Effect of a 1-Week Diet and Exercise Program on Weight and Limb Girth

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ABSTRACT

Objective: This study assessed the effect of a 1-week intensive home exercise program with a low-fat diet on weight loss, fitness (as assessed by heart rate and blood pressure at rest), and circumference at the waist, arms, and legs.

Methods: Seventy-five subjects (46 women and 29 men) began the exercise and diet program; 73 completed the program. The 75 subjects were broken into three groups: group 1 (n = 16) was enrolled in an open-label design; groups 2 (n = 23) and 3 (n = 36) were enrolled as a single-blinded randomized control and active, respectively, and then crossed over. Compliance with the diet was measured on a 7-point scale. The daily exercise program, which included aerobic and anaerobic exercise following a videotaped session, was assessed on a 6-point scale.

Results: The average total compliance was 81.6%, with higher compliance for the diet than the exercise program. Even without perfect compliance, the average subject lost 5.15 ± 3.29 lbs (2.34 kg). The average waist measurement was reduced by 1.4 ± 1.7 inches (3.5 cm). The average loss in circumference of the arm, thigh, and calf were similar. This corresponded to lost Body Mass Index (BMI) of 0.82 ± 0.49. Heart rate and blood pressure were reduced by 4.12 ±11.35 beats per minute and 8.48 ± 11.23 / 5.55 ± 9.7 mmHg, respectively.

Conclusions: The 1-week intensive exercise program led to a corresponding increase in aerobic fitness as shown by improvements in cardiovascular measurements.

INTRODUCTION

There is an epidemic of obesity today, which has been linked to poor diet and a lack of exercise.[1] Diet and exercise, however, can dramatically increase oxi-

Table 1. Mean Height, Weight, and Body Mass Index Characteristics of Study Subjects

	Height	Weight, Start	Weight, End	Change in Weight	BMI, Start	BMI, End	Change in BMI
Inches/lbs	66.1	184.4	179.2	5.2			
SD	3.7	40.4	39.2	1.8			
Metric units	167.8 cm	83.8 kg	81.5 kg	2.3 kg	29.7	28.9	0.8
SD	9.5	18.4	17.8	1.5	5.5	5.5	0.5

BMI = body mass index; SD = standard deviation.

Table 2. Gender Breakdown of Study Subjects by Group

	Male	Female	Total
Group 1	8	8	16
Group 2	8	15	23
Group 3	12	24	36

dation of lipids and reduce body weight, low-density lipoprotein (LDL) cholesterol in the blood, fasting glucose, and resting blood pressure.[2-4] Exercise obviously increases the caloric expenditure of the body in itself,[5] leading to weight loss. After an hour of post-exercise recovery, however, no prolonged increase in caloric expenditure occurs if the exercise was less than 50% of maximum capacity.[3,4,6,7] –*unless* diet is also changed.

Diet has the ability to increase caloric expenditure independent of exercise and throughout the day and night by increasing internal heat production (thermogenesis).[5] Individuals with a higher aerobic capacity have the ability to create a larger thermogenic response than people with low aerobic capacities.[8] Furthermore, they maintain increased thermogenesis for at least 12 hours after exercise[9] or 4 hours after submaximal exercise.[10] In other words, those who are fit stay fit; those who are not fit get less benefit from being on a low-fat diet.[8] When diet and exercise are combined, exercise does cause an increase in thermogenesis after the exercise is over.[6,7,11,12]

One complicating factor in weight loss is that as body weight is reduced, there seems to be a resistance to further loss, a phenomenon called "weight loss resistance syndrome" in which the body begins to resist weight loss and to maintain body weight despite exercise and diet. This syndrome is lessened when a low-fat diet and exercise program are combined.[13]

Leptin is a hormone that assists in regulating fat.[14] It circulates in the blood and shares receptor sites with cytokine receptors, creating high leptin concentrations in the plasma and triggering an inflammatory response throughout the body.[15,16] Leptin exhibits a circadian rhythm and is severely elevated in obese people, lending support to the concept of a defect in the leptin receptor that causes obesity.[16] Leptin itself leads to an increase in thermogenesis and causes cells to reduce their ability to burn sugars.[14] Diet, however, reduces leptin and activates glucose use.[3] In addition, diets with a low fat content favor a depletion of glycogen in muscle and prolonged use of fat as a fuel.[17]

