

# The Effect of High Intensity Interval Training vs Resistance-Based Circuit Training on Body Composition, Muscular Strength & Muscular Endurance

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# Research Question(s)

- What impact would these exercise protocols have on body composition, muscular strength and muscular endurance?
- Which of the two protocols would provide greater improvements in body composition, muscular strength and muscular endurance?

# Introduction (HIIT)

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- High Intensity Interval Training (HIIT) – a form of cardiovascular exercise that involves short bouts of high intensity effort followed by short periods of either active or passive recovery (1).
- HIIT has become quite popular in recent years due to the fact that it provides improvements in aerobic fitness and reduces cardiovascular risk factors, but most importantly does not require a large time commitment.
- HIIT has also shown other health benefits such as increasing insulin sensitivity in the body, which may aid in the prevention of developing Type II diabetes (6).



# Introduction (RBCT)



- Resistance-Based Circuit Training (RBCT) – a form of resistance training that aims to increase muscular strength and endurance by following a circuit of exercises that target different muscle groups, and involve short rest periods (3).
- Circuit training is a well-known and widely used exercise technique that is recognized for its results in improving cardiovascular fitness and muscular endurance (3).
- Circuit training typically involves completing a number of exercises by doing a high number of repetitions with low to moderate weight.

# Study Outline

- This study took place over a 10 week period per each individual subject, with the first and last weeks being used for pre and post testing, while the other eight weeks for the exercise protocol.
- Subjects were randomly assigned to one of the two exercise protocols, being HIIT and RBCT.
- During the eight weeks that the protocols were being completed, subjects were required to exercise three times a week with at least one of the three researchers present.
- All exercise days took place in the Student Recreation Center.
- There was no control group used for this study based on the use of the pre and post measurements of each protocol as the primary source of results.

# Inclusion Requirements

LABEL \_\_\_\_\_ NAME \_\_\_\_\_

Interviewer I.D.   

**LEISURE TIME PHYSICAL ACTIVITIES**

Listed below are a series of Leisure Time Activities. Related activities are grouped under general headings. Please read the list and check "YES" in column 3 for those activities which you have performed in the last 12 months, and "NO" in column 2 for those you have not. Do not complete any of the other columns.

For Clinic Personnel Use Only

To be completed by participant ACTIVITY (ID)	Did you perform this activity?	DID YOU PERFORM THIS ACTIVITY?	Month of Activity												Average Number of Times per Month	Time per session		
			Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec		Mins.	Hrs.	
<b>SECTION A: Walking and Miscellaneous</b>																		
010	Walking for Pleasure																	
020	Walking to Work																	
030	Using Stairs When Elevator is Available																	
040	Cross Country Hiking																	
050	Back Packing																	
060	Mountain Climbing																	
115	Bicycling to Work and/or for Pleasure																	
125	Dancing Ballroom, Square and/or Disco																	
135	Dancing Aerobic, Ballet																	
140	Watersack Riding																	
<b>SECTION B: Conditioning Exercise</b>																		
150	Home Exercise																	
160	Health Club Exercise																	
180	Jog/Walk Combination																	
200	Running																	
210	Weight Lifting																	
<b>SECTION C: Water Activities</b>																		
220	Water Skiing																	
235	Sailing in Competition																	
250	Canoeing or Rowing for Pleasure																	
260	Canoeing or Rowing in Competition																	
270	Canoeing on a Camping Trip																	
280	Swimming (at least 50 ft. in a pool)																	
295	Swimming at the Beach																	
310	Scuba Diving																	
320	Snowskating																	
<b>SECTION D: Winter Activities</b>																		
340	Snow Skiing, Downhill																	
350	Snow Skiing, Cross-Country																	
360	Ice Skating (Leisure)																	
370	Sledding or Tobogganing																	
<b>SECTION E: Sports</b>																		
390	Bowling																	
400	Volley Ball																	
410	Table Tennis																	
420	Tennis, Singles																	
430	Tennis, Doubles																	

LPH—MNMP SURVY 110 (3/80) REV. (3/80)

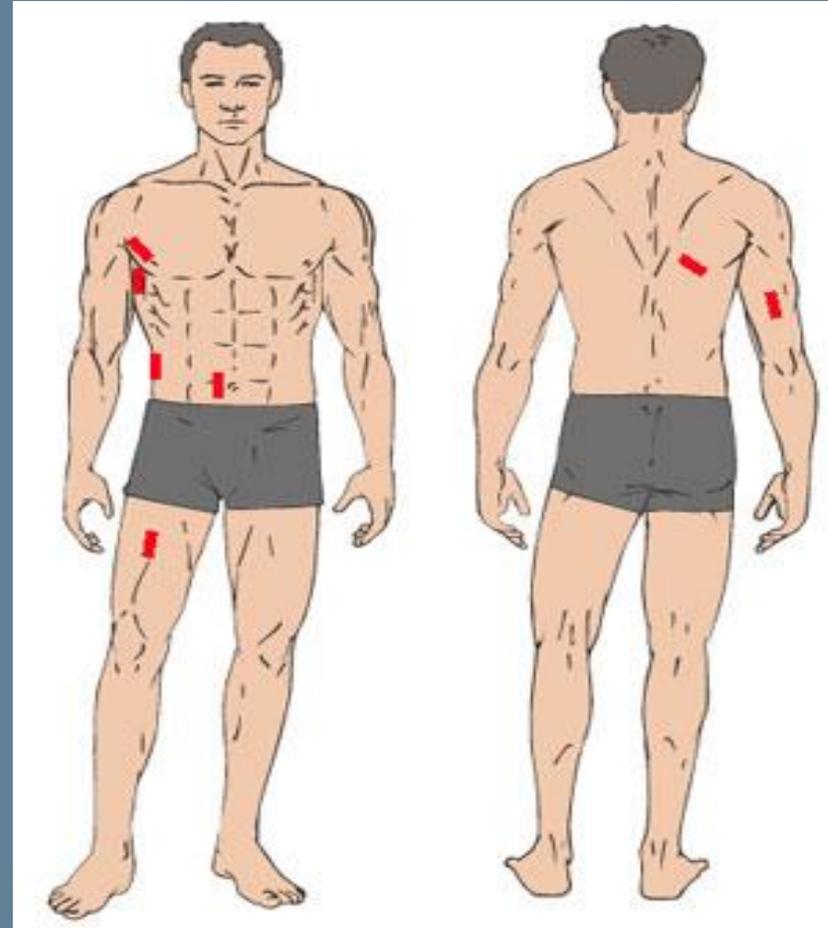
- To be eligible to participate in the study, the subjects needed to meet the following requirements:
  - I. Must be a male between the ages of 18-45
  - II. Must be recreationally active (Minnesota Leisure Time Physical Activity Questionnaire)
  - III. Cannot be considered obese ( $BMI \leq 30$ )
  - IV. Cannot have a musculoskeletal injury within the past 6 months
  - V. Has no current chronic illness (cardiovascular disease, COPD, hypertension, etc.) that could be exacerbated by intense exercise
  - VI. Does not currently use drugs/tobacco products (prescription medications were examined on a case to case basis)

