



High-Intensity Interval Training



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Introduction



- According with ACSM (American college sports medicine) The popularity of high intensity interval training is on the rise.
 - High intensity interval training sessions are commonly called as **HIIT.**
- This type of training involves repeated bouts(sets) of high intensity effort followed by varied recovery times.
- Depending on of training intensity, an effort may last for a few seconds to several minutes, followed by a few minutes rest or low-intensity exercise. (Martin Gibala 2015)





Interval training is not a new methodology

In 1912, the 10 000 m Olympic championship runner, Hannes Kolehmainen (Finland), had already used interval training at the specific 10 km pace.
He had training using 5 to 10 repetitions of 3 minutes
5 seconds every 1000 m (19 km / h).
80 years late the 10 km specific interval training is run at 22.7 km /h.

Four-time Olympic Gold medalist and a world record holder in middle and long distance running.



Hannes Kolehmainen





Interval training is not a new methodology

•He Repeated up to 100 x 400 m repetitions per day, interspersed by 200 m of recovery run at the pace close to that of hard work

•He was champion in 5,000, 10,000 Met and marathon, training only **HIIT**



Emil Zatopek Olympic Champion, 1950





Tabata Protocol

•The most famous high-intensity interval training protocol is without a doubt TABATA.



Training to be considered TABATA must be done on a bicycle, 5 times a week, with a load of 170 % Vo2 max or of the corresponding intensity of Vo2 max, turning speed above 85 rpm, that is, load and speed control, 8 rounds of 20 seconds with 10 second rest intervals, 14 PE students 6 weeks of training 5 days/week.





Doing different exercises from series to series is considered circuit training.





Tabata Explained

Tabata training, also known as the "4-minute workout", is one of the most popular forms of high-intensity interval training (HIIT).

It consists of eight rounds of ultra-high-intensity exercises in a specific "20 seconds on, 10 seconds off" interval, combining to form a 4-minute workout.







Origins of Tabata

•Tabata training was discovered by Japanese scientist <u>Dr. Izumi Tabata</u> and a team of researchers from the National Institute of Fitness and Sports in Tokyo.

•Tabata and his team conducted research on two groups of athletes. The first group trained at a moderate intensity level while the second group trained at a high-intensity level.

The Results

Group 1 had increased their aerobic system (cardiovascular), but showed little or no results for their anaerobic system (muscle).

Group 2 showed much more increase in their aerobic system , and increased their anaerobic system by 28 percent.

In conclusion, high-intensity interval training has more impact on both the aerobic and anaerobic systems.









Benefits & Cautions



- Burns fat
- Protects muscle tissue
- Time efficient
- Highly suitable for group training
- Improves both aerobic & anaerobic capacity

Cautions

- Repetitions must be performed correctly in order to avoid injury
- Periodizations for beginners





How to apply body weight Circuit Training

Exercises:

8 rounds of 20 seconds with 10 second rest intervals

20 seconds jumping jacks
20 seconds push up
20 seconds abs
20 seconds Isometric jump squat







The purpose of Multimodal Circuit Training

The purpose of every training program is to develop physical capabilities.

STRENGTH – Maximum, resistant, explosive

• ENDURANCE - Aerobic, anaerobic, muscle resistant

- SPEED Reaction, displacement
- **FLEXIBILITY** Active, passive







How to apply multimodal Circuit Training







How to apply HIIT in Sports Combat



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What are the benefits of HIIT



Aerobic and anaerobic fitness



Blood pressure





Cardiovascular health



Insulin sensitivity (which helps the exercising muscles more readily use glucose for fuel to make energy)



Cholesterol profiles



Abdominal fat and body weight while maintaining muscle mass.







What are the benefits of HIIT according with

ACSM?







Interval Training for the Elderly, Young and Untrained individuals

- Short-term HIIT is potent stimulus to induce <u>physiological adaptations like traditional</u> <u>endurance training for untrained</u> and recreationally active individuals. (Martin J. Gibala, Andrew M. Jones 2013).
- As little as six sessions of 'all-out' HIIT over 14 days, totaling ~ <u>15 min of intense cycle</u> <u>exercise, is sufficient to enhance skeletal muscle oxidative capacity and exercise</u> <u>endurance.</u>

Of the various methods used to train <u>elderly people</u>, interval training has been reported to be effective in <u>improving aerobic capacity</u> (L. Véronique Billat Faculty of Sport Science, University Lille 2, Lille, France, 2001; 31. 2).





