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The Tabata Protocol: An Overview for the Tactical Population

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Abstract

The tactical populations, to include military, paramilitary, law enforcement, and firefighters, all require fitness in their professions. Notably, each of these professions have competing requirements that interfere with their ability to maintain or improve their fitness, such as reverse sleep cycles, long shifts, and other training. High-intensity interval training (HIIT) has been shown to be highly effective at improving fitness in an efficient manner. One form of HIIT is the Tabata protocol, which consists of a four-minute round, where the participants exercise as hard as they can for twenty seconds, followed by ten seconds of rest, conducted eight times in a row. The purpose of this article is to review the literature on HIIT and the Tabata protocol.

Introduction

It has been shown that law enforcement, firefighters, and military members need strength, speed, power, agility, and endurance to optimally perform their duties.[1,2,3,4] Each tactical population has numerous competing requirements that can negatively impact fitness. For example, most tactical professions consist of long shifts, reverse sleep cycles, field exercises, sustainment training, tactical schools, and deployments, as well as personal matters that can hinder the ability to maintain or improve fitness.

High-intensity interval training (HITT) has been defined as "exercise consisting of repeated bouts of high-intensity work performed above the lactate threshold (a perceived effort of "hard" or greater) . . ."[5] For decades, HIIT has been shown to be effective in creating positive cardiovascular,[6] musculoskeletal,[7] and metabolic[8,9] adaptations. Additionally, HIIT has proven to be more time efficient than moderate-intensity continuous training (MICT) at increasing cardiorespiratory adaptations.[10,11] It has been stated that HIIT applied in as little as twenty minutes per session can lead to improvements in health, anaerobic capacity, and aerobic fitness.[12] One form of HITT is the Tabata protocol.[13] This article will provide the reader with an overview of the protocol, as well as similar procedures, on stimulating fitness adaptations.

The FITT Principle

The FITT Principle, popularized by the American College of Sports Medicine, stands for frequency, intensity, type, and time.[14] As stated, "Regardless of the individual, training modality, or training goals, everyone is applying the FITT principles in their program, whether they realize it or not."[15] The FITT Principle can be simply summarized as: frequency is how often one is working out; intensity is how hard one is working out; time is how long someone is working out; and type is how someone is working out (e.g., running, resistance training, swimming).

Intensity Is King

When it comes to stimulating or maintaining fitness adaptations,

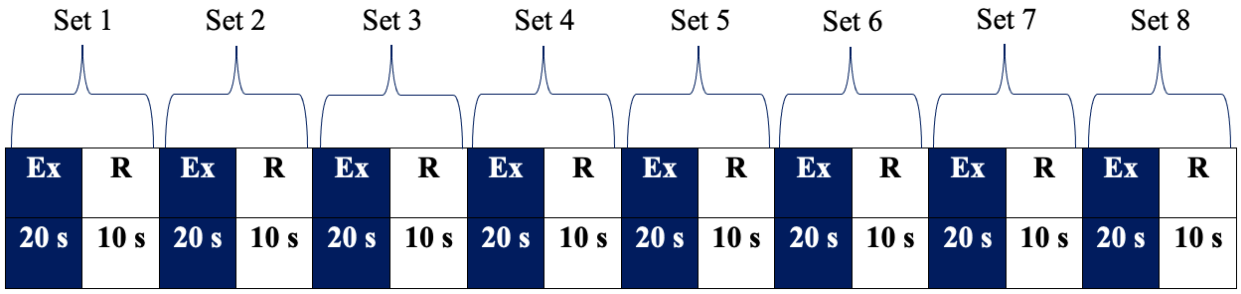


Table 1—Generic Tabata Round. Legend—Ex: exercise; R: rest; s: seconds.

intensity is king. The author has proposed to several tactical professionals the question, "What will make you better at running three miles consecutively, walking three miles every day, or running one mile as hard as you can every other day?" The answer has always been the same: running one mile as hard as you can every other day.

