SUMMARY, CONCLUSIONS AND RECOMMENDATIONS
5.1 SUMMARY

Overweight and obesity are increasing in prevalence, and this has resulted in a significant public health burden. Therefore, it is important to identify interventions that prevent weight gain and prevent weight regain after weight loss. Energy expended in physical activity has the potential to affect energy balance and this can potentially affect body weight regulation. There is some evidence that physical activity can minimize weight gain, and it appears that it requires moderate to vigorous physical intensity to significantly affect body weight. Moreover, it appears that improvements in fitness are associated with reductions in risk of weight gain. Physical activity is also associated with improved maintenance of weight loss. Although it appears that interventions targeting physical activity are necessary to affect weight gain and improve long-term weight loss, the impact of these interventions on other components of energy balance should be examined. In addition, although minimal public health recommendations can significantly affect health outcomes, additional research is needed to identify the feasible mode of physical activity to prevent weight gain and improve long-term weight loss.

Having this concept, when attempting to trace the means and methods, it was found from the recent studies that accumulating several short bouts of moderate to vigorous activity, each day may improve adherence to the programme. The findings of these explained that aerobic fitness levels can
improve as little as 10 minutes duration-provided exercise is performed often, meaning 2-3 times a day, 5 days a week. The American College of Sports Medicine also recommends 3-5 days a week for most aerobic exercise programme. Besides it was found from some of the research studies that combining resistance exercise with aerobic exercise is viable source to reduce the general obesity, central obesity and to increase the essential body mass. By this conjecture, the investigator has design the three modes of treatment using cardio aerobic circuit namely continuous long bout, multiple short bouts and multiple short bouts with resistance exercises to find out its effect on obesity and development of health related physical components (muscular endurance, flexibility and cardio vascular endurance) and physiological factors.

Cardio-aerobic Circuit training is an excellent way to simultaneously increase one's cardio vascular capacity and muscular strength and endurance. This training also increases the lean body mass by a moderate amount and decrease body fat levels through high levels of energy expenditure (body composition improvement). Cardio workouts help to beat boredom, boost the cardio vascular endurance. The circuit training format utilizes a group of exercises that are completed sequentially (one exercise after another). Each exercise is performed for a prescribed time period before moving on to the next exercise. The exercises within each circuit are separated by a shorter rest interval, and each circuit is separated by a shorter rest period thus maintaining elevated heart rates during the circuit workouts and helping the individual to upgrade his cardio vascular capacity. The total number of circuits performed
during a training session may vary from two to six depending on your training level.

Combination of cardio aerobic exercise and resistance exercise is the best training to lose body weight. Generally speaking, aerobic training offers more immediate weight loss benefits than anaerobic exercise, although resistance training also plays a valuable role in normalizing weight levels. On balance, the best weight loss exercise programme combines both cardio aerobic and resistance exercise.

The methodology adopted in the present study was:

Thousand two hundred women students studying in Nirmala College for Women and Bishop Appaswamy College of Arts and Science, Coimbatore, Tamil Nadu were screened by using Body mass index (BMI) expressed as weight / height$^2$ (BMI; k/m$^2$) is commonly used to classify obesity (BMI greater than or equal to 30) among adults (age 20 years and over). Out of one thousand two hundred women students ninety two were found to be obese (BMI; 32.4±1.5 kg/ m$^2$). Among the ninety two, sixty sedentary moderately obese women were randomly selected for the purpose this study.

The selected subjects were assigned at random to one of the four groups in which Group I - continuous long bouts of cardio aerobic circuit training (CLBCACT) underwent one 30 minutes continuous long bout cardio-aerobic circuit training (1x30); Group II- multiple short bouts of cardio aerobic circuit training (MSBCACT) underwent three 10 minutes multiple short bouts of cardio-aerobic circuit training (10 x 3= 30 ); Group III - multiple short bouts
of cardio aerobic circuit training with resistance exercises (MSBCACTRE) underwent three 10 minutes multiple short bouts of cardio-aerobic circuit training with resistance exercises (3X10=30); for five days a week for twelve weeks and Group IV acted as control. The subjects were tested on health related physical fitness components of muscular endurance, flexibility, cardio vascular endurance, body composition characteristics such as body weight, percent body fact, lean body mass and waist circumference and physiological variables of maximum oxygen consumption (VO₂ Max); resting heart rate, resting systolic blood pressure and resting diastolic blood pressure at prior and immediately after 12 weeks of training programme. The experimental groups practiced cardio-aerobic circuit training programme at target heart rates corresponding to 40 % and 60 % of the heart rate reserve at the start of the programme. The group means gains recorded by the various groups during the experimental period of twelve weeks in the criterion measures were tested for significance by applying paired sample t-test. Analysis of covariance was applied to compare the effects of three training programmes on criterion measures used in the study. Further wherever the obtained “F” ratio value in the simple effect was significant, the Seheffe’s test was applied as post hoc test to determine which of the paired mean has significant differences.