# Informed Consent

- Once a potential subject cleared the initial inclusion criteria, they would begin the process of informed consent.
- This took place on the first day of pre-testing and involved one of the researchers explaining the study protocol to the individual, along with the risks/benefits of completing the study.
- At this point the individual would be asked to sign the informed consent document and would begin pre-testing measurements.

# Pre-Testing Measurements

- Upon completion of the informed consent process, we then proceeded to gather the individual's body mass index measurement, their skinfold and girth measurements, and finally their baseline lifts and VO<sub>2</sub> max test.
- Skinfold measurements were taken at 7 sites on the individual's body, such as the chest, midaxillary, triceps, subscapular, abdomen, suprailiac, and thigh.
- Girth measurements were taken on the upper arm and upper thigh. They were measured pre and post intervention to represent a change in muscle size.



<https://gymjp.com/wp-content/uploads/2014/09/skinfoldguy.jpg>

# Pre-Testing Cont'

- Once all measurements were taken, all subjects would go on to complete a  $\text{VO}_2$  max test, 1 repetition bench press max, 1 repetition leg press max, and an endurance bench press.
- After the completion of all pre-testing requirements, the individual would decide on a weekly schedule of times and days that they were available to complete their assigned exercise protocol.



# Completion Requirements

- As previously stated, both exercise protocols spanned a 10 week period, with subjects coming in three times a week for eight weeks.
- Exercise days were separated by a minimum of 24 hours and a maximum of 48 hours between each session.
- Subjects were allowed a maximum of 3 “skip” days throughout the eight weeks, with the 4<sup>th</sup> absence resulting in the subject being dropped from the study.

# HIIT Intervention

- The HIIT protocol was completed with a cycle ergometer (stationary bike), for which each session would last around 30 minutes.
- Every HIIT workout began with a 3 minute warm-up at 50% HR max, followed by 10 sets of 60 second intervals, with 60 seconds of active recovery after each set.
- Each set was completed at 90% HR max, and each active recovery period was completed at a workload of 50 Watts.
- The workout sessions were completed with a 2 minute cooldown at 50% HR max.

# RBCT Intervention

- The RBCT protocol consisted of 7 lifts, completed in the SRC, and each session also lasted about 30 minutes.
- Each session began with a 5 minute warm-up on a stationary bike.
- Following the warm-up, subjects would complete three sets of all 7 lifts, with 90 second rests between each lift and a 150 second rest between each set.
- Both exercise interventions required the presence of at least one researcher to be at each workout session.

# Post-Testing



- Upon completion of the eight week exercise protocol, we began the process of obtaining post-test measurements.
- Post-testing consisted of the re-measurements of the subject's body composition,  $VO_2$  max, 1 RM for bench and leg press, and endurance bench press.
- Once all measurements were gathered and recorded, the subject signed a proof of completion and received their reward of \$100.

# HIIT Group Results

Measurements	DR003	DR004	DR006
1 RM Bench Press	Increased 20 lbs	Decreased 5 lbs	Decreased 5 lbs
1 RM Leg Press	Increased 90 lbs	Decreased 35 lbs	Increased 50 lbs
Endurance Bench Press	∅	∅	Increased 8 reps
Body Fat %	Decreased 2.1%	Decreased .22%	Decreased 3.05%
Upper Arm Girth	Decreased in size	Increased in size	Decreased in size
Upper Leg Girth	Increased in size	Decreased in size	Increased in size

# RBCT Group Results

Measurements	DR002	DR005
1 RM Bench Press	Increased 5 lbs	Increased 20 lbs
1 RM Leg Press	Increased 50 lbs	Increased 20 lbs
Endurance Bench Press	Increased 4 reps	Increased 10 reps
Body Fat %	Decreased .66%	Increased .44%
Upper Arm Girth	Increased in size	Increased in size
Upper Leg Girth	Increased in size	Increased in size

# Conclusion

- Based on the results obtained at this point, both exercise protocols have provided positive impacts in each area of measurement.
- The RBCT protocol has shown greater improvements in increasing muscular strength and muscular endurance among the subjects.
- The HIIT protocol has displayed greater improvements in decreasing overall body fat percentages among the subjects.
- Overall, both exercise protocols were effective in creating positive results for each individual subject.

# Acknowledgments

# References

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