

## **IRB Study Results 2005**

### **MULTIPLE PHYSIOLOGICAL BENEFITS DERIVED FROM A SINGLE BOUT**

#### **EXERCISE PROTOCOL: A NEW MODEL**

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#### **ABSTRACT**

Physical exercise has been thoroughly documented to be associated with a myriad of physiological benefits. Historically, a variety of protocols have been characterized as being associated with predictable outcomes. As a reflection of that historical modeling, certain external (mechanical) modes have been theoretically correlated with internal (metabolic) responses. The protocol used in this study proposed that multiple pathways heretofore considered to be exclusively stimulated and mutually inhibitory, can, in fact, be instigated simultaneously and perhaps even synergistically. In addition, a new exercise model is being proposed that questions the tenets of the traditional paradigms.

90 adults were randomly selected to engage in a 5 week program of exercise. One group performed a twice weekly, 15 minute per session resistance training (RT) protocol and the other group performed (AVERAGED) 3 hrs. and 15 min. of weekly standard cardiovascular (CV) exercise.

A series of 9 Paired-Samples T-Tests were conducted for our examination of treatment outcome for the Cardio treatment group (see Table 1). The Cardio treatment condition was associated with significant pre-post treatment differences in METS score ( $t = -2.79$ ,  $p < .01$ ), upper body strength ( $t = -6.13$ ,  $p < .001$ ), lower body strength ( $t = -7.56$ ,  $p < .001$ ), Flex score ( $t = -3.87$ ,  $p < .001$ ) and BP diastolic ( $t = -2.34$ ,  $p < .05$ ). No significant pre-post treatment differences were found for weight ( $t = 1.43$ ,  $p = .161$ ), body fat % ( $t = .73$ ,  $p = .47$ ), BP systolic ( $t = -.04$ ,  $p = .97$ ) and heart rate ( $t = .35$ ,  $p = .73$ ) in the Cardio treatment condition.

A series of 9 Paired-Samples T-Tests were conducted for our examination of treatment outcome for the Training treatment group (see Table 2). The Training treatment condition was associated with significant pre-post treatment differences on all study measures: weight ( $t = 4.14$ ,  $p < .001$ ), body fat % ( $t = 9.53$ ,  $p < .001$ ), METS score ( $t = -9.85$ ,  $p < .001$ ), upper body strength ( $t = -10.49$ ,  $p < .001$ ), lower body strength ( $t = -9.96$ ,  $p < .001$ ), Flex score ( $t = -8.99$ ,  $p < .001$ ), BP systolic ( $t = 5.51$ ,  $p < .001$ ) BP diastolic ( $t = 3.32$ ,  $p < .01$ ) and heart rate ( $t = 4.63$ ,  $p < .001$ ).

Table 3 presents a series of 9 univariate ANCOVAs that were conducted for our examination of treatment outcome as a function of treatment group condition (Cardio vs. Training). Patient pretest scores were used as covariates in the analysis, thus all post treatment scores reported below use adjusted marginal means. A significant treatment group difference was identified for body fat % ( $F = 47.23$ ,  $p < .001$ ) with the Cardio group exhibiting higher levels of post treatment body fat (27.02 %) than the Training group (22.90 %). A significant treatment group difference was identified for METS score ( $F = 20.70$ ,  $p < .001$ ) with the Cardio group exhibiting a lower post treatment METS score (13.01) than the Training group (15.11).

A significant treatment group difference was identified for upper body strength ( $F = 14.63$ ,  $p < .001$ ) with the Cardio group exhibiting lower post treatment upper body strength (84.15) than the Training group (92.36). A significant treatment group difference was identified for lower body strength ( $F = 9.80$ ,  $p < .01$ ) with the Cardio group exhibiting lower post treatment lower body strength (102.87) than the Training group (112.06). A significant treatment group difference was also identified for the Flex score ( $F = 10.60$ ,  $p < .01$ ) with the Cardio group exhibiting a lower post treatment Flex score (1.02) than the Training group (2.40).

