studied pulse wave and blood pressure during a physical training programme. Members of the Sante Barbara Basketball Team were tested periodically during and after the 1957-58 season of play. The changes in physical conditioning were estimated using a step test. During the period of time the blood pressure and pulse wave measurements were studied to investigate the effects of basketball conditioning on there measurements.

The resting and post exercise systolic blood pressure measurements decreased significantly during

training. These changes were significant after 16 weeks. During detraining these measurements reversed and made significant changes in ten weeks. Pulse wave changes also changed significantly in six weeks, levelled off, and finally reversed to starting level during detraining.

Parks\(^5\) undertook a study to determine the effects of a ten week physical fitness programme on selected physiological and psychological variables of elderly people of 65-82 years. The subjects were 15 females. Pre and Post measurements were obtained for psychological variables by the State Trait Anxiety Inventory. The physiological variables measured were body composition, flexibility, heart rate, blood pressure. The subjects participated in the fitness program half an hour in the morning, three days a week for 10 weeks. Each exercise session began with a 10 min. warming up, followed by 15 min. of exercise of moderate intensity. The last five min. were used as a cooling off period. The 't' test was employed to analyse the data. The following significant changes were found.

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1. The subjects decreased in percentage of body fat.

2. There was an increase in flexibility.

3. There was a decrease in heart rate.

However no significant changes in systolic and diastolic blood pressure and anxiety levels of subjects was observed.

White evaluated the effect of a six month walking and aerobic dance program on skeletal and cardio-vascular system of post menopausal females. His findings indicated that both walking and dancing were equally effective in increasing the efficiency of the cardio-vascular system in post menopausal women. Both groups showed significant increase in treadmill time while showing decrease in resting heart rate and recovery heart rate.

These findings reflected an increased efficiency of the heart and a decreased myocardial O$_2$ demand at given submaximal work load. In conclusion, a six month exercise

significant differences found at different stages of training among females on the variable of vital capacity since the value of $F$ obtained at .05 level was 2.74 for 1 and 156 degrees of freedom at .05 level.

To find out the paired mean differences within each test was significant the Scheffe's post-hoc test was employed and the data pertaining to this is presented in Table 31.

**FIG. 14. MEAN SCORES OF AIR FLOW RATE AT DIFFERENT STAGES OF TRAINING.**
participation in conditioning program which consisted of 35 minutes of exercise, 3 day/week for 8 weeks. ANCOVA was used, and significant changes were found in exercise HR ($P < .05$) and skinfolds ($P < .10$). No significant changes ($P > .10$) were found in resting HR, weight and resting blood pressure. The attendance rate was 80.6% but no significant relationship was found between attendance and improvement in exercise HR ($r = .0469$) or skinfolds ($r = .0649$). There were no significant difference ($P .10$) in the improvement of those under 40 years of age and those 40 or over.

Wallace\textsuperscript{9} selected thirty one college women (age 17 - 42) divided into 4 age groups to observe the effects of 4 months of cardio-vascular training on the composition of body fat. Training was 3 day/week for an average of 15 minutes each session, at 80% of physical work capacity. Measurement of percent body fat, weight and growth were taken before and after 4 months of training. Daily caloric needs and daily caloric intake were measured alongwith the caloric expenditure of each work out. Each  

group decreased in percent body fat; only one group decreased significantly. This significant decrease was found in the group that was extremely above the optimal fat ranges. The remaining groups were within the optimal fat ranges. Weight changes did not reflect fat losses due to lean body mass development.

Daily caloric needs were equal to daily caloric intake which would indicate fat maintenance. All fat that was lost was therefore due to the caloric expenditure of the training. Over fat individuals can reduce body fat significantly with simple cardio-vascular training of walking and running. Individuals within the optimal ranges can maintain body composition with simple cardio-vascular training of walking and running. Further fat losses can be done by increasing the intensity, duration and frequency of exercise.

King \(^{10}\) investigated the effects of two training programmes on selected cardio-respiratory variables of college women. The two programmes were riding bicycles and running. The physiological reaction measured were pulse

rate, inspiration rate, inspiration amplitude, minute volume of inspiration and oxygen consumption. The respiratory variables were recorded simultaneously by a respirometer. All variables improved during the four week training period regardless of the training programme prescribed. Both training programmes were of sufficient duration and intensity to effect changes in post exercise scores.

