



A Historical and Scientific Exploration of High Intensity Training with College Athletes

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Objectives

1. Explore historical background for High Intensity Training?
2. Understand physiological responses to High Intensity Training?
3. Identify programing considerations when using High Intensity Training?
4. Investigate the effectiveness of High Intensity Training with college athletes? What does the Research/Evidence Support?



Definition of High Intensity Training

- Vigorous to maximal effort exercise for brief periods of time, known as the work segment, followed by a rest/recovery/relief period.
- Periods of rest/recovery/relief can be at a lower intensity of exercise or complete rest

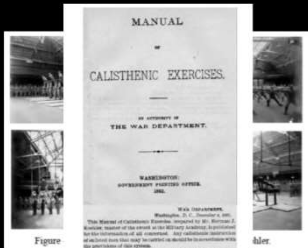


1. Historical background for Training?

- Roots of most physical training are found in preparing young men for military service
- 1st & 2nd Century
 - Greeks – Spartans
 - Romans
- Renaissance 16th Century
 - Francois Rabelais – French Monk and Physician
 - Esquire Gynast – Francois's Assistant



1. Historical background for Training?



- United States Military Academy (USMA) – Master of the Sword – Head of the Physical Education Department (1814)
- 10th Master of the Sword Lt. Colonel Herman Koehler
 - 1887 – *A System of Calisthenic Exercises for use in School of the Soldier.*
 - 1921 *First Manual of Calisthenic Exercises published by War Dept.*

Figure 5: Koehler's First Manual for the Army (1921)



1. Historical background for Training?




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1. Historical background for High Intensity Training?

- Terminology Issue
 - Interval Training Program (ITP)
 - **Circuit Training (CT)**
 - High Intensity Training)
 - High Intensity Interval Exercise (HIIE)
 - High Intensity Interval Training (HIIT)
- Focus
 - Impact of H.I.I.T. on Strength & Power **Athletes**
 - Resistance Training, Calisthenics and Body Weight Exercises

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1. Historical Background

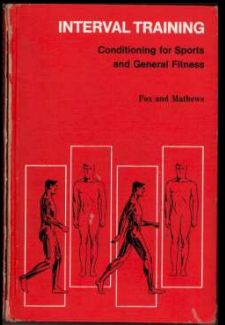


- Morgan, RE and GT Admason, *Circuit Training*. 1st Ed. Bell, London, UK (1959)

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1. Historical Background

- Edward L Fox, PhD
 - Associate Professor of Physical Education
 - The Ohio State University
- Donald K Mathews D.P.E.
 - Professor of Physical Education and Physiology
 - The Ohio State University
- W.B. Saunders Company, Philadelphia, PA 1974



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2. Physiological Response to HIIT

- Energy Systems
- Know your Physiology - Recovery Kinematics

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2. Energy Systems

ATP-PC SYSTEM	ATP-PC and LA SYSTEM	LA and O ₂ SYSTEM	O ₂ SYSTEM
Shot Put, 100 Yd Sprint, Base Skating, Golf Tee Swings	220-440 Yd Sprints, Halfbacks, 100 Yd Swim	880 Yd Dash, Football, Basketball, Soccer	Marathon, Cross Country Sking, Joggng

Figure 6. The energy continuum. On one end are the short-term, high-intensity types of activities such as the 100 yard dash, in which the total ATP required is supplied by the ATP-PC system. On the other end, the long-term, low-intensity types of activities such as the marathon race are supported by the oxygen system. In the middle is the LA system, with the major portion of its ATP production used to support types of activities such as the 440 and 880 yard dashes.

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2. Recovery Kinematics of PCr

DURATION OF RELIEF INTERVAL IN SECONDS	PER CENT POWER RESTORED (ATP-PC SYSTEM)
under 10 seconds	Very little
30	50
60	75
90	88
120	94
over 120	100

*The longer the relief interval a greater percentage of the ATP-PC system (power) will be restored to the muscle. During intermittent work, the relief interval delays the accumulation of lactic acid, the fatigue product.

Figure 6. Representative kinetics of creatine phosphate (CP) recovery in subjects with different end and exercise CP concentrations and different proportions (bias) of slow or fast twitch muscle. Note the more rapid recovery of CP when there is less exercise-induced depletion (---) versus near complete depletion (- - -). Based on unpublished research observations of the authors.