A significant treatment group difference was identified for BP Systolic ( $F = 20.12$ ,  $p < .001$ ) with the Cardio group exhibiting a higher post treatment BP Systolic score (125.22) than the Training group (117.11). A significant treatment group difference was identified for BP Diastolic ( $F = 29.50$ ,  $p < .001$ ) with the Cardio group exhibiting a higher post treatment BP Diastolic score (84.36) than the Training group (77.34). No significant treatment group differences were identified for weight ( $F = 2.72$ ,  $p = .103$ ) and heart rate ( $F = 3.05$ ,  $p = .084$ ).

ANCOVA revealed that the RT group significantly exceeded the CV group in measurements of: Improved body composition (increased lean tissue and decreased fat content), cardio respiratory endurance, upper body and lower body strength, trunk flexibility, decreased resting blood pressure and heart rate.

## BACKGROUND

Decreased muscle mass, bone density and cardio respiratory endurance are associated with increased risk of cardiovascular disease, stroke, hypertension, type II diabetes, osteoporosis and mortality. (1), (2),

Improvements in the aforementioned areas can decrease the probability of disease, disability and mortality. (3), (4)

Aerobic exercise is conventionally associated with increasing cardio respiratory endurance. (5)

Anaerobic, strength training is conventionally associated with increasing lean mass. (6).

There are a number of known pathways associated with variety of positive exercise responses.

As more (pathways) are uncovered, it is obvious that there are innumerable pathways that have not been identified. This new model proposes the following:

That PPR pathway associated with increasing protein uptake in muscle and bone is stimulated by the exercise performed by the (RT) group. (7)

That growth factors are instigated by the exercise performed by the (RT) group. (8)

That CK levels are influenced by the exercise performed by the (RT) group. (9)

That HLDH and MLDH are both increased by the exercise performed by the (RT) group and that the resulting cascading pathways of each of these events are instigated simultaneously by the exercise performed by the (RT) group.(10)

That an NO response is instigated by the exercise performed by the (RT) group and that corresponding and resulting cardiovascular responses (enhanced oxygen delivery and utilization, vascularization, stem cell migration and a number of associated phenomena) occur.(11)

To date, few studies have been designed to measure or observe the effects of total body resistance exercise on all of the aforementioned areas of human performance and their correlation to known health risks.

## INTRODUCITON:

### PURPOSE:

After completing a successful pilot study, the authors undertook this IRB reviewed clinical trial to measure body composition, cardio respiratory endurance, upper body strength, lower body strength, trunk flexibility, resting blood pressure and resting heart rate before and after 5 weeks of incorporating SMaRT Exercise™ (A proprietary protocol) performed on The Total Gym (a licensed, trademarked device). For the purpose of comparison (control), another group of subjects simultaneously undertook a 5 week cardiovascular exercise program (standard, target zone parameters). The same testing (pre and Post) protocol was administered to both groups.

Medical and non-medical exercise practitioners prescribe a variety of regimens intended to address specific physiological conditions that might be positively influenced by some form of exercise. The two general delineations of these are aerobic and anaerobic. Aerobic (cardiovascular) exercise is described in a certain way and applied in the cases of cardio protection, fat reduction and blood sugar regulation. Anaerobic (strength) exercise is normally prescribed as an adjunct for the purposes of reducing muscle and bone loss and increasing functional capacity (strength).

This study proposed a model that assumes that multiple pathways may be instigated by a

particularly structured exercise regimen during a single bout of the model protocol. The practical application of that assumption indicates that a full spectrum of exercise associated benefits can be attained through a significantly condensed exercise exposure. Additionally, exercise adherence to a time efficient, safe and quickly productive protocol would appear to be invaluable to both the participants and the practitioners of exercise.

## PARTICIPANTS AND METHODOLOGY

### SUBJECTS

90 healthy adults were randomly selected and placed into two groups. Subjects age, gender and fitness levels ranged from the age of 18 to 72 within fitness levels categorized from non-conditioned to highly fit.

