

A Video Exercise and Diet Program Using a Nutritional Meal Replacement Shake for Weight Loss

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ABSTRACT

A single blinded randomized design was used to evaluate a one month exercise and diet program involving a meal replacement shake and an exercise program involving exercise videos to provide weekly workouts to increase fitness. For weight loss, a dietary restriction program was used at the same time involving a nutritional shake that was substituted for lunch and dinner while a healthy breakfast was allowed. After 3 days, 10 days and 30 days, data were collected including weight, girth, body fat, strength and blood pressure and heart rate at rest. One group of 60 subjects was the control group and a second group of 60 followed the exercise and diet program. The diet was 1500 calories a day for men and 1300 calories a day for women. The results of the study showed that even at 3 days, there was a reduction in body weight and fat in these subjects. At each measurement period, there was a progressive loss in body weight. After the first 3 days, the average weight loss was 1.4+/- 1.4 kg with a body fat loss of 1.2+/-0.7 %. By the 10th day, the average weight loss was 2.2+/-1.2 kg with a body fat loss of 2.1+/-0.8 %. By the 30th day, the average weight loss was 5.1+/-2.3 kg with a body fat loss of 3.8+/-1.4 %, these losses were significant ($p<0.01$). Additionally some subjects lost as much as 17.2 Kg and as much as 11.6 cm reduction in girth at the waist.

INTRODUCTION

Obesity, diabetes, and lack of exercise have lead to health costs escalating at an unprecedented rate in the world. To combat this, there have been many diet and exercise programs that have been introduced to society. They range from low carbohydrate diets, low glycemic index diets, high protein diets, and many other permutations¹⁻³. But it is not just adults; childhood obesity is becoming rampant throughout the United States at

Figure 1: Subject demonstrating abdominal strength measurements through a forward crunch on an abdominal crunch machine.



Table 1- General demographics of subjects

	age (years)	height (cm)	weight (kg)	bmi	% body fat	
mean	42.1	167.3	85.1	29.6	37.2	controls
Standard deviation	11.4	14.2	16.3	5.2	14.2	
Mean	45.7	166.8	83.6	29.8	38.2	Exercise
Standard deviation	12.3	12.0	18.2	4.2	7.6	

an alarming rate⁴. Dieting alone has been largely ineffective in reversing this trend, but by incorporating a diet and exercise plan into lifestyle, it has more permanence in reducing obesity and diabetes⁵. Diet and exercise has been shown to reduce all cause mortality figures⁶.

Exercise and diet together are synergistic for a good program for both weight loss and lifestyle change. Exercising will increase muscle tone⁷⁻⁹. Muscle also burns fat during exercise. During exercise more calories are burned, but even when exercise is over, the caloric increase can last 24 hours or more⁸. A further benefit of exercise in a weight loss program is in increasing skin tone¹⁰.

Weight loss brings many added health benefits. Risks for heart disease, diabetic complications, and atherosclerosis related disease can all be reduced with weight loss¹¹. Weight loss can give an individual more energy to everyday normal things that were formerly a burden while carrying more weight. Self esteem is likely to be raised with weight loss as well. Also weight loss provides a sense of accomplishment and this can lead to betterment in other aspects of their life¹¹.

In this present investigation, an exercise program combined with a diet plan was tested. The diet involved using a liquid drink for lunch and dinner. For breakfast, a healthy menu was used. Each subject was also provided with exercise videos that included high intensity cardio, steady state cardio and a strength training workouts. Girth, weight, body fat %, and cardiovascular markers were used to assess the efficacy of this new exercise and diet program.

SUBJECTS

Sixty six male and female control subjects in the age range 21 to 64 and 60 exercise subjects whose age was 21-65 years old participated. Subjects were recruited over a wide range of body masses. Subjects were free of cardiovascular and neurological disease. There were no differences in the average age between the groups as shown in Table 1 along with subject demographics.

There was no statistical difference between the groups ($p>0.05$). All subjects signed a consent form and all procedures were approved by the Human Review Committee of Azusa Pacific University.