Tooshi\(^{11}\) investigated the effect of three different duration of endurance training on serum cholesterol, body composition and other fitness measures. Resting pulse rate was one of the physical fitness measures. Twenty four adult men between the ages of 27-54 years were selected randomly from men who have requested to be included in the adult fitness programme. These groups were divided into three experimental groups on basis of their serum cholesterol values. Group A exercised for 15 minutes a day. Group B exercised 30 min./day. Group C exercised 45 min./day for five days/week for a total of

\(^{11}\)Ali Tooshi, "Effects of Three Different Duration of Endurance Training on Serum Cholesterol, Body Composition and Other Fitness Measures," *Dissertation Abstracts International* 31:9 (September 1970):4533-4534.
twenty weeks. A control group of eight sedentary men was used for the purpose of the study. The training programme consisted of walking, jogging and running, endurance training of 30 and 45 min./day decreased resting pulse rate than 15 min./day for five days used per week.

Meyer\textsuperscript{12} selected adult males (N=52), described as sedentary, participated for a period of 8 weeks in prescribed exercise programmes of either running, swimming, calisthenics or sports activity while a group of control subjects continued to follow their normal routines. Subjects were pretested and post tested on parameters of cardio-vascular fitness, lean body mass and serum cholesterol content of the blood. A statistically significant difference was found between the increase in cardio-vascular fitness or the running group and all other groups. No significant differences were found when mean differences pre test and post test scores of the 5 groups were compared for the variables of lean body mass or serum cholesterol content of blood.

Saudler et al.\textsuperscript{13} conducted study focussing on age and physical activity as determinants of muscle strength. The study involved 620 women 25-73 years of age. The five muscle groups assessed were: grip, planter flexors, hip abductors, trunk flexors, and trunk extensors. Pearson correlations yielded significant negative correlations of muscle strength with age and positive correlations with height as well as physical activity. The greatest incremental differences in muscle strength were registered in the perimenopausal years between the age decades of 45-54 years and 55-64 years. In stepwise regression analysis age was the strongest predictor of strength of all muscle groups, with smaller contributions to the variance by physical activity and anthropometric variables. When the sample population, divided by decades of age, was further subdivided by fteriles of physical activity, the results of factorial analysis indicated that the main effects due to age and physical activity were significant. It was concluded that 1) moderate levels of physical activity tend to improve muscle strength even in

\textsuperscript{13}Rivka Black Saudler et al.,"Muscle Strength as an Indicator of the Habitual Levels of Physical Activity," 
older women, and 2) normative values of muscle strength could serve as an indicator of the adequacy of the habitual levels of physical activity.

Garber et al.\textsuperscript{14} conducted a study to compare the physiological effects of an 8 week aerobic dance programme to those of a walk-jog exercise training program, 60 male and female university employees ages 24-48 years were randomly assigned to an aerobic dance program (N = 22), a walk-jog program (N = 24), or a sedentary control group (N = 15). Subjects who had an exercise compliance rate 85% were dropped from the study, as were control subjects who had scheduling conflicts or illness precluding post treatment testing. Thirty five subjects completed the 8 week period with a compliance rate > 85%, leaning 14 in the aerobic group 11 in the walk-jog group and 10 in the control group. Significant increases (P < 0.0001) in maximal oxygen uptake occurred in both the aerobics (+ 3.9 ml/kg\textsuperscript{-1}/min\textsuperscript{-1}) and walk-jog group (+ 3.4 ml/kg\textsuperscript{-1}/min\textsuperscript{-1}), while no significant change was observed in the control

group. Peak heart rate decreased significantly (P < 0.05) in the aerobic (- 4 b/min\(^{-1}\)) and walk-jog\(^6\) groups (-3 b/min\(^{-1}\)) but was unchanged in the control group (-1 b/min\(^{-1}\)) following the treatment period. Body weight, peak respiratory exchange ratio and peak minute ventilation remained the same in the aerobics, walk-jog and control groups throughout the treatment period. It was concluded that aerobic dance programmes can result in similar improvements in aerobic power as a walk-jog program. Thus an aerobic dance program is an effective alternative to a traditional walk-jog training regime.