Diet and exercise have many positive benefits, including a reduction in resting blood pressure, heart rate, and toning of the cardiovascular system.[18] Fasting glucose and lipids are also reduced by a low-fat diet.[19] The combination of low leptin and plasma cholesterol leads to activation of peroxisome proliferator-activated receptor gamma (PPAR) gamma, a nuclear receptor that contributes to a decrease in the size of LDL particles and a reduction in plaque deposits in the arteries thereby reducing heart disease.[20] For example, PPAR ligands such as rosiglitizone (Avandia)

Figure 1. Subject in the seated position using the "6 Second Abs" machine.

reduce arterial plaques and lower plasma glucose.[20]

Thus, diet and exercise together are the most effective way to promote weight loss and improve overall health. Unfortunately, most people who start exercise programs become discouraged and resume their old habits. Those who do stay with exercise programs typically continue because of the effectiveness of group participation and incorporating both aerobic and anaerobic types of exercise in their program.[3]

Abdominal muscle fitness is an important measure of fitness.[21] In recent publications in this journal, we examined the effects of the "Six Sec Abs" machine (Savvier LP, Carlsbad, Calif.) on exercising the abdominal muscles, and found it to be effective as an exerciser to build strength and endurance in the abdominal muscles.[22-24] The "Six Sec Abs"

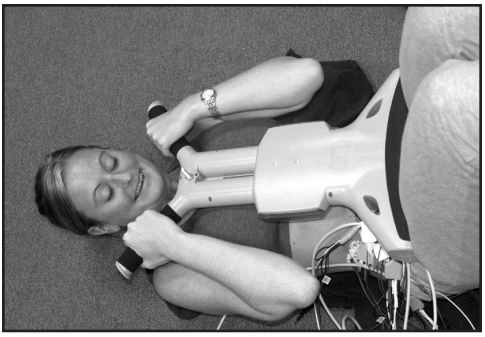

Figure 2. Subject laying supine using "6 Second Abs" machine.

machine is very muscle specific and creates a general increase in the strength and endurance of the abdominal muscles. However, this type of exercise program has never been tested along with a low-fat diet. Because a good exercise program should include aerobic as well as anaerobic exercise, we wanted to find out how aerobic exercise, anaerobic exercise, and diet would interact. Therefore, in the present investigation we used a low-sodium, low-fat diet combined with the two types of exercise to see if in a single week subjects could experience significant weight loss and cardiovascular benefits.

Diets such as the Atkins diet encourage the intake of high-fat and high-salt food.[25] This type of diet decreases PPAR activity and reduces carbohydrate burning. Such a diet, without exercise, goes against conventional advice and can have serious consequences such as ketoacidosis.[25] Furthermore, high-fat diets increase blood coagulation, possibly leading to a stroke.[26] Conventional programs recommend low-fat diets and exercise,[27] but most programs are conducted over many months, a time period that can be frustrating if results are not seen quickly. Therefore, in the present investigation, a short time period was used with an intense diet and exercise intervention to see if subjects could achieve better results in as little as 1 week.

