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EFFICACY OF AEROBIC, RESISTANCE AND COMBINATION TRAINING ON ANTHROPOMETRIC PARAMETERS OF OVERWEIGHT ADULTS

[1]Dr Rahul Kumar Verma,[2]Dr Archana Verma,[3]Dr Keshav Kumar Sen, [4]Dr Priya Verma

[1]HOD of Physiotherapy Department, ,[2]Senior physiotherapist,[3] RSO 2 (MS Ortho), [4]Senior physiotherapist
[1] Head of Physiotherapy Department,
[1]Utkarsh Hospital, Ecotech-3, Greater Noida,India

Abstract : Health is an important aspect of an individual from all gender, age, ethnic group, execution of regular exercise in daily life plays a role of maintaining health and fitness since being overweight can seriously affect health and longevity and is associated with depression, heart disease, diabetes, cancer, hyperlipidemia and hypertension American College of Sports Medicine (ACSM).

Many researchers examined the role of aerobic exercise and strength training on weight loss. Since we know adolescence is a decisive period in human life due to the multiple changes that take place between childhood and adulthood. Puberty is the main neurohormonal determinant of both physiological and psychological changes.

Obesity is more than an excessive deposition of fat in the body. Excess body fat is associated with adverse metabolic complications as well as with significant short and long term physical and psychosocial problem that must be include in the same concept therefore in order managing the enormous problem and its consequence objective and the standard parameters of body fitness are required for the screening of obesity.

Purpose of our study is to find out an effective mode of the exercise for fast weight reduction. Body weight is reduced by aerobic exercise training, but it is important to consider exercise type, intensity and frequency.

Outcome Result of this study is an attempt to investigate that which form of exercise training is helpful in reducing body fat percentage by preserving lean body mass. So the combined aerobic and resistance training was given to Group C and was compared to Group A and Group B, Group A underwent aerobic training alone. Group B underwent resistance training. The results are different for all the three groups. However the group which consisted combination or aerobic and resistance training showed much significant improvements in PMI, LBM, Fat % and Waist Hip ratio.

It concluded that, the duration of 6 weeks of combined training with 3 days per week can be safely used to enhance fat loss and preserve Lean body mass.

INTRODUCTION

Health is an important aspect of an individual from all gender, age, ethnic group, execution of regular exercise in daily life plays a role of maintaining health and fitness since being overweight can seriously affect health and longevity and is associated with depression, heart disease, diabetes, cancer, hyperlipidemia and hypertension American College of Sports Medicine (ACSM). Overweight and obesity were associated with cardiovascular disease, cancer, hypertension, metabolic disease and all- cause mortality. Appropriate body weight is important for athletic performance since overweight athlete can present numerous challenges particular to lean weight sports (gymnast, track and field figure scatting) weight loss is to be done in such a

way that the body is stronger and healthier after the bodyweight loss program. The execution of regular exercise in daily life plays a role for maintaining health and fitness and become the prevention and treatment of various diseases from the guideline of American College of Sports Medicine. In order to maintain ideal body weight the energy consume needs to equal the energy output exercise appears to play a critical role in body weight control management. When energy expenditure exceeds energy intake, a negative energy balance exists and body mass is reduced. BMR represents the largest percentage of an individual's daily energy expenditure at (60-75%) of total energy expenditure), many researchers have been identifying interventions that may potentiate an increase in BMR and RMR to facilitate weight loss. Typically endurance training has been used for altering body composition because of its ability to increase energy expenditure and fat utilization. Many factors have been shown to influence metabolic rate. The strongest correlation exists between an individual's Fat-Free Mass (FMM) and BMR. It has been proposed that increase in lean body mass will increase BMR thus increasing total energy expenditure. Fat Mass (FM) and Total Body Mass (TM) are generally reduced with endurance exercise; however, this reduction contributes minimally to gains in lean body mass. Much of researches entering on increases in lean body mass have used resistance training as the exercise modality.

The potential influence on BMR and body composition that resistance and endurance exercise may offer to individuals warrants further investigation. Recently, combined resistance and endurance exercise has received much attention as a form of training.

Many researchers examined the role of aerobic exercise and strength training on weight loss. Since we know adolescence is a decisive period in human life due to the multiple changes that take place between childhood and adulthood. Puberty is the main neurohormonal determinant of both physiological and psychological changes.

Unfortunately because of conflicting study the beneficial impact of aerobic or strength training in weight loss among overweight subjects is unclear. Since strength and endurance training represent in their extreme opposite form of training. Strength training consists of a relatively small number of contractions of maximal or near maximal force, Endurance training consist of a large number of sub maximal contractions.