In the Resistance Training (RT) group, the participants all performed the same seven exercise protocol two times per week. The exercise method utilized was The SMaRT Exercise System(Slow Maximum Response Training), a patented, proprietary method founded and designed by Dr. Bocchicchio. This regimen incorporates very slow speed resistance training performed in a sequence of large to small muscle (groups) to a point of (perceived) momentary failure within time under load parameters that coincide with physiological indices and clinical observation.(12). Each exercise follows with as little rest as required by the subject to perform the next exercise without perceived respiratory limitation. ALL subjects at all levels were readily capable of following these design parameters.

All exercises were performed on a Total Gym XL or a Total Gym 26000. All increments were recorded for each training session. All repetitions and sets were timed under load and the total workout time was recorded for each session. All exercise sessions were constantly supervised by two testers. Subjects reported very little difficulty in performing the basic exercises and very little was noted by the supervisors. Nutritional material was provided to all subjects based on healthy food selection and information pertaining to the glycemic index and glycemic load of common foods.

The second group ( C ) performed a minimum of 2 hours of target zone, cardiovascular exercise with sessions ranging from 20 minutes to 60 minutes at least 2 times per week. These subjects kept daily logs and reported to testers on a regular basis or whenever subjects felt that feedback and assistance were necessary. The mean cardiovascular exercise time was 3 hours and 15 minutes weekly for the 5 week study.

ALL participants underwent the following assessments on a pre-test and post-test basis:

### BODY COMPOSITION ANALYSIS:

Using an RJL B-103 Analyzer, all subjects were pre-tested using a bio-electrical impedance method. The instrument was calibrated each day testing was recorded. All tests were performed by Dr. Bocchicchio and an assistant to witness data collection. (13)

#### AEROBIC POWER ASSESSMENT:

Using a Schwinn Airdyne ergometer, each subject was pre-tested using an incremental protocol of one minute intervals after a 30 second exposure at the minimum level of resistance. Each full interval was sustained for one minute and then increased for each additional minute or part thereof until the subject felt a perceived exertion of 8 to 8.5 on the Borg scale. (14)

#### UPPER BODY STRENGTH ASSESSMENT:

Using a MAXICAM seated bench press machine, each subject was tested for a one, full repetition maximum lift. If the subject succeeded, he or she elected to increase the load by 5 to 20 pounds until a maximum lift was attained.

#### LOWER BODY STRENGTH ASSESSMENT:

Using a MAXICAM leg extension machine, each subject was tested for a one, full repetition maximum lift. If the subject succeeded, he or she elected to increase the load by 5 to 20 pounds until a maximum lift was attained.

#### TRUNK FLEXIBILITY:

Each subject was pre-tested performing a simple sit and reach trunk extension test. The subjects were given 3 attempts and instructed not to bounce or strain.

#### RESTING BLOOD PRESSURE:

Each subject was seated for 5 minutes and a simple plethysmographic measurement was taken on the left arm and repeated to insure accuracy.

#### RESTING HEART RATE:

While seated for the blood pressure analysis, each subject was manually tested for resting heart rate using a left arm radial pulse count for 60 seconds.

The authors would like to note that NONE of the performance testing indices were performed during the study in order to prevent any level of skill acquisition from convoluting the data.

#### STATISTICAL ANALYSIS

The 86 participants recruited for this study were randomly assigned to the two exercise treatment protocols (Conventional Cardiovascular Group or FIRST Training Exercise System). A counterbalancing procedure was used to maximize the random assignment of study participants and minimize potential confounds.

#### *Examining Pretreatment Group Differences*

Descriptive and frequency statistics were reported for the treatment groups on the demographic variables and assessment measures. An Analysis of Variance (ANOVA) was conducted to assess the differences between the two treatment groups on the pretreatment scores of Body Composition, Aerobic Power Assessment, Upper Body Strength Assessment, Lower Body Strength Assessment, Trunk Flexibility, Resting Blood Pressure and Resting Heart Rate.