METHODS

Measurement of Core Strength- Strength was measured with a modified abdominal exercise device. The device consisted of an abdominal crunch machine with strain gages added to measure the compression force (Figure 1). Subjects were asked to compress the device with their abdominal muscles while side bending left and right. Force was measured on three occasions with 1 minute between each measurement. The strength of each 3-second contraction was recorded on a BioPac MP 100 system (Goleta CA) and the greatest strength in each direction was recorded as the maximum strength.

Compliance- For the exercise group, a compliance scale was used. Subjects were asked to complete log sheets on a daily basis for compliance for both the diet and exercise programs and log any food that they ate that was not on the diet and the date. The scale allowed subjects to have a maximum of 1 point each day for exercise and 1 point each day for diet compliance.

Diet- The diet consisted of a drink for 2 meals a day and a suggested diet for the third meal (breakfast). The daily composition of the diet for men and women, including the 2 meals with drinks was:

WOMEN

Days 1-3 (and Days 28-30) 1100 kcal

110g carb (40%)

83g protein (30%)

37g fat (30%)

Sat fat < 8.5g (7% total kcal)

Sodium < 2,000g/day

Sodium Chloride < 4 g

Days 4-27 1300 kcal

130g carb (40%)

98g protein (30%)

43g fat (30%)

Figure 2- Exercise Schedule in the exercise group

Workout Schedule

Follow the workout schedule provided below and check off each workout that you've completed. Always workout at a level that is comfortable for your abilities and yet challenging. Stay motivated and **do not** skip workouts. If you are feeling less motivated on a particular day, then still do your workout and move to the level you feel comfortable. Exercise has actually been found to reduce stress and boost our moods, so doing even a little bit of exercise will keep you motivated and energized.

S = STRENGTH TRAINING WORKOUT
C = STEADY STATE CARDIO (Cardio Workout 1)
CH = HIGH INTENSITY CARDIO (Cardio Workout 2)

SUN	MON	TUES	WED	THURS	FRI	SAT
25 C Completed <input type="checkbox"/>	26 S Completed <input type="checkbox"/>	27 C Completed <input type="checkbox"/>	28 S Completed <input type="checkbox"/>	29 CH Completed <input type="checkbox"/>	30 S Completed <input type="checkbox"/>	31 C Completed <input type="checkbox"/>
1 Rest Day	2 CH Completed <input type="checkbox"/>	3 S Completed <input type="checkbox"/>	4 C Completed <input type="checkbox"/>	5 S Completed <input type="checkbox"/>	6 CH Completed <input type="checkbox"/>	7 S Completed <input type="checkbox"/>
8 Rest Day	9 CH Completed <input type="checkbox"/>	10 S Completed <input type="checkbox"/>	11 C Completed <input type="checkbox"/>	12 S Completed <input type="checkbox"/>	13 CH Completed <input type="checkbox"/>	14 S Completed <input type="checkbox"/>
15 Rest Day	16 CH Completed <input type="checkbox"/>	17 S Completed <input type="checkbox"/>	18 C Completed <input type="checkbox"/>	19 S Completed <input type="checkbox"/>	20 CH Completed <input type="checkbox"/>	21 S Completed <input type="checkbox"/>
22 Rest Day	23 CH Completed <input type="checkbox"/>	24 S Completed <input type="checkbox"/>	25 C Completed <input type="checkbox"/>			

<10 g sat (7% total kcal)
 Sodium < 2,000g/day
 Sodium Chloride < 4 g

50g fat (30%)
 <12g Sat Fat (7%)
 Sodium < 2,000g/day
 Sodium Chloride < 4 g

MEN

Days 1-3 (and Days 28-30) 1,300 kcal
 130g carb (40%)
 98g protein (30%)
 43g fat (30)
 <10 g sat (7% total kcal)
 Sodium < 2,000g/day
 Sodium Chloride < 4 g

Days 4-27 1,500 kcal
 150g carb (40%)
 113g protein (30%)