Theoretical strength training should lessen the declining resting metabolic rate if it preserves fat free mass by inducing hypertrophy of skeletal muscle on the other hand aerobic exercise although it often significantly increase muscle mass, may have other advantage over strength training because it results in greater utilization of fat stores and greater energy expenditure in a typical training session than does a aerobic training.

Our study is to find out an effective mode of the exercise for fast weight reduction. Body weight is reduced by aerobic exercise training, but it is important to consider exercise type, intensity and frequency.

Physiology of Overweight

Obesity result from an imbalance between energy intake and energy expenditure, Excess in adipose tissue mass also can be viewed as a pathological derangement in the feedback between energy intake and expenditure. In modern item this excess in adipose tissue fuel storage in considered a disease; however, a better way to view obesity may be as a survival advantage that has gone astray. It is important to remember that what is now considered "path physiology" was probably advantageous when food was less available and a high level of energy expenditure in the form of physical activity was a way of life. Adipose tissue is critically involved in feedback regulation of energy balance by the production of a number of peptide hormones, and leptin and adiponectin are two of the most important. The absence of leptin produces massive obesity, and treatment of leptin deficient individuals reduces food intake and body weight. In most obese people however, leptin has little effect on food intake or body weight.

Assessment of body fat

The measurement of body fat, which is composed mainly of adipose in the form of triglyceride, represents a challenge to researchers and clinicians. The main stores of fat are subcutaneous and intra-abdominal, and considerable amounts of fat can also reside within muscles, particularly in elderly persons Because fat is diffuse and inaccessible, it is impossible to measure total adipose directly. Traditionally, the gold standard

for estimating body fat has been hydro-densitometry (underwater weighing), which is based on the principle that fat tissue is less dense than muscle and bone. Dual-energy x-ray absorptiometry is now replacing densitometry as a standard because of its high precision and its simplicity for the subject. Both of these methods are used primarily for research purposes and are not available for routine clinical care, but they can be used to validate other methods of measuring body fat.

Obesity Definition in Adolescence

Obesity is more than an excessive deposition of fat in the body. Excess body fat is associated with adverse metabolic complications as well as with significant short and long term physical and psychosocial problem that must be include in the same concept therefore in order managing the enormous problem and its consequence objective and the standard parameters of body fitness are required for the screening of obesity. It is obvious that body cut off values determined by reference methods are the best criteria for overweight and obesity definition. The definition of excess body fat is somewhat arbitrary even if total body fat mass percentage is known. Nowadays, there is no consensus about % FM cutoffs for obesity in adolescents, especially in this period the level of adiposity may vary widely in relation with age, gender and pubertal development. In absence of clear cutoff points, the most consistent % FAT values for the definition of excess body fat in female adolescent range between 30 and 35% contrary to females, adiposity in male adolescents increases with age and sexual development. Strategies for improving physical activity participation.

It appears that physical activity does play a significant role in management of body weight. However although the importance of physical activity is well known, strategies for improving participation in physical activity are desperately needed. As described earlier, as physical activity deceases, weight has a tendency to increase. This is especially troublesome because the prevalence of physical inactivity in both children and adults is extremely high.
Therefore, it is important to consider strategies to enhance physical activity participation in under active and inactive individuals because this may have a significant impact on the overweight and obesity rates. Fat Distribution according to shape:

1) Apple (Android) shape
2) Pear(Gynoid) Shape.