High-Intensity Interval Training as a Therapy for **Type 2 Diabetes**

Variable	Weeks 0–4	Weeks 5–9	Weeks 10–13	Weeks 14–16
Exercise intensity (% HR _{RESERVE})	90-100	90-100	90-100	90-100
Exercise duration (s)	30-34	38-44	46-50	52-58
Number of exercise bouts	8	10	12	14
Exercise method	jogging/running	jogging/running	jogging/running	jogging/running
Recovery intensity (% HR _{RESERVE})	≤70%	≤70%	≤70%	≤70%
Recovery duration (s)	120	108	100	96
Number of recovery bouts *	9	11	13	15
Recovery method	walking	walking	walking	walking

•Every 2 weeks = $\int 10\%$ in Effort time and $\int 4\%$ in Recovery time

•Every 4 weeks = /Increase of 2 effort intervals



Alvarez et al. Low-Volume High-Intensity Interval Training as a Therapy for Type 2 Diabetes. Int J Sports Med, 2016.





Energy contribution related to maximum effort





Aerobic energy contribution starts with a greater contribution from **75 seconds** or 1 minute and 15 seconds than the anaerobic zone.





Main HIIT training groups

- HIIT short workouts of <u>1min duration</u> with E:P (Effort: Pause) ratio close together.
 Workout setting example: 30seconds: 30seconds 14x 30:30
- HIIT long efforts from <u>1 min or more</u>, with intensity associated with Vo2 max 90-100%
 Workout setup example: <u>90 seconds :90 seconds 5x 90:90</u>
- SIT (repeated sprint training) training consisting of interval sprints, lasts around 5x <u>20 and</u> <u>30 seconds, with long recovery periods of 2 to 4 minutes</u>
- **RST (repeated Sprint training)** repeated sprint training, with little effort.

Workout setup example: <u>5x 10:30</u>, This type of training suggests a high loss of power production during efforts and great metabolic wear.





HIIT – Recovery

Active recovery: Higher caloric expenditure in the training section, as well as oxygen consumption and a higher average heart rate in training

Passive Recovery: Increased power output over training sprints, as well as more efficient mechanical maintenance throughout the training section.



According to Del Vecchio (2019), the author also mentions the types of recovery in relation to highintensity interval exercises





Heart Rate Monitoring







Physiological characteristics

The scale allows individuals to subjectively rate their level of exertion (effort) during exercise or exercise testing (American College of Sports Medicine, 2010).







Physiological characteristics

BORG RPE	Modified RPE	BREATHING	% MAX HR	
6	0	No exertion		
7	U		50% - 60%	
8	1	Very Light		
9	_ _			
10	2	Notice breathing deeper but still		
11	2	notice breatning deeper, but still	60% - 70%	
12	2	comortable. Conversations possible.		
13	5	Aware of breathing harder; more difficult	700/ 900/	
14	4	to hold a conversation	70% - 80%	
15	5	Starting to breathe hard and get	80% 00%	
16	6	uncomfortable	80% - 90%	
17	7	Deep and forceful breathing,		
18	8	uncomfortable, don't want to talk	0.0% 1.0.0%	
19	9	Extremely hard	90% - 100%	
20	10	Maximum exertion		





Progressive intensity







How to organize HIIT drills with load training

Five (5) workouts a week:

Sunday	Monday	Tuesday	Wednesday	Thursday
Strength	Aerobic +Stretching	Strength	Aerobic +Stretching	Strength
Sunday	Monday	Tuesday	Wednesday	Thursday
Strength	HIIT + Core	Strength	HIIT + Core	Strength

Three (3) workouts a week:

Sunday	Monday	Tuesday	Wednesday	Thursday
Strength		HIIT + Core		Strength
Sunday	Monday	Tuesday	Wednesday	Thursday
Strength/Upper body +		Strength/Lower		Strength/Upper
HIIT		body + Core		body + HIIT





How to organize HIIT drills with load training

Two (2) workouts a week:

Sunday	Monday	Tuesday	Wednesday	Thursday
	Circuit Training		Circuit Training	





Conclusion

This is an efficient training system that:

- Could be trained by any age group.
- It can be very effective for both athletes and beginners.
- Excellent tool for cardiorespiratory improvement.
- Efficient for fat burning.
- Effective for patients with various pathologies.
- Optimizes training time during sections.
- Could be combined with other types of training.





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Literature.