5.2 FINDINGS

1. In testing the significance of mean differences on pre-test among the four groups namely continuous long bout cardio aerobic circuit training; multiple short bouts cardio aerobic circuit training; multiple short bouts cardio aerobic circuit training with resistance exercises and control the
observed F-ratios for selected variables were found to be statistically
insignificant.

2. In testing the significance of mean differences on post-test means
among the four groups namely continuous long bout cardio aerobic
circuit training; multiple short bouts cardio aerobic circuit training;
multiple short bouts cardio aerobic circuit training with resistance
exercises and control the observed F-ratios were found to be statistically
significant for all the selected variables except body weight.

3. In testing the significance of mean differences on adjusted means
among the four groups namely continuous long bout cardio aerobic
circuit training; multiple short bouts cardio aerobic circuit training;
multiple short bouts cardio aerobic circuit training with resistance
exercises and control, it was found that the observed F-ratios for the
selected variables were statistically significant.

4. In testing the adjusted mean differences between the MSBCACTRE
(Group -III) and CLBCACT(Group – I) it was found that the treatment
effect of MSBCACTRE on muscular strength and endurance, cardio-
vascular endurance, percent body fat, waist circumference and
maximum oxygen consumption was significantly higher than that of
CLBCACT, whereas in the remaining variables of flexibility, body
weight, lean body mass, resting heart rate, resting systolic blood
pressure and resting diastolic blood pressure MSBCACTRE (Group-III)
was not significantly differ from CLBCACT –( Group I).
5. In testing the adjusted mean differences between the MSBCACTRE (Group -III) and MSBCACT(Group II), it was found that the treatment effect of MSBCACTRE on muscular strength and endurance, cardio-vascular endurance, percent body fat, lean body mass, waist circumference, maximum oxygen consumption and resting diastolic blood pressure were significantly better than that of MSBCACT, whereas in the remaining variables of flexibility, body weight, lean body mass, resting heart rate and systolic blood pressure, no significant mean differences were existed between MSBCACTRE and CLBCACT groups.

6. In testing the adjusted mean differences between the CLBCACT (Group-1) with MSBCACT(Group- II), it was found that CLBCACT significantly reduced the percent body fat and waist circumference and significantly increased the lean body mass as compared to MSBCACT and functioned as superior. Besides it was observed that the adjusted mean differences on body weight between these two treatments were statistically significant and it was found that, MSBCACT was superior to the CLBCACT in reducing the body weight of obese women. Likewise, when testing the adjusted mean differences on the remaining variables of muscular strength and endurance, flexibility, cardio-vascular endurance, maximum oxygen consumption, resting heart rate, resting systolic blood pressure and resting diastolic blood pressure no significant mean difference was observed between CLBCACT and
MSBCACT since the observed F-ratios on these variables were failed to reach the significant level.

7. In testing the adjusted mean differences of CLBCACT (Group -I), MSBCACT (Group - II) and MSBCACTRE (Group - III) with the control group it was found that the treatment effects of all the three groups on all the variables (muscular strength and endurance, flexibility, cardio-respiratory endurance, body weight, percent body fat, lean body mass, waist circumference, maximum oxygen consumption, resting heart rate, resting systolic blood pressure, and resting diastolic blood pressure were significantly better than that of control group.

8. The continuous long bout cardiac aerobic circuit training produced a significant improvement positively in muscular strength and endurance, flexibility, lean body mass, maximum oxygen consumption, cardio-vascular endurance, percent body fat, waist circumference, resting heart rate, resting systolic blood pressure, and resting diastolic blood pressure.

9. The multiple short bouts cardiac aerobic circuit training highlighted an increase in muscular strength and endurance, flexibility, maximum oxygen consumption and reduction in body weight, percent body fat, waist circumference, resting heart rate, resting systolic blood pressure, and resting diastolic blood pressure from baseline to post treatment whereas the lean body mass was found to be insignificant.