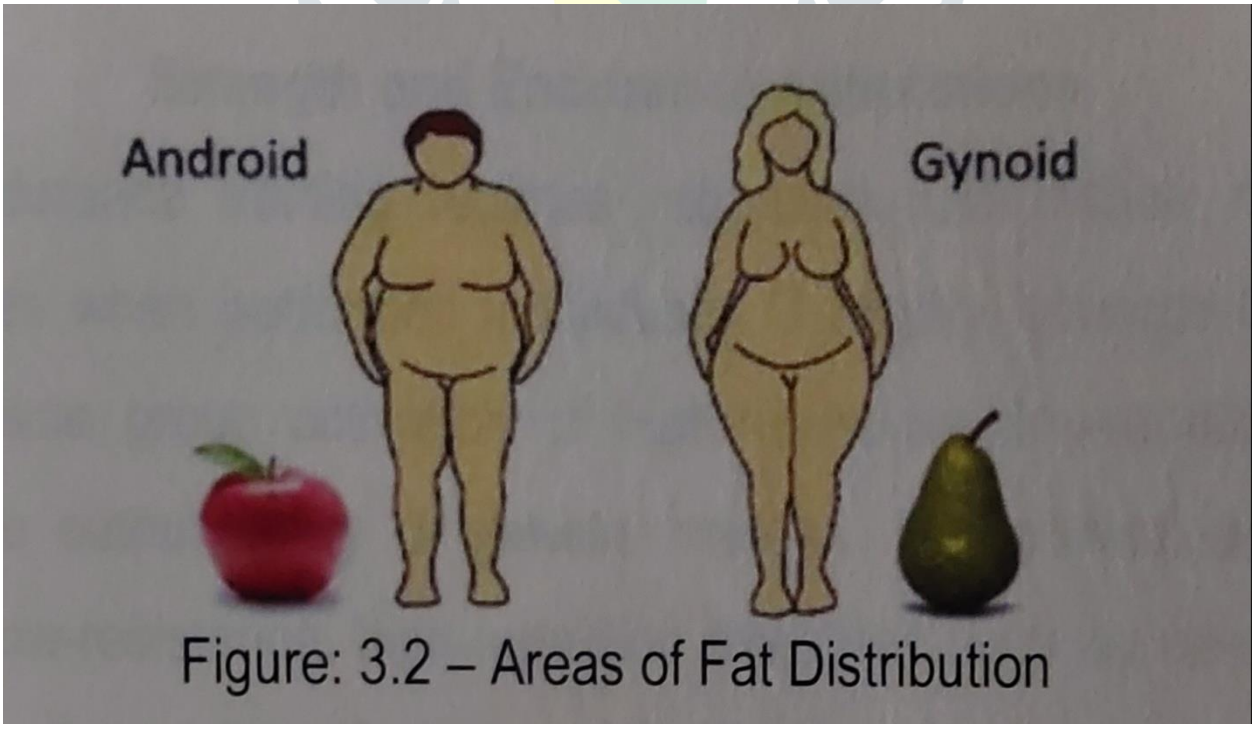

Figure: 3.2 – Areas of Fat Distribution

Aerobic Training

Aerobic training or cardio respiratory endurance training leads to improved central and peripheral blood flow and an enhanced capacity of the muscle fibers to greater amounts of ATP. The Aerobic training leads

to an increase in one's maximal aerobic capacity (VO2max) There is wide individual variation in the degree of improvement in VO2 max as a result of same training program. The number of capillaries supplying each muscle fiber increases with training. Aerobic training increases both size and number of mitochondria. All these changes that occur in the muscles, combined with adaptations in the oxygen transport system lead to enhanced functioning of the oxidative system and improved endurance.

Anaerobic training

Anaerobic training leads to increased muscular strength and a greater tolerance for acid- base imbalances during highly intense efforts. Anaerobic training bouts improve anaerobic performance, but the improvement appears to result more from Strength gains than from improvements in the functioning of the anaerobic energy system. Anaerobic training also improves the efficiency of movements, and more efficient movement requires less energy expenditure. Muscle buffering capacity is increased by anaerobic training, permitting higher muscle and blood lactate levels. Improved buffering capacity allows the H' that dissociates from lactic acid to be neutralized, thus delaying fatigue.

Strength and Endurance Adaptations

Strength and endurance training regimes represent and induce distinctly different adaptive responses when performed individually. Typically, strength-training programs involve large muscle group activation of high-resistance low-repetition exercises to increase the force output ability of skeletal muscle. In contrast, endurance-training programs utilize low-resistance, high-repetition exercises such as running or cycling to increase maximum O2 uptake (VO2 max). Accordingly, the adaptive response in skeletal muscle to strength and endurance training are different and sometimes opposite. Strength training has been reported to cause muscle fiber hypertrophy, associated with increase in contractile protein, which contributes to an increase in maximal contractile force. Strength training also reduces mitochondrial density and suppresses oxidative enzymes activity which can cause impede endurance capacity, but has minimal impact on capillary density or in the conversion of music fiber types from fast twitch (type II fibers) to slow twitch (type I fibers) 38.39. In contrast, endurance training usually causes little to no muscle fiber hypertrophy, but it does induce increase in mitochondria content, citric acid enzymes, oxidative capacity and the possibility of muscle fiber conversion from fast twitch to slow twitch.

OBJECTIVES

Statement ofproblem

Aerobic and strength training are important component of weight loss intervention in practice where there is dearth of literature stating the comparative and combined effect on LBM, BMI and other Anthropometric variables.

Aim

To compare the effect of aerobic, resistance and combination training in weight loss of overweight adults on different anthropometric variables.

Purpose of the study

The study aims to analyze the comparative and combined effect of aerobic, resistance and combined training on Lean Body mass, fat % BMI and Waist Hip ratio (WHR).