Table 3. Diet Menu

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Breakfast	1 scrambled egg; 1 scrambled egg with yolk; 1/2 banana; 8-12 oz water	1/2 orange; 1/2 cup chicken; 8-12 oz water	1 cup plain yogurt; 1/2 banana; 3 frozen pineapple slices; 1 tsp coconut extract; 8-12 oz water	1 scrambled egg; 1 scrambled egg with yolk; 1/2 banana; 8-12 oz water	1/2 orange; 1/2 cup chicken; water	1 cup plain yogurt; 1/2 banana; 3 frozen pineapple slices; 1 tsp coconut extract; water	1 scrambled egg;1 scrambled egg with yolk; 1/2 banana; 8-12 oz water
Snack	1 yogurt 8-12 oz water	1 large apple; 8-12 oz water	1 orange; 8-12 oz water	1 yogurt; 8-12 oz water	1 apple; 8-12 oz water	1 orange; 8-12 oz water	1 yogurt; 8-12 oz water
Lunch	3/4 cup pasta; 1/4 cup chicken breast; 1/4 apple; 5 tbs salsa; 8-12 oz water	1/2 cup cooked broccoli; 1/2 bag dry baked Ramen Noodles, boiled; 1/2 bag crunched up 1/2 cup snow peas; 1 orange; 3 thin slices of turkey meat; 1 tsp lite sesame seed dressing or vinaigrette; 8-12 oz water	2 slices whole wheat toast; 1/2 chicken breast; 1 slice sharp cheddar cheese; 10 large spinach leaves; mustard; 8-12 oz water	3/4 cup angel hair pasta; 1 tbs peanut butter for pasta; 1/2 cup broccoli; 1/4 apple; 8-12 oz water	1/2 cup cooked broccoli; 1/2 bag dry baked Ramen noodles, boiled 1/2 bag crunched up; 1/2 cup snow peas; 1 orange; 3 thin slices of turkey meat; 1 tsp lite sesame seed dressing or vinaigrette; 8-12 oz water	2 slices whole wheat toast; 1/2 chicken breast; 1 slice sharp cheddar cheese; 10 large spinach leaves; mustard; 8-12 oz water	3/4 cup pasta; 1/4 cup chicken breast; 1/4 apple; 5 tbs salsa; 8-12 oz water
Snack	1 cup straw-berries; 8-12 oz water	1 banana; 8-12 oz water	1 orange; 8-12 oz water	Large handful leafy spinach; 8-12 oz water	1 cup strawberries; 8-12 oz water	1 orange; 8-12 oz water;	1 cup straw-berries; 8-12 oz water
Dinner	3 oz chicken breast; 1/2 cup grapes; 1/2 cup strawberries; 1/4 cup celery; 1/2 cup pineapple slices; 1 tbs ranch dressing; 8-12 oz water	1 cup spinach leaves; 2 tangerines; 4 almonds; 4 thin slices of peppered turkey meat; 1/2 cup cooked broccoli; 1 tsp lite sesame seed dressing or vinaigrette; 8-12 oz water	1/4 lb ground turkey; 3 mushrooms; 1 cup celery; 2 tbs Jamaican jerk seasoning; 1 cup spinach; 2 tsp lite vinaigrette; 8-12 oz water.	3 oz chicken breast; 1/2 cup cooked broccoli; 3 cooked asparagus; 1 slice sharp cheddar cheese; 1/2 cup seedless grapes; 8-12 oz water	1 cup spinach leaves; 2 tangerines; 4 almonds; 4 thin slices of peppered turkey meat; 1/2 cup cooked broccoli; 1 tsp lite sesame seed dressing or vinaigrette; 8-12 oz water	1/4 lb ground turkey; 3 mushrooms; 1 cup celery; 2 tbs Jamaican jerk seasoning; 1 cup spinach; 2 tsp lite vinaigrette; 8-12 oz water	3 oz chicken breast; 1/2 cup cooked broccoli; 3 cooked asparagus; 1 slice sharp cheddar cheese; 1/2 cup seedless grapes; 8-12 oz water
Snack	1 cup plain yogurt; 8-12 oz water	1/2 orange; 8-12 oz water	3 frozen pineapple slices	Large handful leafy spinach; 8-12 oz water	1 cup plain yogurt; 8-12 oz water	1/2 orange; 8-12 oz water	3 frozen pineapple slices

METHODS

Subjects

Seventy-five research subjects (46 female and 29 male) participated in these experiments. Table 1 lists the means of the subjects' height, weight at start, weight at end, weight change, and body mass index (BMI) of all participants. Table 2 shows the gender breakdown of the study subjects in the three study groups. All subjects were informed of the experimental procedures and signed a statement of informed consent as approved by the Institutional Review Board at Azusa Pacific University.

Prior to participation in these studies, subjects underwent medical screening and were excluded if they had a history of low back injury, hip/knee injury, high blood pressure (not under

Table 4. Composition of Diet

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	% Diet
Fats	29	34	29	37	35	28	33	12
Carbs	91	196	138	100	175	134	72	49
Protein	124	103	90	74	113	90	131	39
Cholesterol	614	249	213	518	518	240	696	
Kcal	1182	1448	1152	994	1424	1138	1152	
Average calories/day								1213

Table 5. Exercise Work-out Sequence

Monday (Day 1)	Tuesday (Day 2)	Wednesday (Day 3)	Thursday (Day 4)	Friday (Day 5)	Saturday (Day 6)	Sunday (Day 7)
"Total Body" video or "Rock Hard Abs" Workout #1	Fat Burning "Cardio Video" or Aerobic Workout	"Total Body" video or "Rock Hard Abs" Workout #2	"Fat Burning Cardio Video" or Aerobic Workout	"Total Body" video or "Rock Hard Abs" Workout #2	"Fat Burning Cardio" Video or Aerobic Workout	Rest day

the control of a physician or present systolic reading of over 155/90 mmHg), history of cardiovascular disease, present treatment for cancer, or if they were pregnant. Patients were included in the study if, according to the Metropolitan Life Body Build and Blood Pressure study, they were greater than 15 lbs (6.81 kg) overweight for their body size but less than 80 lbs (39.5 kg) overweight. Some subjects, selected at random, had blood drawn in the fasting state before and after the 1-week diet and exercise program.