#### *Treatment Outcome*

Paired-Sample T-Tests were conducted to measure the treatment outcome of participants in the Conventional Cardiovascular Group and the FIRST Training Exercise System separately. Participants' scores on the measures of Body Composition, Aerobic Power Assessment, Upper Body Strength Assessment, Lower Body Strength Assessment, Trunk Flexibility, Resting Blood Pressure and Resting Heart Rate were used to assess treatment outcome for this analysis. An Analysis of Covariance (ANCOVA) was conducted to measure treatment outcome for participants as a function of Conventional Cardiovascular and FIRST Exercise group assignment. Participants' scores on the aforementioned measures were used to assess treatment outcome for this analysis. Participant pretest scores were used as a covariate in the analysis.

## RESULTS

Table 1

Paired-Samples T-Tests Comparing Cardio Group Pre and Posttreatment Differences

Paired Differences		M	SD	t	p
Pair 1:	pre weight score –				
	post weight score	.90	4.05	1.43	.161
Pair 2:	pre body fat % -				
	post body fat %	.24	2.08	.73	.471
Pair 3:	pre METS score –				
	post METS score	-.83	1.92	-2.79	.008**
Pair 4:	pre upper body –				
	post upper body	-9.63	9.93	-6.13	.000***
Pair 5:	pre lower body –				
	post lower body	-13.63	11.55	-7.56	.000***
Pair 6:	pre flex –				
	post flex	-1.21	2.00	-3.87	.000***
Pair 7:	pre BP systolic –				
	post BP systolic	-.07	10.57	-.04	.965

Pair 8:  
pre BP diastolic –  
post BP diastolic      -2.27   6.22   -2.34      .025\*

Pair 9:  
pre HR –  
post HR            .54    9.74   .35            .726

Note: \*p < .05. \*\*p < .01. \*\*\*p < .001.

Table 2

Paired-Samples T-Test

Paired Differences

Variable Pair    M    SD    t    p

Pair 1:  
pre weight score –  
post weight score      2.13    3.46    4.14      .000\*\*\*

Pair 2:  
pre body fat % -  
post body fat %            4.50    3.17    9.53      .000\*\*\*

Pair 3:  
pre METS score –  
post METS score        -3.45    2.35    -9.85      .000\*\*\*

Pair 4:  
pre upper body –  
post upper body            -17.33   11.09   -10.49   .000\*\*\*

Pair 5:

post lower body      -22.76 15.33 -9.96 .000\*\*\*

Pair 6:  
pre flex –

post flex      -2.73 2.04 -8.99 .000\*\*\*

Pair 7:  
pre BP systolic –

post BP systolic      7.31 8.91 5.50 .000\*\*\*

Pair 8:  
pre BP diastolic –

post BP diastolic      4.11 8.32 3.32 .002\*\*

Pair 9:  
pre HR –

post HR      6.29 9.11 4.63 .000\*\*\*

Note: \*\*p < .01. \*\*\*p<.001.

Table 3

Comparison of Pre- and Posttreatment Outcome Measures for Cardio (n = 41) vs. Training (n = 45) Treatment Groups

Variable	Pre		Post		Group Status by		<i>SD</i>	F	p	
	M	SD	M	SD	Cardio Training	Cardio Training				
Weight (lbs.)	171.30	40.34	164.33	30.30	170.40	40.18	162.20	29.73	2.72	.103
Body Fat %	25.49	8.18	29.01	7.27	25.25	8.13	24.51	7.61	47.23	.000***
METS Score	12.84	2.67	11.05	2.67	13.67	2.97	14.50	2.54	20.70	.000***

Upper Body	77.31	39.46	72.54	36.94	86.94	42.21	89.88	44.11	14.63	.000***
Lower Body	89.90	40.57	88.69	28.43	103.54	41.35	111.44	36.99	9.80	.002**
Flex Score	0.32	4.41	-0.79	4.38	1.52	4.36	1.94	4.28	10.60	.002**
BP Systolic	125.49	8.83	124.11	10.28	125.56	11.69	116.80	6.84	20.12	.000***
BP Diastolic	82.32	5.15	81.24	8.94	84.59	6.82	77.13	6.47	29.50	.000***
Heart Rate	71.12	9.44	76.87	8.88	70.59	12.26	70.58	8.04	3.05	.084

Note: The Flex score uses both positive and negative values. \*\* $p < .01$ . \*\*\* $p < .001$ .