Hypothesis

Research Hypothesis

It is hypothesized that combination training will have fast reduction in body Mass Index, percentage body fat and Waist Hip ratio by preserving Lean Body Mass.

Null hypothesis

There is no significant relationship between types of training on different Anthropometric variables.

Significance of the Study

If proved it can be incorporated in the fitness training program for early and effective weight reduction by preserving appropriate LBM.

METHODOLOGY

This study is a Pre-test and Post-test experimental type.

Sample

Sample of 30 subject (n=30) overweight adults age group of 18-30 yrs. (A-24. 2+3. 32, B-22.5+2.95, C-21.2+1.75) were included in the study after they fulfilled the inclusion criteria and were assigned in 3 groups 10 in each group.

Inclusion Criteria

1) Collegiate male and female
2) Age 18-30 years
3) BMI 25-29.9 Kg/m²

Exclusion Criteria

1) Any back or lower extremity injury within the past year
2) Any cardiovascular problem
3) Any neurological problem
4) Any orthopedic problem
5) Obesity/Underweight
6) Any form of previous training.

Instrumentation

The equipments during the study are as follows:
a) Skin fold caliper
b) Weighing machine
c) Height chart
d) Inch tape
e) Heart rate monitor
f) BP apparatus
g) Free-weights
h) Multi gym apparatus

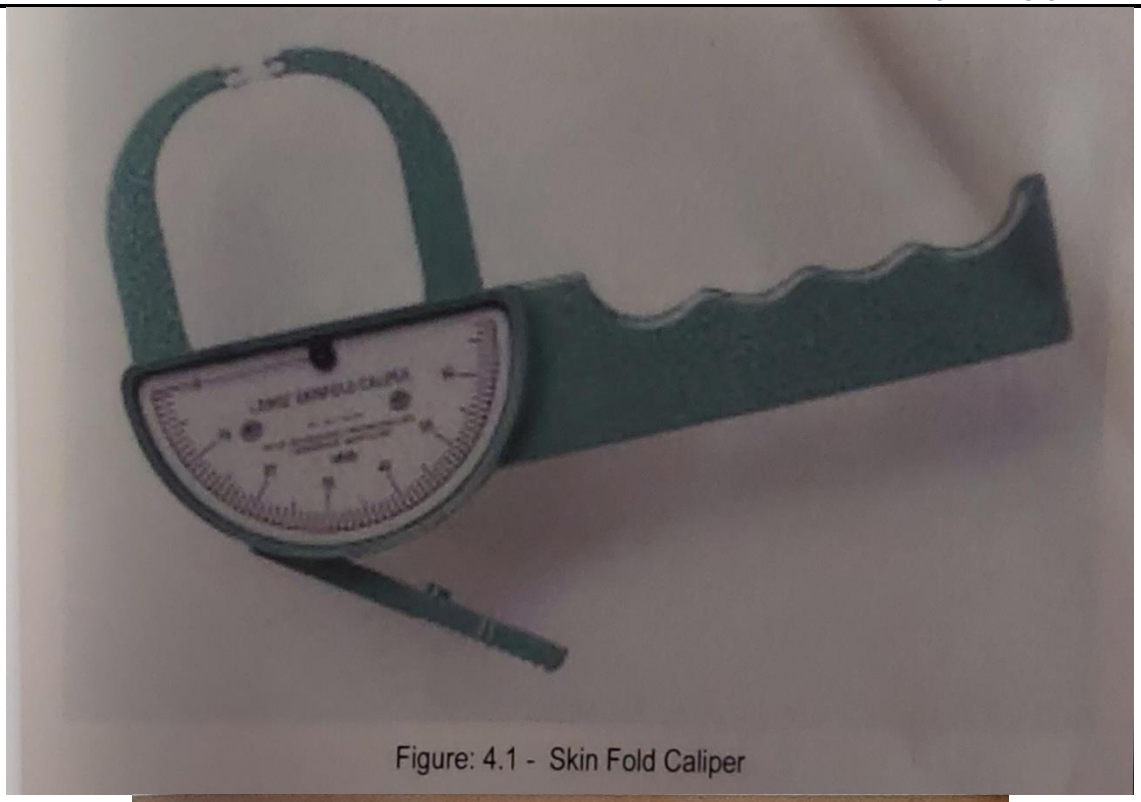

Figure: 4.1 - Skin Fold Caliper

Figure: 4.2 – Heart Rate Monitor

Figure: 4.3 – Multi Gym Apparatus

Spaces and Facilities - The study was conducted in the following spaces and sports facilities:

1) The gym (Mohan Swarup Hospital), Greater Noida.
2) Noida College of Physical Education, Greater Noida.
3) Bundelkhan Medical College, Sagar, (M.P.)