Resistance (Anaerobic) Exercise

The "Six-Second Abs" machine consists of a rectangular plastic frame with rubber bands on the inside to adjust resistance. Resistance can be increased in a number of different stages so that it becomes increasingly more difficult to compress the rectangle (Figures 1 and 2). As the machine is compressed to the first, second, and third position with 3 different resistance bands, there is a linear increase in load. The upper part of the rectangle was placed under the subject's arms (under the triceps muscles bilaterally) or held in the subject's arms against the chest while the base of the rectangle was placed on top of the middle of the quadriceps muscles.

Diet

The subjects followed a low-fat (12% fat) and low-sodium diet with a total caloric intake that averaged 1,213 calories per day, as recommended by the U.S. Department of Agriculture (http://www.nal.usda.gov/fnic/foodcomp/Data/). The diet contained a balance of protein and carbohydrates. To avoid hunger, 3 snacks were provided between meals at additional times each day. The diet menu is listed in Table 3; the caloric composition of the diet is shown in Table 4.

To limit variations in food from one brand to another, all groceries were provided by the university from the same store. Study subjects also received a written meal plan.

Blood Pressure and Heart Rate

Blood pressure and heart rate were measured on all subjects before and after the 1-week diet and exercise pro-

Table 6. Single-Blinded Random Crossover Design Used for Groups 2 and 3

Time	Day 1	Day 7	Day 14
Group 2	Measure weight and girth—no diet/exercise	Measure weight and girth—start diet/exercise	Measure weight and girth—end diet/exercise
Group 3	Measure weight and girth—start diet/exercise	Measure weight and girth—end diet/exercise	Measure weight and girth*

* Data not used; taken only to avoid bias in person measuring subjects.

gram. Blood pressure was measured by auscultation of the left arm per American Heart Association standards. Heart rate was determined by counting the radial pulse over a 15-second period and multiplying by 4.

Girth Measurements

Girth measurements were made by a measuring tape with a tensiometer that applied 3 grams of force during the measurements. All measurements were made by a senior student in the Doctor of Physical Therapy Program. Girth was measured at the umbilicus, the ischeal tuberosity, and at a point half-way between the two. It was also measured at the wrist and across the mid-thigh and mid-calf as assessed by anatomical landmarks.

Video Exercise

Subjects were provided with a "Six-Second Abs" machine and exercise videos. Subjects were encouraged to stick with the exercise and diet program. The total workout time varied between 30 and 35 min per day. The exercise program is shown in Table 5.

After 1 week, all measurements were repeated. To get the effects of group participation in exercise, we used videotaped exercise sessions. This also defined the workout that would be done each day so that all individuals accomplished the same workout.

The videos that were used for the exercise sessions were the "Fat Burning Cardio" video, the "Rock Hard Abs" video, and the "Total Body" video, also produced by Savvier LP. The "Fat Burning Cardio" video was a 30-minute aerobic exercise video containing upper and lower body aerobic exercise consisting of in-place jogging, walking, hopping, squats, and jazzercise with upper body movement. The "Rock Hard Abs" video provided three 5-minute workouts with beginner, intermediate, and advanced workouts on the "Six Second Abs" machine. The "Total Body" video was a 30-minute aerobic video that used circuit-training involving marching, working aerobically with elastic exercise bands for the upper and lower body, and kickboxing.

Assessing Compliance

Compliance with the program was assessed in two ways. A 6-point scale was used to assess exercise compliance:

0 = did not exercise at all
1 = exercised 1 day of the 6 required
2 = exercised 2 days of the 6 required
3 = exercised 3 days of the 6 required
4 = exercised 4 days of the 6 required
5 = exercised 5 days of the 6 required
6 = exercised all 6 days

There was also a diet compliance scale as follows:

0 = did not follow the diet
1 = cheated 6 days
2 = cheated 5 days
3 = cheated 4 days
4 = cheated 3 days
5 = cheated 2 days
6 = cheated 1 days
7 = did not cheat

For the diet-compliance scale, subjects were asked to write a dated log including any foods they ate that were not on the diet.