Julien S. Baker, Marie Claire McCormick, and Robert A. Bohannon. "Interaction among Skeletal Muscle Metabolic Energy Systems during Intense Exercise," *Journal of Nutrition and Metabolism*, vol. 2010, Article ID 905612, 13 pages, 2010. doi:10.1155/2010/905612

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2. Recovery Kinematics of PCr

PERIODIZATION TRAINING FOR SPORTS

Science-based strength and conditioning plans for 28 sports

Tudor O. Bompa, PhD
Michael C. Carrera

Recovery process	Recovery time
Restoration of ATP/PCP	3-5 minutes
Restoration of muscle glycogen:	
After prolonged exercise	24-48 hours
After intermittent exercise (such as strength training)	24 hours
Removal of lactic acid from muscle and blood	1-2 hours
Restoration of vitamins and enzymes	24 hours
Recovery from overly taxing strength training (both metabolic and CNS to reach overcompensation)	2-3 days
Repayment of the anaerobic oxygen debt	5 minutes
Repayment of the lactacid oxygen debt	30-60 minutes

Adapted, by permission, from E. Fax, 1989, Physiological basis of physical education and athletics (New York: McGraw Hill), 95.

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3. Program Considerations

- Where would HIIT fit into a colligate Periodized training regime?
- Volume / Intensity
- Rest Time


Haff, GG & NT Triplett (2010) Essential of Strength Training & Conditioning, 4th Edition, Human Kinetics, Champaign, IL.

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3. Program Considerations

- Volume - Repetitions

Haff, GG & NT Triplett (2010) Essential of Strength Training & Conditioning, 4th Edition, Human Kinetics, Champaign, IL.



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Source: 1066-2580, pp 49-52
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SYSTEMATIC REVIEW

Effect of Training Leading to Repetition Failure on Muscular Strength: A Systematic Review and Meta-Analysis

Theo Dimeo¹, Rhonda Oke², Mark Hobel², David R. Kral¹


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3. Program Considerations

increases in muscular strength (+ 2%). It has been shown that training with shorter RI durations may impair performance and the total number of repetitions per set [8, 10]. Cumulatively, this would lead to a lower total training volume, as training volume is calculated as load x repetitions x sets. Due to the direct relationship between muscular adaptations and training volume in a dose-response fashion [48], it would seem that the use of a shorter duration RI is insufficient for maximizing gains in muscular strength.

Conclusion

The body of research indicates that long-duration RIs (i.e., > 2 min) are required to maximize gains in muscular strength in trained individuals. It is unclear if RIs longer



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3. Program Considerations

- Where would HIIT fit into a colligate Periodized training regime?

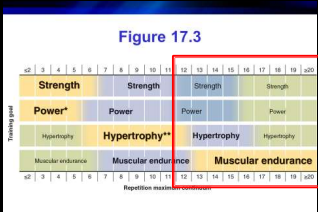



Figure 17.3

Goal	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Strength	Strength				Strength				Strength				Strength							
Power	Power				Power				Power				Power							
Hypertrophy	Hypertrophy				Hypertrophy				Hypertrophy				Hypertrophy							
Muscular endurance	Muscular endurance				Muscular endurance				Muscular endurance				Muscular endurance							

Haff, GG & NT Triplett (2010) *Essential of Strength Training & Conditioning*, 4th Edition, Human Kinetics, Champaign, IL.



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What is the physiological price of Rhabdomyolysis?

- How long are players out after Rhabdo?
- 4 Phase = 4 weeks

Journal of Athletic Training, 2016, 51(2), 48-50
doi:10.4085/1082-4062-51.2.12
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www.nata.org

short report

Return to Play After Exertional Rhabdomyolysis

Kevin Schleich, PharmD¹; Tyler Slayman, BS¹; Douglas West, PhD, ATC²; Kyle Smoot, MD¹

¹The University of Iowa, Iowa City; ²University of Kentucky, Lexington

Objective: To outline a 4-phase progressive program that safely and successfully enabled athletes to return to sport without recurrence of exertional rhabdomyolysis symptoms.

Background: In January 2011, a large cluster of National Collegiate Athletic Association Division I football athletes were evaluated and treated for exertional rhabdomyolysis. After the athletes were treated, the athletic trainers and sports medicine providers were challenged to develop a safe return-to-play program because of the lack of specific reports in the medical literature to direct such activities.

Treatment: A progressive 4-phase program based on existing recommendations, including guidelines for continued clinical and laboratory monitoring.

Conclusions: Although the actual process of reintegrating players will differ based on each athlete's unique circumstances, this program provides a safe and effective foundation that can be modified based on the response to activity and sport.

Key Words: athletes, football, reintegrating program



4. Research / Evidence:
Effectiveness of High Intensity Training with college athletes?

- Limitations H.I.I.T Research / Evidence
 - Endurance Athletes
 - Plethora of Evidence for H.I.I.T. during training (Running, Cycling, Rowing)
 - Recreational
 - Strength & Power Athletes
- There are very few research studies that use college athletes at any level as subjects for HIIT.
 - Possible conclusion, it does not fit the performance development paradigm.



4. Research / Evidence:
Effectiveness of High Intensity Training with college athletes?

- When and Why to use HIIT?
- Transition Periods
- Weight Loss
- Develop Aerobic Capacity (Running, Cycling)
- Build Mental Toughness



Questions

Thoughts

Corrections

Thank You for you time and attention.

*Whoever heeds life-giving correction will be at home among the wise.
Proverbs 15:31*