Protocol

Upon fulfilling the inclusion criteria, the subjects were included in the study. As the subjects were divided in three groups i.e. Group-A, 10 subjects, Group-B, 10 subjects and Group-C, 10 subjects. The protocol consisted of 'Aerobic training', 'Resistance training' and combined training as mentioned below. Group-A underwent only 'aerobic training'. Group-B underwent only 'resistance training' and Group-C underwent 'combined training program'.

Exercise	**0-3 weeks**	**4-6 weeks**
Bench press	(5 sets x 6 rep at 60% 1 RM), 3-minutes	(5 sets x 6 rep at 70% 1 RM), 3-minutes
Arm curl	(5 sets x 6 rep at 60% 1 RM), 3-minutes	(5 sets x 6 rep at 70% 1 RM), 3-minutes
Leg curl	(5 sets x 6 rep at 60% 1 RM), 3-minutes	(5 sets x 6 rep at 70% 1 RM), 3-minutes
Leg extension	(5 sets x 6 rep at 60% 1 RM), 3minutes	(5 sets x 6 rep at 70% 1 RM), 3minutes
Abdominal crunch	(5 sets x 6 rep at 60% 1 RM), 3-minutes	(5 sets x 6 rep at 70% 1 RM), 3-minutes
Lat pull down	(5 sets x 6 rep at 60% 1 RM), 3-minutes	(5 sets x 6 rep at 70% 1 RM), 3-minutes
Leg raise	(5 sets x 6 rep at 60% 1 RM), 3-minutes	(5 sets x 6 rep at 70% 1 RM), 3-minutes
Triceps push away	(5 sets x 6 rep at 60% 1 RM), 3-minutes	(5 sets x 6 rep at 70% 1 RM), 3-minutes

Table 4.1 Resistance training program

Step	(0-3) weeks, 60% Hr max	(4-6) weeks, 70% HR max
Step touch	(0-3) weeks, 60% Hr max	(4-6) weeks, 70% HR max
Lunge side	(0-3) weeks, 60% Hr max	(4-6) weeks, 70% HR max
V step	(0-3) weeks, 60% Hr max	(4-6) weeks, 70% HR max
Diamond step	(0-3) weeks, 60% Hr max	(4-6) weeks, 70% HR max
Heel touch	(0-3) weeks, 60% Hr max	(4-6) weeks, 70% HR max
Sit up	(0-3) weeks, 60% Hr max	(4-6) weeks, 70% HR max
Push up	(0-3) weeks, 60% Hr max	(4-6) weeks, 70% HR max
Jumping jack	(0-3) weeks, 60% Hr max	(4-6) weeks, 70% HR max
Knee up	(0-3) weeks, 60% Hr max	(4-6) weeks, 70% HR max
Side kick	(0-3) weeks, 60% Hr max	(4-6) weeks, 70% HR max

Table 4.2 Aerobic Training program

Combination Training Protocol

The combination training protocol consist of combination of Aerobic and resistance training in a single training session. The training session of 45 minutes was divided in to 5 minutes of cool down. 10 minutes of warm up, 15 minutes of Aerobic training, 15 minutes of resistance and rest 5 minute of cool down.

Procedure

Begin with noting the height and weight of the individual as per the inclusion criteria to rule out any pathological condition. All the procedures will be explained to the subjects, Informed consent will be taken from those selected in the study. Subjects will be allocated with proper warm up protocol which includes 5 minutes of jogging and 5 minutes of static stretching for quadriceps, hamstrings, calf muscles, hip flexors, and gluteal group music prior to intervention. A pre-intervention measurement of Target heart rate for aerobic and combined training group and 1 RM for resistance as well as combined group were taken. Skin fold measurement, girth measurement, waist hip ratio prior to each training and subjects were allocated to either of the groups and then asked to perform aerobic, strength training and combined training.

After the conclusion of training session, cool-down including 5-7 minutes of jogging was performed by all the subjects. The total duration of the study was 6 weeks, where training was administrated for 3 days a week for 45 minutes a day. Post intervention readings were taken at the end of 2nd, 3rd, 4t and 6th week. The subjects performed actively during the overall procedures.