Table 7. Repeatability of Girth Measures in Subjects Who Did Not Diet

Measure	Waist	Trochanter	1" Above Waist	Thigh	Forearm	Mid- humerus
Change	0.48	0.02	0.51	-0.23	0.14	-0.10
t-value	0.22	0.77	0.35	0.48	0.10	0.14

STUDY DESIGN

Initially, a group of 15 subjects was assessed (Group 1). To ensure that there was no bias in measurements of girth, heart rate, and blood pressure, the remaining subjects were randomly divided into 2 groups: groups 2 and 3, a single-blinded randomized control and active with crossover (Table 6). Girth was measured on each subject 3 times, at the beginning of week 1, at the end of week 1, and at the end of week 2. Half of the group (Group 3) followed the diet and exercise program week 1; group 2 followed it on week 2. During week 1, group 2 was a control group that did not follow the diet and exercise program and were instructed not to change their lifestyles or diet during this week.

The person measuring girth did not know which subjects were to go on the diet each week. In this manner, group 2—the group that did not go on the diet until week 2—had no intervention aside from girth and weight measurements. The data from the beginning of week 1 to the end of week 1 for this group provided reliability data as to the repeatability of girth measurements from one week to the other. The actual change in girth was used only for the week the participants were on the diet. The groups were selected at random from the subject pool.

Statistical Analysis

Statistical analysis involved the calculations of means, standard deviations, and t-tests. The level of significance was $P<0.05$.

RESULTS

Compliance Studies

The reliability of the data collected depends largely on the reliability of repeated measures of girth, heart rates, and blood pressures. Therefore, using the matrix described previously, one group of 23 subjects was tested at the beginning and end of a week during which the investigators did not know which group was dieting and which was not. The girth measurements from this group were then compared at the beginning and end of the week to see the reliability and repeatability of the investigators' technique (Table 7). The data at the top of the table show the mean change in value from the beginning to the end of the week for the group. Using a related t-test, the significance of the measured change was determined. Even though there were average differences in many measurements, the difference averaged less than 0.48 inches in the worst case and less than 0.02 inches for the best case. More important, the t-scores showed that there was no statistical difference in any of the measures taken at the beginning and end of the week. For example, the t-score for measurements at the waist was 0.22. While there were variations from week to week in technique, repeated measurements showed there was no consistent bias.

Two subjects did not complete the study; therefore, the final total number of subjects was 73. Average compliance for all 3 groups together was 6.0 for the diet (86%) and 4.4 for the exercise (73 %), for an average compliance of 81.6% (Table 8). Figure 3 shows the distribution of the compliance data versus the numbers of subjects in each category. As seen in this figure, most people complied with the study. The mean compliance was 90%. The mean compliance for the

Table 8. Compliance Studies*

Diet Scale	Exercise Scale	Combined	% Compliance	
6.0	4.4	10.4	81.6	Mean
1.5	2.1	2.7	18.9	SD

*Based on 6-point compliance scales.

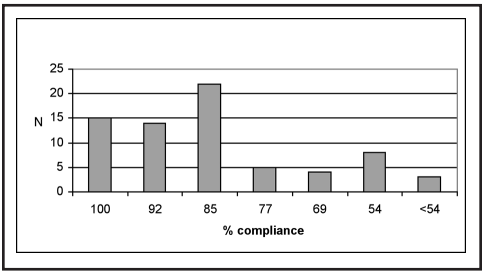

Figure 3. Percentage of subjects complying with exercise/diet program.

diet was 93% and for exercise was 83%. An analysis in which the subjects are further divided into the whole group, the group above 75% compliance, and the group that complied with at least 50% of the diet and exercise program shows that there was little difference in the results for these groups (Table 9).

Changes in Girth with Diet Plus Exercise

The changes in girth with diet are shown in Table 9. As can be seen here, for the entire group the mean loss in circumference at the umbilicus was 1.5 inches. One inch above the waist, the mean loss was 1.2 inches. At the hips the mean loss was 1.5 inches. While the loss was less at the forearm and mid-calf and mid-thigh, the percentage lost remained similar. These changes were significant (P<0.001). For example, the actual t-score comparing the waist size before and after the 1-week program was 1.22×10^{-9} while that of the measurement at the trochanter (hips) was 2.17×10^{-12}. It is interesting to note that more than 20% of the participants lost more than 2 inches at the waist and hips.