## DISCUSSION

A three-step procedure was used to examine treatment outcome. One-way Analysis of Variance (ANOVA) tests were initially conducted to assess for differences in patient pre-scores as a function of treatment group condition (Cardio vs. Training). Paired-samples T-Tests were then conducted to compare pre and post treatment differences for both the Cardio and Training treatment groups separately. Finally, an Analysis of Covariance (ANCOVA) was conducted to measure treatment outcome as a function of treatment group condition.

### *Descriptive & Frequency Statistics*

The Cardio treatment group was comprised of 41 participants. The mean age of these participants was 47.29 (SD  $\pm$ 13.50) ranging from 20 to 70 years old. Seventeen of the participants were men and twenty-four were women. The mean height of these participants was 67.13 inches (SD  $\pm$  4.10) ranging from 60 to 74.5 inches. The mean pretreatment weight score of the Cardio group was 171.30 lbs. (SD  $\pm$  40.34) ranging from 110 to 343 lbs. The mean pretreatment body fat % of these participants was 25.49% (SD  $\pm$  8.18) ranging from 10.10 to 43.30%.

The Training treatment group was comprised of 45 participants. The mean age of these participants was 42.22 (SD  $\pm$ 12.49) ranging from 20 to 65 years old. Thirteen of the participants were men and thirty-two were women. The mean height of these participants was 67.32 inches (SD  $\pm$  3.54) ranging from 61 to 77 inches. The mean pretreatment weight score of the Training group was 164.33 lbs. (SD  $\pm$  30.30) ranging from 114 to 239 lbs. The mean pretreatment body fat % of these participants was 29.01% (SD  $\pm$  7.27) ranging from 13.20 to 46%.

### *Pretreatment Group Differences*

A one-way Analysis of Variance (ANOVA) was conducted to assess for differences between Cardio and Training participants on pretreatment scores. There were no significant differences between the groups on the pretreatment scores of weight, upper body strength, lower body strength, Flex score, blood pressure-systolic, & blood pressure-diastolic. (Weight:  $F = .830$ ,  $p = .37$ ; Upper Body:  $F = .33$ ,  $p = .57$ ; Lower Body:  $F = .03$ ,  $p = .87$ ; Flex:  $F = 1.34$ ,  $p = .25$ ;

BP-systolic:  $F = .44$ ,  $p = .51$ ; BP-diastolic:  $F = .45$ ,  $p = .50$ ).

There was a significant difference between the groups on the pretreatment score of body fat % ( $F = 4.46$ ,  $p < .05$ ) with the Cardio group exhibiting greater pretreatment mean weight differences (171.30 lbs.) than the Training group (164.33 lbs). There was a significant difference between the groups on the pretreatment METS score ( $F = 9.62$ ,  $p < .01$ ) with the Cardio group exhibiting a greater mean pretreatment METS score (12.84) than the Training group (11.05). In addition, there was a significant difference between the groups on the pretreatment score of heart rate ( $F = 8.45$ ,  $p < .01$ ) with the Cardio exhibiting a lower pretreatment heart rate (71.12) than the Training group (76.87).

### HEALTH BENEFITS OF EXERCISE TRAINING

The benefits of both aerobic training and resistance training are widely and consistently reported and supported in the literature. (15), (16), (17). An overview of that scientific data provides the consensus that aerobic activity reduces the long-term development of cardiovascular disease. (18), (19). Concurrently, resistance training has been more recently reported to promote musculoskeletal fitness and metabolic improvements in insulin sensitivity, glucose metabolism and a host of other health related conditions. (20), (21).