Figure: 4.4 – Subject performing Leg Curl

Figure: 4.5 – Subject performing Arm Curls

Figure: 4.6 – Subject performing Aerobic Training

Figure: 4.7 – Subject performing Lunge

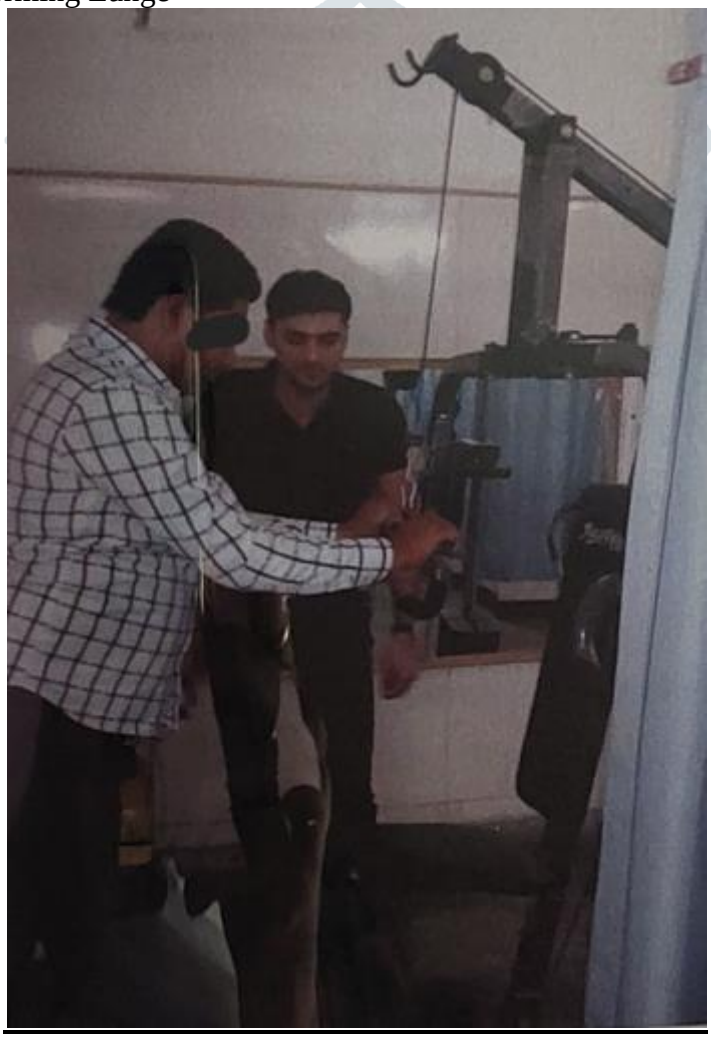

Figure: 4.8 - Subject performing Triceps Push Away Exercise

Intervention Measurements

Total Body weight

Subject is in minimal clothing, stood straight on the weighing machine without looking down on carrying any object that may falsely add to the weight.

Standing height

The subject stood straight with shoes-off, against an upright wall with a stand meter, touching the wall with the, bullock and back both heels. The head is oriented in Frankfurt plane i.e. the lower border of eye socket and upper border of eye opening should be in horizontal line. The subjects were asked to stretch upwards and hold a full breath. The ruler was lowered until it touched the vertex firmly. Then marking at vertex were noted.

Target Heart Rate

The Karvonen Formula is a heart rate reserve formula and it's one of the most effective methods used to calculate training heart rate. Target heart rate was measured by measuring the maximum heart rate of the subject i.e. (220-age) and by calculating 70% of that heart rate.

220-Age=Maximum Heart Rate

Target Heart Rate=Maximum Heart Rate-Resting Heart Rate x 0.70 + Resting Heart

1 Repetition maximum (RM)

1 RM of abdominal, biceps, triceps, Lateral pull down, knee flexion, knee extension was taken as by Kuramoto and Payne et al.

It was measured by Kuramoto and Payne (1995) [1RM= (1.06 x lifted weight (kg) + (0.58 x repetition frequency) - (0.20 x age) - 3.4)].

Base line and Post intervention measurement

DMT

The formula used in our studies to calculate body-mass index, also called the Quetelet index, which is the weight in kilograms divided by the square of the height in meters.

Skin Fold thickness

Skin fold was measure by using a skin fold caliper at the following sites: iliac crest in the mid-maxillary line and back of arm in the midline halfway between acromion and olecranon processes with the elbow extended. All skin folds were taken vertically on the non-dominant side of the body.

Body Density

It was calculated by following equation Db=1.0764-0.00081X1-0.00088X2, where Db-Body density (g/ml), X1-skin fold thickness over iliac crest (mm), X2-skin fold thickness over back of arm (mm).

Body Fat Percentage

It is calculated by using the formula of Brozek et al: F= (4.570 / Db) - 4.142 x 100 protrusion.

Lean body mass

It was calculated by subtracting the estimated fat weight (e.g. % BF x Total body weight/100) from total body weight.

Waist Hip ratio

Waist circumference was measured by an inch tape at the centre of abdomen at an umbilical level, whereas Hip ratio was measured by an inch tape at an area of maximum protrusion.