There was some difference in the data comparing women and men. Women lost an average 1.5 ± 2 inches from their waist at the umbilicus, while men lost an average 1.2 ± 0.8 inches for the group. At the hip, they both lost 1.4 inches on average**.** But 1 inch above the waist, men lost an average of 1.4 ± 1 inch, while the women lost an average of 1.0 ± 1.0 inches. This can be accounted for by the fact that the natural curves of women's bodies made their waist at the umbilicus an average of 2.1 inches larger than at 1 inch above their waist, while the men were only an average of 0.78 inches larger at the umbilicus. Women also lost more inches off of their thigh than men. For the women, the loss was on average, 1.1 ± 4.7 inches at the thigh, while the men lost only an average of 0.5 ± 0.9 inches at the mid-thigh.

Compliance in men was also better, averaging 85.9 % compared with 79.0 % for the women. Men lost more weight, averaging 7.01 ± 3.29 pound compared with 4.2 ± 2.9 pounds for women.

In a similar manner, if the group was restricted only to those with 75% compliance and greater (n = 55), the girth losses were not significantly different and the losses with the program were all significant (P<0.001). Even when the group was limited to those with 50% compliance and greater (n = 70), the changes in girth were still not significantly different. When comparing the results of group 1 to group 2 and 3 subjects by ANOVA, none of the changes in girth were significantly different from each other (P>0.05).

Cardiovascular Measurements

Systolic blood pressure in the whole group, and in the 2 groups restricted by compliance data, all showed a reduction in systolic and diastolic blood pressure

Table 9. Girth Measurements (Means)*

	N	Waist at Umb Start	Waist at Umb End	Girth Lost	Hip (Gr Troch) Start	Hip (Gr Troch) End	Girth Lost	ABD (1" above) Start	ABD (1" above) End	Girth Lost
Full group	73	38.9	37.4	1.5	43.3	41.9	1.5	37.5	36.3	1.2
SD		9.7	9.4	1.4	10.0	9.7	1.4	9.6	9.3	1.1
75% compliance	55	38.4	36.8	1.6	42.7	41.5	1.2	37.2	35.9	1.3
SD		6.1	6.1	1.3	4.1	3.9	1.2	6.0	5.9	1.1
50% compliance-	70	38.5	37.0	1.5	42.9	41.5	1.4	37.2	36.0	1.2
SD		5.7	5.6	1.1	3.9	3.7	1.4	5.8	5.6	1.1
	N	**Forearm Start**	**Forearm End**	**Girth lost**	**Mid-humerus Start**	**Mid-humerus End**	**Girth lost**	**Thigh Start**	**Thigh End**	**Girth Lost**
Full group	73	10.8	10.6	0.2	12.6	12.3	0.5	26.8	26.3	0.9
SD		2.6	2.5	0.3	3.1	3.0	1.7	6.3	6.4	3.8
75% compliance	55	10.7	10.5	0.2	12.5	12.2	0.4	26.4	25.9	0.8
SD		1.2	1.2	0.4	1.6	1.5	0.6	2.8	3.3	2.5
50% compliance	70	10.7	10.5	0.2	12.5	12.2	0.5	26.6	26.1	0.9
SD		1.1	1.1	0.3	1.5	1.5	1.7	2.7	3.0	3.8

*Measurement in inches.

Umb = umbilicus; Gr Troch = hip; ABD = 1" above waist

Table 10. Cardiovascular Data

	Whole Group								
	Sys. Start	**Dia. Start**	**Sys. End**	**Dia. End**	**Change Sys.**	**Change Dia.**	**HR Start**	**HR End**	**Change HR**
Mean	131.07	83.42	122.60	77.87	8.48	5.55	80.09	75.61	4.12
SD	14.18	9.88	12.23	10.07	3.43	2.72	14.80	11.85	2.35
	75% Compliance Group								
	Sys. Start	**Dia. Start**	**Sys. End**	**Dia. End**	**Change sys.**	**Change Dia.**	**HR Start**	**HR End**	**Change HR**
Mean	132.22	84.04	122.90	78.84	9.32	5.20	81.98	76.14	5.21
SD	14.70	9.61	11.67	8.96	1.14	3.4	15.63	12.45	1.93
	50% Compliance Group								
	Sys. Start	**Dia. Start**	**Sys. End**	**Dia. End**	**Change Sys.**	**Change Dia.**	**HR Start**	**HR End**	**Change HR**
Mean	131.51	83.75	122.73	78.46	8.78	5.29	80.89	75.86	4.61
SD	14.38	10.08	12.50	10.08	4.73	2.31	14.72	11.75	1.09