The drink for the meal replacement at lunch and dinner was a powder. The powder mix was mixed with skim milk, and the powder mix came in premeasured packets. Milk contribution was 90 calories, of which 8 grams were protein, 12 grams of carbohydrates, and 0 grams of fat. The powder mix was: 160 calories, of which 11 grams were protein, 13 grams were carbohydrates and 8 grams of fat. Thus the total for meal replacement for lunch and dinner was (milk + powder): 250 calories, of which 19 grams were protein, 25 grams carbohydrates and

8 grams of fat. The powder mix contained crystalline fructose, whey protein, vegetable oil powder, inulin fiber, and flavoring and was vanilla in taste. The breakfast each day came from a healthy food menu (i.e. lean proteins, veggies and fruit), so that the overall nutritional content provides a 40% carbohydrates, 30% protein, and 30% fat, a mixed diet.

Blood Pressure- Blood pressure was measured by auscultation of the left arm. An automatic blood pressure cuff will be used on the wrist (Omron Hem 621, Bannockburn).

Heart Rate- Heart rate was determined by counting the radial pulse over a 15 second period and multiplying by 4.

Girth Measurement- Girth measurements were made by a measuring tape with a tensionometer that applied 3 grams of force during the measurements (Vital signs model 67020, Country Technology, Gays Mills, WI.). To improve reliability, all measurements were made by the same investigator. Girth was measured at, 2.5 cm above and 2.5 cm below the umbilicus, at the hip around the greater trochanter, and half of the

distance between the greater trochanter and the top of the patella.

Body Fat Content- Body fat content was measured by an Impedance Plethysmograph (RJL systems, Clinton TWP, MI).

Video Exercises- There were three videos used here. They were the “Strength training workout” video, the “Steady Cardio Video” and the “High Intensity Cardio Workout”. The “Strength Training Workout” involves walking in place, squats, arm exercises, hops, pushups and lunges. It was 30 minutes long. The “Steady Cardio “video was also 30 minutes long as was the “High Intensity Cardio Workout”. The “Steady Cardio Workout” consisted of squats, single leg balancing, side lying exercise, kicks, jogging in place and running front and back. There was a cool down period with quad stretching and hamstring stretches. No exercise equipment was needed to accomplish the exercise.

Videos were arranged so that the duration of the workout was 1 hour and the video was alternated to do these 6 days a week; the 7th day was a rest day. The workout schedule is shown in Figure 3.

Table 2 Change in demographics in control group over 1 month

	weight (kg)	BMI	% body fat
mean	1.1	0.0	0.3
sd	0.1	1.2	0.5

Table 3- Change in girth in control group over 1 month

	Average umbilicus	hips	thigh
mean	-0.2	0.1	0.3
sd	0.3	0.1	0.1

Table 4- Change in strength in control group over 1 month

	rectus strength	oblique strength left	oblique strength right
mean	-0.2	1.4	1.0
Standard Deviation	0.1	0.3	0.2

Table 5- Initial girths for the 3 areas measured

	Average umbilicus	hips	thigh
mean	98.9	101.6	58.2
Standard Deviation	8.9	10.5	9.4