Busby et al.\(^{15}\) conducted a study on a group of 50 healthy women between the ages of 40 and 65, who participated in a 12 week program of exercise, discussions sessions or both. The discussion group served as the controls. Levels of serum cholesterol, tri-glycerides, total HDL, and HDL\(_{2a}\) and HDL\(_{2b}\) were monitored at baseline, at 6 weeks, and at 12 weeks. The exercise groups were instructed to walk-jog for 30 minutes (after a 15 - minute warm up session) and to pace their activity in order to

maintain their heart rate at 70 to 80 percent of their predicted heart rate maximum. One exercise session was supervised by a group therapy leader, and the other two exercise sessions (per week) were repeated on their own. Cardio-respiratory function was determined at baseline and at 12 weeks, having subjects walk on a motorised treadmill until they declared fatigue or reacted their predicted maximal heart rate. The exercising group had a significantly greater increase in VO\textsubscript{2} max, time spent on the treadmill, and the time required to obtain 90 percent of maximal oxygen consumption (P < 0.01), but did not show a statistically significant difference in the lipid or lipoprotein tractions at either 6 or 12 weeks.

Weltman\textsuperscript{16} conducted a study in order to assess the relationship between extremes in over-fatness and serum lipid levels, 69 women were assessed for body composition (hydrostatic weighing), total serum cholesterol, total serum triglycerides, and high density lipoprotein cholesterol. Women with a body fat content of 40% or

greater were labeled as extremely over fat for the purpose of this study (N = 48, X age = 42.6 years, X % fat = 48.2). Twenty one women with a body fat content of 35% or lower served as normal controls for comparison (X age = 40-1 years, X % of Fat = 30.1). Total serum cholesterol levels were significantly elevated in extremely over fat women (208 mg % for over fat women vs. 189 mg % for normal controls P < .05). Total serum triglyceride levels were also significantly elevated in extremely over fat women (134 mg % for over fat women vs. 75 mg% for normal control P < .05). Extremely over fat women also demonstrated a marked reduction in high density lipoprotein cholesterol levels (57 mg% for over fat women vs. 67 mg % for normal control P .05) and a marked elevation of total cholesterol /high density cholesterol ratio (3.6 for over fat women vs. 3.8 for normal controls, P .05). It was concluded that extremely over fat women develop unfavourable serum lipid profiles. It was further suggested that increased risk of coronary heart disease in extremely over fat women may be due in part to a marked reduction in high density lipoprotein cholesterol.
Wilmore and others\textsuperscript{17} conducted a study on body composition changes with a 10 week programme of jogging. The following conclusion was drawn that the change in body composition induced by training are as follows: (1) a decrease in total body fat, (2) no change or slight increase in lean body weight, and (3) a small decrease of total body weight. For the most part, these changes, particularly that of fat loss, are more pronounced for obese men and women than for the already 'lean' individual. It is important to note that more calories are expended when running rather than walking because weight is directly related to how many calories are expended during training.

\textsuperscript{18}Albert conducted the study to determine the effect of a 12-week quantitative aerobic training


programme (jogging) on the fasting serum concentration of cholesterol (C) and triglycerides (TC) in the high density lipoprotein (HDL), how density lipoprotein (LDL) and very low density lipoprotein (VLDL) classes in middle aged men after 3,6,9 and 12 weeks. Using the 2 x 3 or 2 x 5 multivariate and univariate ANOVAS with repeated measures, no significant changes were observed in the concentration of total serum (LDL - C, HDL - TC, LDL - TC and the ratio of HDL - C/ LDL - C). The jogging however, had significantly (P < .05) lower level of total serum TC (130.0 vs. 177.5 mg%), VLDL - TC (83.6 vs. 128 mg%) and VLDL - C (21.4 vs. 34.2 mg%) than the TRL. The analysis of covariance indicated that these changes in the lipoprotein fraction were independent of diet and alternations in weight and adipose tissue. The data (1) supported the contention that aerobic training may aid in prevention of hyper triglyceridemia and (2) suggests that a training threshold may exist with respect to exercise induced changes in the level of HDL-C.
Joseph\textsuperscript{19} conducted the study on sixty college women between the ages of 18 and 28. One group ($n = 20$) consisted of numbers of a physical education class engaged in a twelve week fitness programme employing the Aero-Kinetic programme developed by human performance systems, Ine of Fayetteville, Arkansas. The second experimental group consisted of 20 subjects in physical education class engaged in a twelve week progressive running programme. An additional group of 20 matched volunteers was also used to serve as control.

Participation in the aerokinetic programme yielded significant improvements in the cardio-vascular fitness, total cholesterol, triglycerides, LDL cholesterol and the risk ratios.