DISCUSSION

Body composition refers to the constituents of your Lean Body Mass, Fat Mass and water and is not only important for athletes, since an athlete's performance is partially influenced by the proportion of his fat free mass (PEM), but also for individuals of ages, gender and ethnic groups. Exercise training has been thought to be a good addition to any weight loss program because individuals who train on regular basis are usually thin and lower fat compared to sedentary counterparts.

It has been shown that aerobic exercise can be important component of weight loss intervention and therefore commonly included as part of a comprehensive weight loss management program. Although most research studies have examined the effect of endurance exercise on weight loss, weight training has recently become an important component of a successful weight loss program by helping preserve FFM and maximizing fat loss.

The addition of exercise to weight-loss regimes has been found to increase caloric expenditure derived from fat, decrease appetite, Improves cardiovascular function, and promotes a sense of psychological well-being.

Strength and endurance training are often concurrently by fitness enthusiasts and athletes. However, since the adaptive responses to strength and endurance training are different and some may even be opposite. It is conceivable that skeletal muscle cannot adapt optimally to the two contradictory training stimuli when they are simultaneously imposed. Whenever the interaction between concurrent strength and endurance training results in "antagonism: or mutual enhancement of the training response probably depends on several factors, including the initial state of training of trainees; the training modes; the intensity, volume and the frequency of training and the way the two forms of trainings are integrated.

This study is an attempt to investigate that which form of exercise training is helpful in reducing body fat percentage by preserving lean body mass. So the combined aerobic and resistance training was given to Group C and was compared to Group A and Group B, Group A underwent aerobic training alone. Group B underwent resistance training. The results are different for all the three groups. However the group which consisted combination or aerobic and resistance training showed much significant improvements in PMI, LBM, Fat % and Waist Hip ratio.

The subjects selected in the study were over weights adults between age group of 18-30 years (A-24.2+3.32, B-22.5+2.95, C-21.2+1.75) and BMI between 25-29.9 Kg/m2, who did not participate in any organized exercise, were recruited to participate in a 6 weeks Exercise training program. Following a detailed explanation of the tests and training programs involved, the subject signed a consent form before participating in the study and completed a medical history questionnaire in which they were screened for any possible injury or illness. Also they were requested not to change their eating pattern during the study. Such results are in consistence with the study by Rahman Rahimi.

The changed in total body weight reported in this study were in general agreement with results from other training programs. Following a 6 weeks of training program the greater change in body weight was not accepted this was in accordance to Douglas p. Smith et al.

The result demonstrated that BMI was changed from pre training to post training from 28.99±0.6251 to 27.99 ± 0.6487 (-3.44%) in Group A which underwent aerobic training 28.92 ±0.5073 to 28.34 ± 0.7786 (-2.35%) in Group-B which underwenttraining While Group-C which underwent both i.e. combined aerobic and resistance training showed decrease in BMI from 28.87 ± 0.3793 to 26.97 ± 0.2063 (-6.58%). Hence BMI was significantly reduced in all the three groups.

Changes in Waist hip ratio in Group-A 0.8920 ± 0.02300 to 0.8790 ± 0.02807, and in Group-B 0.891 ± 0.02025 to 0.8830 ± 0.2163 and combined training Group shows from 0.899 ± 0.02726 to 0.8690 ± 0.02685. The result from all the three groups does not show significant difference from pre to post training. In our study changes in Waist Hip ratio was more in Group-C combined training group (3.33%), then in Group-A aerobic training group (1.45%) and changes was least seen in Group-B i.e. resistance training group

(0.89%). However, the between group difference in waist circumference never reached statistical significance (p= 0.716, pre intervention, pre= 0.464). This was in accordance to study done by KH Schmitz et.al. Accordance to Sang-Kab Park et.al if the ratio of subcutaneous and visceral fat is 0.4, which is a index of the abdominal obese, it is considered to be the abdominal obese.

The abdominal obesity with the ratio is higher than 0.4 was highly related to the circulation and endocrine problem.