Figure 3- Compliance in the diet for the video group

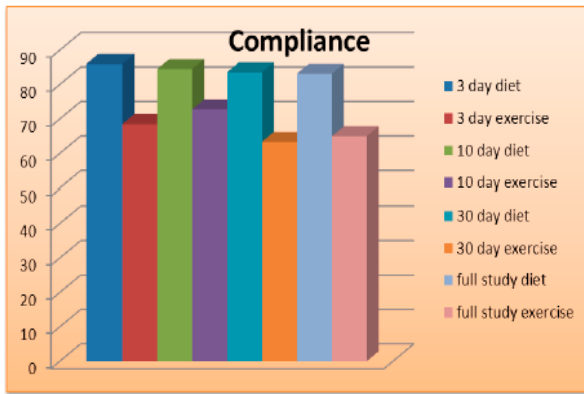
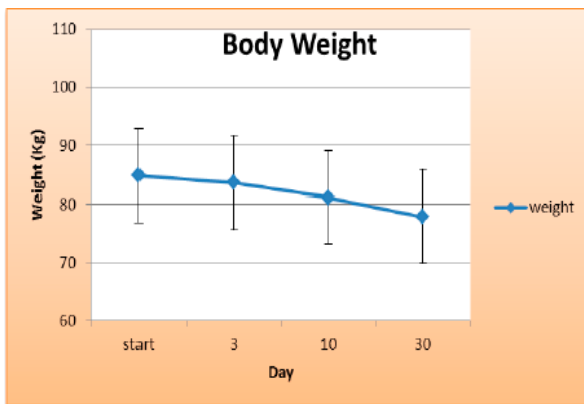


Figure 4- weight change during the month



PROCEDURES

This study was a single-blinded randomized design. At the onset of the study, each subject was randomly assigned to a group and demographic data was obtained including age, height, weight, BMI, resting heart rate, body fat and blood pressure. Girth of the waist (at the umbilicus and 2.5 cm above and below the umbilicus) and thighs (half of the distance between the hip and knee) were also measured as described in the methods section. The technicians taking the measurements were blinded. All measures were obtained at baseline, 3 days, 10 days and 30

Table 6- Girths at the end of the month

	Average umbilicus	hips	thigh
mean	94.5	97.8	53.5
Standard Deviation	9.4	8.7	6.3

days at the completion of the study.

RESULTS

Control subjects- For the control subjects, only study measurements were taken. These subjects were integrated with the other group to validate the reliability and accuracy of measurements taken. They did not change their eating habits or exercise habits over the exercise period. Table 2 shows the change in weight, BMI and body fat from the beginning to the end of the study. Essentially no change was noted for each time point in the study for the controls. There was no significant differences observed in any of these three parameters ($p>0.05$).

Table 3 shows similar findings for the girth measurements. Girth started at 104.2+/-15.3, 111.2+/-10.4 and 55.2+/- 5.2 cm for the waist, hips and thighs respectively at the onset of the studies. There was no statistical difference in the girth measurements in the control group at 3 days, 10 days or 30 days when comparing data in these subjects ($p>0.05$ ANOVA).

Likewise, heart rate, blood pressure and strength did not change over the one month period. The change in strength data is shown in Table 4. Strength started at 16.1+/- 4.7, 14.1+/-3.6 and 16.1+/-5.1 kg for the rectus abdominus, left and right obliques respectively. There was no change at any measurement period (ANOVA $p>0.05$).

Exercise group-Compliance data- Compliance for the exercise group on the diet and exercise are shown in Figure 3. For the diet, the average compliance averaged 83.1+/- 20.7%. For the exercise, average compliance was 64.5+/- 10.3 %. On a period basis,

the compliance is also shown in Figure 3. As shown in this Figure, compliance was fairly uniform each week for the diet and exercise program.

Weight and Girth-The subjects in this group lost weight continuously as shown in Figure 4. At each measurement period, there was a progressive loss in body weight. After the first 3 days, the average weight loss was 1.38+/- 1.4 kg with a body fat loss of 1.5%. By the 10th day, the average weight loss was 2.2+/- 1.2 kg with a body fat loss of 2.1+/-0.8%. By the last day, the average weight loss was 5.1+/-2.3 kg with a body fat loss of 3.8+/-1.4%. At 3 days, subjects lost as much as 3.7 kg while at 10 days, as much as 8.2 kg and at 30 days, as much as 17.2 kg. At 30 days, the weight loss was 97% a loss of fat and not lean body mass. Girth followed a similar pattern. The initial data is shown in Table 5.

During the month, for all three areas, girth was reduced. For example, for the umbilicus, girth was reduced by 4.4 cm. The final girths are shown in Table 6. As a basis for comparison, Figure 6 shows the change in girth at the waist throughout the month. At 3 days, subjects lost as much as 5.6 cm at the waist, while at 10 days, they lost as much as 6.7 cm and after 30 days, as much as 11.6 cm.