Perhaps the most significant hypothesis proposed by this study is the concept that multiple (beneficial) metabolic pathways can be stimulated by a singular mechanical (exercise) intervention. In addition, it is hypothesized that the exercise exposure (time) required to elicit these myriad responses can be reduced drastically from that supported in the existing literature

### AUTHOR'S SUMMARY AND CONCLUSIONS

The predominant theme of the public health advisors reinforces the need for a bona fide effort to institute and program productive exercise for all Americans from childhood through the elder years. (22), (23). The growing prevalence of type II diabetes, obesity, osteoporosis and a number of fat related, sedentary lifestyle disorders mandates that real intervention is essential on a social, economic and a scientific level.(24) (25).

The governmental and academic models for exercise adherence have NOT been embraced and have quite frankly failed. Recently, those recommendations have increased with regard to the suggested optimal exercise exposure. In our collective opinion, that is an unrealistic approach. It would appear rather logical and practical to provide some viable alternative to the apparently overwhelming (with regard to compliance) model that has failed so convincingly. (26).

In a 1989 thesis presented by Bocchicchio, he established that no significant long term weight loss was sustained without the inclusion of exercise. As substantiated by the preponderance of the associated literature, the predictable metabolic response to caloric restriction is (metabolic) rate reduction. (27), (28). With the exception of precarious pharmacological intervention or radical surgery, no methodology other than exercise has proven to be an effective adjunct to long term weight loss maintenance. The proposed working model suggests that the metabolic pathways that stimulate protein uptake also stimulate fat utilization and inhibit fat storage. It is further hypothesized that a modest regimen of exercise that effectively stimulates those cascading pathways associated with protein uptake is essential for continued positive feedback and associated widespread adherence.

This study, in addition to a long term clinical observation has reinforced the notion that older populations can significantly increase lean mass.(29), (30). This working model attributes this phenomenon to local growth factor responses to this protocol. (31). (32). The consequences of that mechanism can reasonably be assumed to provide additional benefits manifested in the support systems (cardiac, vascular, endocrine etc.) as reinforced by the data in this trial. (33), (34), (35).

In addition, it might be interesting to note that the average cumulative muscle load time of the exercise protocol was less than 13 minutes per session. It is our understanding that nothing approaching such a limited exercise exposure has produced positive responses of this magnitude using such a wide variety of parameters.

This study provided a small reflection of a simple, safe and universally applicable exercise protocol performed on a simple device that can be utilized in a home setting. The prescription of this protocol is palatable (twice per week for less than 20 minutes per session). It has been demonstrated historically (since 1974) that its application can provide ample stimulus to produce positive responses in the muscle, skeletal and cardiovascular systems. In addition, consistent and universal (at all fitness levels) increases in performance and physiological status have been noted and reinforced by the study data.

Further study of this protocol is being formulated to measure bone density and lipid profile responses as well as, the effects on Syndrome X. Anecdotal and observational information has been consistently positive with regard to these additional indices. Those results will be published by the authors and if they remain consistent and hold up to peer reviewed scrutiny, those involved in the health field should take note that a legitimate, practical solution to our national dilemma may be in sight.

## THE NEW MODEL

As an exercise in encapsulating the basic assumptions involved in the new model for exercise the following are offered:

1. The body's main impetus in non-diseased states is to maintain homeostasis.
2. In order to instigate a change or influence status (performance or health) it is necessary to disrupt the homeostatic environment.
3. That disruption must, of necessity, be subtle and gradual if it is to be adopted and incorporated into a "new" level of homeostatic support.
4. Once the acceptable incremental change (of the metabolic milieu) is stimulated at its threshold level, no further stimulation is necessary or productive. By the same token, no amount of sub-threshold stimulation will instigate real change or adaptation.
5. Since muscle fiber stimulation or recruitment is the basis for all exercise response and consequent adaptation, it is incumbent upon those involved to identify those manipulations (mechanical) that correspond to the desired (metabolic) changes.
6. The basic premise of this model is that the myriad of positive metabolic consequences resulting from a variety of muscle fiber recruitment patterns can be simultaneously instigated by a specific pattern (or system) of mechanical action.

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