In 1990, the Dietary Guidelines for American were accompanied for the first time by recommendations for the ratio of waist circumstance to hip circumference; the ratio was not to exceed 0.95 for men and 0.80 for women. In 1995, however, the guidelines stated that concern was warranted if the ratio exceeded 1.0. Waist circumference and the ratio of waist circumference to hip circumference are similarly correlated with measure of risk factors for coronary heart disease, such as high blood pressure or blood lipid levels, and neither method has been consistently superior in predicting the risk of disease. Thus, because of its greater simplicity, waist circumference may be most useful in clinical practice

Fat % was changed from 39.8720 ± 0.03360 to 39.8690 ± 0.05174 (-0.0075%) in Group A Aerobic training group. 39.8690 ± 0.03414 to 39.8570+ ± 0.03268 (-0.0301%) in Group B, and in Group-C 39.8690 ± 0.03414 to 39.8490 ± 0.05280 (-0.0505%). Pre and post test there was no significant difference between the groups. This was in accordance with Douglas p. Smith et al who studied the effects of jogging on body composition and cardiovascular response to sub maximal work in young women and found that % body fat was decreased because of decrease in adipose tissue following training. The loss of adipose tissue appears to be related to the frequent increase in daily caloric expenditure without an offsetting increase in caloric consumption.

Lean body mass was changed from pre training to post training in Group-B from 43.1420 +2.67502 to 43.2950± 1.09151(0.35%), Group-A 42.15 ± 0.84089 to 42.1570 ± 0.83982 (0%) and in Group-C 42.4370 +0.72463 to 42.6930 ± 0.82636 (0.60%). The changes in Group-A and Group-C as in accordance to the study done by Sang-Kab Park et al studied. The effect of combined Aerobic and resistance exercise training on abdominal fat on obese middle aged women and concluded that aerobic training decrease body fat% (9.2%), body weight (4.7 kg). But not lean body mass. The combined training group also decreased in body weight 6.4 kg and % body fat (10.3%) but especially increase in LBM 5.6 kg.

Group-B i.e. resistance training also showed improvement in Lean body mass (0.0301%). This may be due to increase in the cross-sectional area of skeletal muscle. Hypertrophy in both slow and fast twitch muscle fibers has been observed after strength training. While resistance training causes a greater fiber hypertrophy than endurance training.

When strength and endurance training are done concurrently they may not interact at all i.e. concurrent training would cause the same strength and endurance adaptations as strength and endurance training done alone. They may interact to cause antagonism; i.e. a strength and endurance adaptation would be less than in response to strength or endurance training alone or they may interact to cause "addition: i.e. Strength and endurance adaptation would be greater than in response to strength and endurance training alone. Whether the interaction occurs and the form it takes probably depends on a several factors; the intensity, volume, and frequency of two types of training integrated. The result and conclusions drawn will be affected by the selected criterion the measures of strength and endurance development.

When subjects undertake concurrent training programs the muscle is placed in a situation of conflict, were the muscle is attempting to adapt to both forms of training. However, this is not possible because adaptations to strength training are often inconsistent with adaptation observed during endurance training. Endurance training has been shown to increase the activity of aerobic enzymes and mitochondrial density. However aerobic enzyme activity may be decreased after strength training. Therefore muscle is therefore unable to adapt optimally to either the strength or endurance training stimulus. Concurrent training therefore elicits different adaptations at the skeletal muscle level compared to each mode of training when performed in isolation, which may cause a lack of development in either strength or endurance.

In summary, the findings of this study show that 6 weeks of concurrent resistance and endurance training have beneficial effects on energy expenditure and weight loss. Whereas single-mode training such as

endurance or resistance training has been shown extensively to after fat%, BMI and waist hip ratio. In the study concurrent training was shown to increase this entire trait together. Moreover, whereas resistance training alone induces increase in LBM, and no changes was observed in LBM I aerobic training group. Concurrent training shared all of these benefits, thereby providing for the most effective exercise program strategy when weight loss is considered.

Relevance to Clinical practice

1) With the help of the findings of the study therapist or practitioners can incorporate the combination of aerobic and resistance training for getting effective result in Body composition.
2) The combined training regime can also be used to alter body composition by reducing body fat and maximizing Fat-Free mass.

Future research

The effect of combined aerobic and resistance training was seen only for 6 weeks. Previous research have proved the individual and combined effect of aerobic and resistance training for different duration on obese adults. So, in future research can be conducted on combined effect of aerobic and resistance training on overweight adults for different adults. Moreover future research can focus on increasing frequency of combined training as the frequency of our training was 3 days a week.

CONCLUSION

The study demonstrated that aerobic training and resistance training when used in conjunction with one another provides statistically significant and clinically relevant improvement in LBM, fat%, BMI and waist hip ratio over a period of 6 weeks in overweight adults.

The aerobic training when performed individually showed decreased in fat% but there was decrease in Fat-free mass.

The resistance training when performed alone showed slight decrease in fat% and Fat- Free mass was increased.

The combined training group showed significant different in BMI, Fat%, Waist hip ratio and increase in LBM from pre training group.
To conclude, the duration of 6 weeks of combined training with 3 days per work can be safely used to enhance fat loss and preserve Lean body mass.

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