10. The multiple short bouts cardiac aerobic circuit training with resistance exercises showed a positive sign as having the significant improvement
in muscular strength and endurance flexibility, lean body mass, maximum oxygen consumption; and as having significant reduction in cardio vascular endurance, body weight, percent body fat, waist circumference, resting heart rate, resting systolic blood pressure, and resting diastolic blood pressure, from the performance of baseline to post test.

5.3 CONCLUSIONS

In the light of the above findings of the present study the following conclusions have been made.

1 All the three training programmes (CLBCACT, MSBCACT, and MSBCACTRE,) produced a significant improvement in health fitness components, body composition indices, and selected physiological variables.

2 The training programme of three 10 minutes multiple short bouts of cardio aerobic circuit training may be a suitable alternative to that of one 30 minutes continuous long bout cardio aerobic circuit training to develop the health fitness components of muscular strength and endurance, flexibility and cardio vascular endurance and selected physiological variables of maximum oxygen consumption, resting heart rate, resting systolic blood pressure and resting diastolic blood pressure

3 The cardio–aerobic circuit training based multiple short bouts is more effective than the cardio–aerobic circuit training based continuous long bout in reducing the percent body fat (general obesity) and waist
circumference (central obesity) and in creasing the lean body mass of obese women.

4 The multiple short bouts cardio aerobic circuit training with resistance exercises programme is more effective than the continuous long bout cardio aerobic circuit training in developing the health fitness components, body composition indices and selected maximum oxygen consumption.

5 The multiple short bouts cardio aerobic circuit training with resistance exercises programme is better than the multiple short bouts cardio aerobic circuit training without resistance exercises programme in reducing the body composition indices of percent body fat (general obesity) and waist circumference (central obesity) and lean body mass for the obese women.

6 The multiple short bouts cardio aerobic circuit training with resistance exercises programme is the more appropriate training programme to reduce the general and central obesity and simultaneously develop the health fitness components, and body functional efficiency of maximum oxygen consumption for obese women.

5.4 RECOMMENDATIONS

1 The results of the study have proved that both continuous and intermittent cardio aerobic circuit training builds health fitness and loss of body fat and body weight and improves the lean body mass, aerobic capacity when done in the target zone, it has the same benefits and
continuous exercises. Therefore those who want to maintain the health fitness and reduce their body fat can follow the exercise programme used in this study and who can not exercise for long duration due to low fitness levels or busy lifestyles do not have to sit and wait for a heart attack, even if we can encourage people to be active and spare at least 30 minutes of exercises in 10 minutes bouts each day, it will have a positive effect on overall health.

2 If short bouts are performed repeatedly throughout the day, thus the accumulated amount of calories are burned after exercises sessions increases, compared to a single session of exercises equal in duration, intensity and caloric expenditure.

3 Three 10 minutes of cardio aerobic circuit training sessions might be easier to schedule for the people of busy lifestyle than longer periods.

4 The cardio aerobic circuit training schedule if done at relatively higher intensity with the alternating resting periods, it can be beneficial in preparing for athletes for sports competition.

5 Survey results repeatedly show that calisthenics are among the most frequently performed participants’ activities. It is recommended from the results of this study that calisthenics that are done without stopping or with jogging performed during the rest period can develop virtually all health related aspects of physical fitness. Almost every one can plan a continuous calisthenics exercise programme by selecting exercises for
each fitness components that will elevate the heart rate to the optimal level and sustain this level intensity an adequate length of time.

6 Thus, based on the findings of the investigation, it is recommended that combining aerobic and resistance training produces the greatest alteration in body composition. Multiple short bouts of exercises are as beneficial as one long period so as to provide an alternative effective way to exercise, which is easier to incorporate into every day life.

FUTURE WORK

1 A similar study may be conducted with the large samples of different age groups.

2 A similar study may be conducted selecting combination of aerobic exercises and resistance exercises with varied intensities.

3 A similar study may be conducted selecting combination of aerobic and resistance exercises by extending the duration of the present study.

4 A similar study may be conducted with exercise training and severe caloric restriction of obese women.

5 A study may be conducted on the effects of long-term, moderate intensity, and intermittent exercises on body composition.

6 A study may be conducted on effects of lifestyle activities and structured aerobic exercise on obese women.