Sys. = systolic blood pressure (mmHg); Dia. = diastolic blood pressure (mmHg); HR = heart rate (beats per minute); SD = standard deviation.

and heart rate (Table 10). For the whole study group, the average reduction (change) in systolic blood pressure was 8.48 mmHg, while the average reduction (change) in diastolic pressure was 5.55 mmHg. Heart rate was reduced by an average of 4.12 beats per minute (BPM) for all 73 subjects. The changes for the whole group or the 75% or 50% compliance groups were all significant ($P<0.01$). Even so, results in groups 1, 2, and 3 were not significantly different from each other.

There were some differences in the cardiovascular responses between men and women. Men had a greater decrease in heart rate and blood pressure. For men, the decreases, respectively, were an average of 10.8 ± 9.3 mmHg systolic and 6.43+/-4.8 mmHg diastolic and 4.96 ± 14.7 BPM. For women, the average values were 7.5 ± 5.7 mmHg systolic and 5.2 ± 3.7 mmHg diastolic and 3.7 ± 9.8 BPM. These differences in each group were significant losses from before using the diet to after using the diet ($P<0.001$). While the women started at the same heart rate (average of 80.5 ± 14.5 BPM for women and 79.0 ± 15.1 BPM for the men), the men's blood pressures were significantly higher than the women's, averaging 142 ± 14.8 mmHg systolic and 90.6 ± 9.5 mmHg diastolic for the men and 126.1 ± 11.0 systolic and 80.2 ± 8.2 mmHg diastolic for the women.

DISCUSSION

Exercise and diet have been a winning combination for generations.[13] It comes as no surprise that a combination of aerobic exercise and diet has been able to produce a rapid loss in weight and girth, as seen in the present investigation. By using exercise videos and alternating the workouts, even if subjects exercised alone, they had the ability to participate with a group on tape, increasing compliance.

Compliance with a long-term exercise and diet program must start with patient education.[28] Education and motivation helps clients to stay with their diet and exercise program, but they also need to see results. If the individual can be educated to stay with a low-fat diet, the diet progressively becomes more effective as the subject becomes more fit from exercise.[8] While this is its own incentive, the diet must show continuous results. It is well established, for example, that diet reduces cholesterol in the blood and that this will decrease mortality by as much as 35%.[29] This should be motivation enough, but for most people visible evidence of weight loss is important.

In the present investigation, compliance was excellent. However, an analysis of compliance with exercise versus diet shows that people find a diet easier to stay with than an exercise program. Even so, median compliance was still 90%. The individuals in this study were from a wide variety of backgrounds at Azusa Pacific University. Given good motivation by the staff, along with self-motivation, they tolerated the 1-week program well. Many reported that they would like to stay on for many more weeks but some, especially the men, found the diet restrictive. If the diet were to last for more than a single week—at least for the men—the number of calories and choices in the diet would need to be increased to promote long-term compliance.

In previous studies, we have shown that in as little as 3 weeks, considerable increases in muscle tone and increases in abdominal strength and endurance could be achieved with only exercise on the "Six Second Abs" machine.[22-24] In the current study, use of aerobic workout videos and abdominal exercise yielded larger increases in training, reductions in blood pressure and heart rate, and weight loss in just a single week. Since abdominal muscle tone, defined as the tesion in the muscle with the subject at rest, is the key to cosmesis, this should form a basis for compliance in people who are overweight. Most studies show reductions of 5-10 mmHg in blood pressure with diet and exercise, but the diets in these studies usually many weeks. Here we have shown equal reductions in a single week,[17] a finding that should provide additional motivation for people to follow this program.

The reduction in heart rate and blood pressure at rest speaks to the benefit of the diet and exercise. It is well established that exercise will increase fitness and lower blood pressure and heart rate at rest. The reduction in heart rate and blood pressure in the present study after only 1 week shows considerable increase in fitness from the exercise program. This should translate into better health and lower mortality, a good goal of any diet/exercise program.

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