No significant changes were observed in the control group. By comparison, participation in either the running or aerokinetic programme resulted in similar improvement in cardio-vascular fitness, total cholesterol, LDL cholesterol and the lipo-protein risk ratios, while the

running programme yielded greater improvements than the aerokinetic group in percent body fat, body weight and triglycerides.

Penny and Others\textsuperscript{20} have pointed out that the role of exercise (especially running) in raising the level of HDL - cholesterol has received considerable attention over the past few years and is presently being researched in various laboratories throughout the world. Epidomologic research indicates that a vigorous exercise programme may bring about an increased level of HDL - cholesterol in young and middle aged men, white at the same time, exercise appears to bring about minor, if any decrease in total serum cholesterol levels.

Turn and Weltman\textsuperscript{21} studied the differential effect of exercise on blood lipids and lipo-proteins seen with changes in body weight. Regular exercise is thought to have favourable effects on serum lipid and lipo-protein


levels. However, the available data are not clear with respect to the magnitude and direction of these changes when there are concomitant changes in subjects body weight (B.W.). This study examines the relationship between the changes in serum lipids and lipo-proterins and B.W. changes during exercise using a meta-analysis. Meta-analysis allows for statistical integration of separate research findings and determination of the overall magnitude and direction for a given effect. Sixty six studies met the criteria for inclusion in this analysis. Result shows that changes in body weight during exercise are significantly associated with changes in total cholesterol (C) and low density lipo-protein cholesterol (LDL-C), (r = + .5) and + .68, respectively) indicating that increasing body weight losses result in larger decrease in C and LDL-C. With body weight held constant, there are also significant correlation between changes and C and high density lipo-protein cholesterol (HDL-C) and exercise (r = + .41 and - .48 respectively) indicating that decrease in C (7 mg/dl) and increase in HDL-C (1 mg/dl) are related to the exercise. With B.W. losses during exercise, the correlations between C and HDL-C and exercise are not significant (r = .06 and - .18 respectively) C decrease by
12 mg/dl while HDL-C increase by 2 mg/dl. This suggests that the actual relationship between the changes in serum lipid and lipo-protein levels and exercise may be obscured by metabolic changes and that studies not maintaining their subjects on an iso-weight diet may expect conflicting results.

According to Aluzo22 physical exercise produces certain measurable physiological effects such as lower pulse rate, increase in vital capacity, causing the heart to pump more blood with every stroke, probably promotes increased vascularisation and the growth of better network of blood vessels, which may contribute to the reduction of cholesterol level in blood, consistent exercise also tends to some extent, lower body weight.

According to Morehouse and Miller23 the red blood cell counts is frequently increase in the early stages of exercise. During more prolonged exercise, fluid posses into the blood, and the resulting dilution, of course,


lowers the red blood cell count. Very strenuous exertion may also cause an increased rate of destruction of red blood cells due to compression of the capillaries of blood flow. This is especially noticeable in persons of sedentary habits who sporadically indulge in exercise.

Janaka\textsuperscript{24} investigated the relative effects on spot reduction of two types of exercise, one representing the anaerobic (abdominal exercises) or spot reduction model, and the other representing the aerobic (jogging/running) model.

Fifty-four male volunteer subjects ranging in ages from 17 to 56, from a Northern California Community College were stratified into three fitness levels. All subjects were then presented on the hydrostatic and anthropometric measures. The population was then randomly assigned to either order 1 (12 sessions of anaerobic followed by 12 sessions of aerobic) or order 2 (12 sessions of aerobic followed by 12 sessions of anaerobic). After each of the exercise sessions all subjects were tested on

the hydrostatic and anthropometric measures.

It was found that after only 12-25 minutes exercise cycles, aerobic exercise resulted in a 4% decrease in the percent of body fat and approximately one inch loss in waist girth for the jogger runners. Anaerobic treatment showed no effects.

Michielli and Co-workers\textsuperscript{25} studied a comparison of exercise training intensity on lipoprotein cholesterol fractions. Forty nine men with a mean age of 44 + 8 years were studied to determine the effect of 12 weeks of bicycle ergometer training at 65%, 75%, 85% of heart rate maximum on lipoprotein cholesterol fractions.

All other lipid values, total cholesterol HDLC, LDLC, VCDLC and TG showed no significant changes related to training, while exercise intensity caused a training effect. It did not significantly effect lipid levels in the blood.

Hopewell and others\textsuperscript{26} conducted a study to profile waist to hip ratio and cardio-vascular risk factor in middly obese young women. Waist circumference was measured at the natural waist line, and hip circumference was measured where the buttocks was widest. Subjects percentage fat was determined by skinfolds. Blood was analysed for total cholesterol, HDL-C, and triglycerides.