The strength of the rectus abdominus, and the right and left obliques increased during the month. For example, the increase in rectus abdominus strength over the 1 month period is shown in Figure 6. As illustrated here, there was a significant increase in strength throughout the 1 month period ($p < 0.01$) for the subjects in this group. The left and right obliques increased from 14.3+/-4.7 and 14.1+/-3.7 kg at the start to 17.6+/-6.1 and 17.1+/-5.5 kg respectively. The heart rate and blood pressure did not change throughout the month.

Figure 5- Girth at the waist during the month

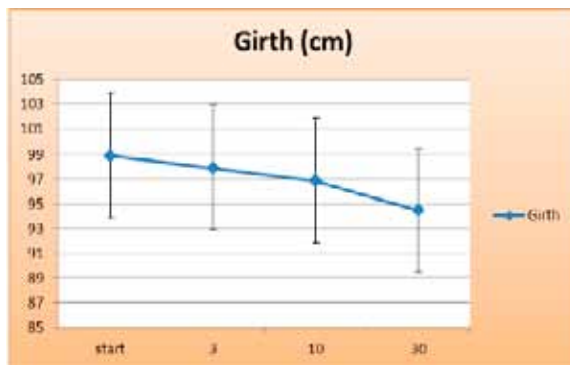
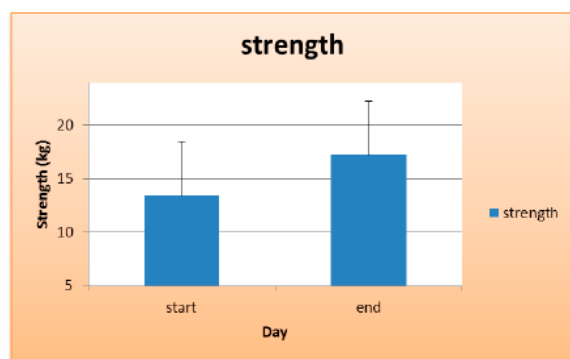


Figure 6-Change in Rectus Abdominus strength during the month



DISCUSSION

Obesity and diabetes are becoming an epidemic in today's world^{6, 12, 13}. There has been a worldwide health concern for the reduction in obesity with exercise and diet programs¹³ through exercise and diet programs^{14, 15}. Weight training and cardio exercises increases metabolism and fat loss for 24 hrs. post exercise vs. a few hours with just cardio alone. Combining weight training, cardio exercises and a proper diet will give you the best results in weight reduction and health benefits⁷⁻⁹. Weight training also prevents the flabbiness that results from just weight loss through cardio without toning exercises¹⁰.

There are many diet programs out there for people to choose from. The best is with an equal mixture of carbohydrates, proteins, and fats⁸. Here, a shake was used made of a powder that was nutritionally balanced and

skim milk. The shake was in two flavors to keep subjects from being bored with the diet. A balanced diet avoids dehydration¹⁶ and by using a shake with a high fluid content, dehydration is also prevented.

In the present investigation, subject compliance was good, averaging over 70% for both the diet and exercise programs. With this study the subjects were satisfied with the exercise program and the diet program. The satisfaction with the diet and exercise program was seen in a linear rate of decrease in weight and girth. Most people lose a considerable amount of water from their bodies in the first few days of an exercise program and then weight loss slows down¹⁷. In this study, the weight loss did not slow down and there was a continual loss in girth measurements. During the month, the loss in girth measurements on the subjects can be translated in several pants and dress sizes. In the first 3 days of the program, the average loss in girth at the waist was approximately one pant or dress size. Throughout the month the weight loss was 97% fat with very little loss in lean body mass. Most people like to see their clothes fitting looser or even having to buy new clothes due to their weight loss and girth loss. This helps in the reinforcement of the exercise and diet programs satisfaction. This also helps in communicating to their friends in how a person was able to lose weight and inches.

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