Akuthota, V. & Nadler, S. (2004). Core strengthening. Archives of Physical Medicine and Rehabilitation, v.85, n.3 (Sup. 1), p.86-92.

- Amtmann, J.; Amtmann, K. & Spath, W. (2008). Lactate and Rate of Perceived Exertion Responses of Athletes Training for and Competing in a Mixed Martial Arts Event. *Journal of Strength & Conditioning Research*, v.22, n.2, p.645-647.
- Andrew et al. (2006). Sildenafil improves cardiac output and exercise performance during acute hypoxia, but not normoxia. *Journal of Applied Physiology* v.100, n.6, p.2031-2040.
- Bazett-Jones, D.; et al. (2008). Comparing the effects of various whole-body vibration accelerations on countermovement jump performance. *Journal of Sports Science and Medicine*, v.7, n.1, p.144-150.
- Behm, D.; Anderson, K. & Curnew, S. (2002). Muscle force and neuromuscular activation under unstable and unstable conditions. *The Journal of Strength e Conditioning Research*, v.16, n.3, p.416-422.
- Behm, D.; et al. (2004). Effect of acute static stretching on force, balance, reaction time, and movement time. *Medicine & Science in Sports & Exercise*, v.36, n.8, p.1397-1402.

Bereket-Yucel, S. (2007). Risk of Hepatitis B Infections in Olympic Wrestling. British Journal of Sports Medicine, v.41, n.5, p.306-310.







- Blach, W.; Kownacki, S. & Bojarski, J. (2007). *The influence of training exercise on the activity of creatine kinase in plasma of the elite men judo players du 42-ring direct starting prepararion*. In: Annals of the 5th International Judo Federation World Research Symposium, Rio de Janeiro, Brazil.
- Blanco, F. (2008). *El automasaje deportivo*. Disponível em: <www.efdeportes.com>. Acesso em: jun. 2019.
- Blanco, F. (2007). *El método Pilates. Control muscular y precisión en el movimiento*. Disponível em: <www.efdeportes.com>. Acesso em: jun. 2019.
- Blank, S. (2006). Physiological Responses to Iyengar Yoga Performed by Trained Practitioners. *Journal of Exercise Physiology online*, v.9, n.1, p.7-23.
- Bledsoe, G.; et al. (2006). Incidence of injury in professional mixed martial arts competitions. *Journal of Sports Science and Medicine*, v.5, p.136-142.
- Bogaerts et al. (2007). Effects of whole-body vibration training on cardiorespiratory fitness and muscle strength in older individuals, a one year renormalized controlled trial. In: 12h Annual Congress of 144 the ECSS, Finland.
- Boland, E. et al. (2007). A Comparison of Strength Gains Between Exercises Utilizing the Power Plate Versus Free Weights. *Medicine & Science in Sports Exercise*, v.39, n.5, p.S298.
- Bonov, P. & Corica, D. (2006), *Training at medium altitude, 1800-2000m above sea level (Bulgarian tests)* In: European Athletics Coaches Association Conference-"The Winning Difference", Dublin, Ireland.





Borg, G. (2000). Escalas de Borg para dor e o esforço percebido. Barueri: Manole.

- Bosco, C.; et al. (1999). Adaptive responses of human letal muscle to vibration exposure. *Clinical physiology*, v.19, n.2, p.183-187.
- Bosco, C.; et al. (1999). Influence of vibration on me chanical power and electromyogram activity in human arm flexor muscles. *European Journal of Applied Physiology*, v.79, n.4, p.306-311.
- Bouhlel, E.; Jouini, A.; Gmada, N.; Nefzi, A.; Ben Abdallah, K. & Tabka, Z. (2006). Heart rate and blood lactate responses during Taekwondo training and competition. *Science and Sports*, v.21, n.5, p.285 290.
- Brown, L. & Weir. (2001). (ASEP) Procedures Recommendation I: Accurate Assessment of Muscular Strength and Power. Journal of Exercise Physiology, v4, n.3, p.1-21.
- Bullock, N.; et al. (2008). Acute effect of whole-body vibration on sprint and jumping performance in elite skeleton athletes. *The journal of strength & conditioning research*, v.22, n.4 p.1371- 1374.

CDC – Centers for Desease Control and Preventinon. (1998). Youth risk behavior surveillance Atlanta - EUA, v. 47. (SS-3).

L. Véronique Billat Faculty of Sport Science, University Lille 2, Lille, France, 2001; 31. 2.

Martin J. Gibala, Andrew M. Jones 2013.