Subjects were grouped according to waist hip ratio (WHR), where in Group 1 (N=19), had WHR > 0.8 and Group 2 (N=41) had WHR < 0.8. Statistical analysis revealed that Group 2 had lower blood pressure, (116/77 vs 130/85 mmHg), % fat (37 vs. 41%), WC (79 vs. 91 cm), C (180 vs. 212 mg/dl), than Group 1. Significant correlation of low to moderate magnitude were observed between percent fat and diastolic blood pressure ($r = 0.51$) and between WHR and C ($r = 0.43$) etc. These data suggest that a WHR > 0.8 in middly obese younger women is associated with an increased risk of developing cardio-vascular disease as evidenced by higher blood pressure, more body fat, and less desirable lipid levels.

William et al.\textsuperscript{27} conducted a study on 81 sedentary men aged 30-55 years, who were randomly assigned to either a superused running group, 48 men or to a sedentary control group - 33 mn. After 6 weeks the exercise group was asked to run 45 min. daily for 5 day/week. Laboratory measurements were taken at baseline and at 3, 6, 9 and 12 months. Waist, hip and thigh girths; estimated body composition; and calculated caloric intakes were also determined. Max \( VO_2 \) was measured by maximal treadmill testing.

The distances, that exercisers ran varied considerably. Mean changes in any LDL and VLDL measures did not differ significantly among runners and controls; however, within the exercise groups the distance run correlated negatively with changes in mass concentrations of small LDL. Weight loss and reduced upper body weight correlated positively with changes in small LDL, intermediate - density lipoprotein, and VLDL mass, and

\textsuperscript{27}P.T. William et al., "Effects of Exercise-Induced Weight Loss on LDL Subtractions in Healthy Men," (Stanford University: University of California, Ber Keley, University of Washington) cited in Roy J. Shepard et al., \textit{Yearbook of Sports Medicine} (St. Louis, Mosby - Yearbook Inc., 1990), pp.73-75.
negatively with change in the LDL peak-flotation rate. Weight loss may primarily affect LDL mass distributions through metabolic processes related to HDL or small VLDL. The decrease in small LDL concentrations, coupled with the increase in the LDL peak-flotation rate, suggests that exercise induced weight loss might effectively reduce the risk of coronary heart disease in persons with a high-risk lipoprotein profile.

Mc Cord and Others\textsuperscript{28} studied the effect of 12 weeks of low-impact aerobic dance conditioning on 16 females aged 17-29 years, who had not exercised regularly and had peak oxygen uptake values of less than 43 ml/kg/min. The women exercised 3 times a week for 45 minutes, including 20-35 minutes of low-impact exercise. Peak oxygen uptake increased by 7.6\% during the study period. Submaximal heart rate decreased significantly. The percentage body fat decreased from 25\% to 21\%, as lean body mass increased from 44 kg to 47 kg (6.8\%). Body weight did not change significantly.

These data indicate that 12 weeks of low impact aerobic dance exercise produces a small but significant increase in peak oxygen uptake. Given proper supervision, this appears to be a form of endurance training that is both safe and pleasurable.

Franklin and others\textsuperscript{29} conducted a study on lean and obese middle-aged female subjects who participated in the 12 week aerobic training program. The program was structured along ALSM guidelines (walking-jogging 15 to 25 minutes, 4 days per week, 75% max VO\textsubscript{2}). Normal-weight subjects decreased their body fat from 24.7 to 23.9%, obese subjects reduced from 38.0 to 36.2% and the sum of 10 skinfolds decreased significantly in both groups. This moderate intensity physical conditioning program affected both obese and leaner women in a similar fashion.

\footnote{B.A. Franklin et al., "Body Composition, Physical Work Capacity and Physical Activity Habits at 18-Month Follow-up of Middle-Aged Women Participating in An Exercise Intervention Program," cited by Fox; Bowers and Foss, The Physiological Basis of Physical Education and Athletics, p.587.}
Leon and Others\textsuperscript{30} conducted a study on six sedentary obese men, ages 19 to 31 years. These subjects completed a 16 weeks of vigorous walking, 90 minutes per day, 5 days per week, on a treadmill at speeds up to 3.2 mph on a 10% grade. The subjects lost a significant amount of body weight and fat during the completion of the 16 weeks of vigorous walking. It was estimated that they expended about 1100 Kcal per session or about 88,000 kcal during the experimental period. This would be equivalent to 25 lbs of fat. The subjects actually lost an average of 5.7 kg (11.5 lbs) so by any rough accounting of caloric balance it is apparent that no attempt was being made to "influence their diet."

Martin and Kauwell\textsuperscript{31} conducted a study of continuous assistive - passive exercise and cycle ergometer training in sedentary women. The subjects were divided into three groups; continuous assistive - passive

\textsuperscript{30}A.S. Leon et al., "Effects of a Vigorous Walking Program on Body Composition, and Carbohydrate and Lipid Metabolism of Obese Young Men," cited by Fox; Bowers and Foss, The Physiological Basis of Physical Education and Athletics, p.586.

exercise training (CAPE), cycle ergometer training and control. The cycle ergometer and CAPE groups trained for 12 weeks, while the control groups remained sedentary for the duration of the study. Groups were similar with respect to age, height, weight, girths and skinfolds and aerobic power upon entering the study.

Following training, changes in caloric intake, sum of seven girths, skinfolds were not significantly different among groups. The cycle group lost 1.1 kg ($P < 0.05$) and increased VO₂ max ($1 \text{ min}^{-1}$) by 9.2% ($P < 0.05$), while the CAPE group significantly decreased VO₂ max ($P > 0.04$). The results indicated that CAPE does not alter girth or skinfolds in sedentary and that 30 minutes sessions of cycle training per week at 70 - 85% of maximal heart rate can result in moderate but significant increases in VO₂ max in sedentary subjects.

Jette, Sidney and Campbell conducted a twelve week training programme on selected cardio-vascular and work

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out indices in sedentary middle aged men and women and compared a laboratory procedures for prescribing an individualised programme of walking/jogging with that employing a prediction formula which utilizes percentage of VO₂ max along with height and weight.

Results indicated that the gains in VO₂ max were significant ($P < .05$) for both exercising males (9.7%) and females (17.3%) and there were significant reductions in mean submaximal training heart rates. It was concluded that an exercise prescription based on an appropriate walking pace was an effective, safe and simple procedure to enhance cardio-respiratory fitness of sedentary middle aged men and women.

Bazzare and Izlar $^{33}$ evaluated the effects of a 12-week aerobic exercise - lifestyle management program on total cholesterol, HDL cholesterol, and on weight loss and body fat on adult insulin dependent diabetic. The exercise sessions included a 5 to 10 minute warm-up, an aerobic exercise session at 65-75% of maximum heart rate

and a 5 to 10 min. cool down. Exercise sessions increased 5 minute each week from 20 minute at week 1 to 60 minute, for 9-12 weeks. Body weight, body fat, the sum of four skinfolds, diastolic pressure and glyco-haemoglobin decreased significantly among seven participants who were classified as good attendance participants.

Kosich et al.\textsuperscript{34} conducted a study on thirty-two healthy married couples who exercised aerobically (70-80\% of HR max), 40 min/day, 6 days/week, and consumed either a 10\% (of totalcalories) fat diet (LF) or a 35\% fat diet (MF) for 16 weeks to determine the effects of exercise and dietary fat on selected CAD risk factors. Periodic measurements was done for VO\textsubscript{2} max, percentage body fat, resting blood pressure, and serum lipid levels. All subjects kept daily diet and exercise records and attended weekly training sessions which taught exercise guide lines and appropriate food preparations techniques. Males and females in both groups realised significant (P < 0.05) increases in VO\textsubscript{2} max (13\%, 15\%), respectively and significant decreases in body fat (25\%, 17\%) and systolic (10\%, 11\%) blood pressure, with no group by - sex

\textsuperscript{34}Daniel K. Kosich et al., "The Effects of Exercise and a Low Fat or A Moderate - Fat Diet on Selected Coronary Risk Factors," cited by Dotson and Humphrey, Exercise Physiology: Current Selected Research,p.173.
differences. Lower fat males and females had significant reductions in total cholesterol (TC) (29%, 25%), LDL-C (34%, 24%), and HDL-C (24%, 27%), but no change in TC values. On the other hand, MF males and females demonstrated a sharp decrease in TC (42%, 36%) and VCDL-C (41%, 38%), a moderate, but significant decrease in TC (7%, 8%), but no change in LDL-C values. The powerful effect of LF on TC and LDL-C indicates that lower the fat intake, the greater the reduction in risk in healthy, exercising adults.