This concept is supported by scientific research spanning five decades. In 1975, Burke and Franks showed that that running for fourteen and a half minutes at 85 percent of maximal heart rate (HR) is superior to running for 22.5 minutes at 75 percent maximal HR, or thirty-five minutes at 65 percent maximal HR.[16] Since then, decades of research have demonstrated that higher intensity exercise increases VO_{2max}, running economy, lactate thresholds, muscular power, and performance times greater than lower exercise intensity.[17,18,19,20]

Accordingly, both anaerobic and aerobic athletes benefit from high intensity exercise. As stated by Dr. Owen Anderson (researcher and coach in running performance) regarding running adaptations, "greater intensity equals greater improvements."[21] Thus, when conducting the Tabata protocol, tactical professionals must have maximum effort during the working set. For HIIT, to include the Tabata protocol, how hard the individual is working out is more important than how long one is working out.

Tabata Protocol Overview

The Tabata protocol is summarized in Table 1. In the Tabata protocol, one conducts twenty seconds of all-out exercise or at intensity that is above one's VO_{2max} (i.e., maximum amount of oxygen (O_2) one's body can use during exercise), followed by ten seconds of rest, repeated eight times. The Tabata protocol was introduced via the research of Tabata et al. (1996).[22] The Tabata protocol was based on the observed effects of a HIIT protocol on Japanese Olympic sprint skaters using eight bouts of twenty seconds of high intensity exercise (i.e., 170 percent of VO_{2max}), followed by ten seconds of rest (i.e., 20:10 work-to-rest ratio). In the original study, Tabata et al. (1996) compared the response in recreational athletes who conducted MICT (sixty minutes of exercise at 70 percent VO_{2max}) to individuals that conducted seven to eight intervals using the 20:10 work-to-rest ratio.[23] While both groups improved their VO_{2max} (slightly greater improvement in the HIIT protocol), there were no improvements in anaerobic capacity for the MICT, while the HIIT protocol improved by 28 percent in their anaerobic capacity.[24]

When conducting the working set, one needs to have maximum effort, or at an intensity greater than $VO_{2}max$. This threshold is needed because as one increases the velocity of an exercise, there is increase in the power output, caloric expenditure, and oxygen consumption. As individuals progress throughout the Tabata protocol, it is common to accumulate fatigue and decrease one's tempo. Thus, when using resistance (i.e., dumbbells, kettlebells, barbells, bands), it is common to use a lighter weight to facilitate numerous repetitions.

A Brief Review of Tabata Protocol Research

The Tabata protocol is versatile, as it can be used with or without equipment. The protocol can be applied via running, cycling, rowing, kettlebell exercises, sandbag exercises, calisthenics-based style, etc., or a mixture of the modalities. Cin and Cabuk studied the effects of two different Tabata protocols on four hundred gendarmerie (law enforcement) cadets; specifically, the effects of using a running protocol to a calisthenics protocol.[25] The cadets conducted the training three times per week for five weeks, increasing the sets conducted each week.[26] The running protocol cadets conducted training on a tartan track (all-weather synthetic surface track), where they ran at 120 percent of their 2,400-meter running speed for the 20:10 work-to-rest ratios. The calisthenic cadets conducted burpees, high knees, push-ups, squats, mountain climbers, step-ups, lateral skaters, and jump rope.[27] The cadets were assessed on a thirty-meter sprint, a 2,400-meter run, standing long jump, crunches, push-ups, overhead medicine ball throw, pull-ups, isometric leg strength, and isometric back strength.[28] To the researchers' surprise, both groups improved in all assessments equally, except in the crunch test, where the running group improved greater than the calisthenics group.[29]

This is similar to the findings of Menz et al. (2019) who showed that a calisthenic Tabata protocol improved VO_{2max} in a manner similar (11 percent increase in VO_2max) to a running Tabata protocol (13 percent improvement in VO_2max).[30] Williams and Kraemer found that three bouts of the Tabata protocol with a kettlebell is effective in stimulating cardiorespiratory and metabolic responses needed for health and anaerobic performance.[31] For tactical professionals, this research is enlightening, as it shows how one can improve in numerous fitness assessments with minimal equipment, time, and space, as well as without the need to run.

Ratamess et al. (2018) found that sixteen minutes of using the Tabata protocol with sandbags (11-, 20-, or 48-kg sandbags) caused greater metabolic stimulus, determined by blood lactate response and respiratory exchange ratios compared to running for sixteen minutes at 60 percent of VO_2 Reserve ($\%VO_{2R}$) (i.e., the low end of vigorous intensity) and $80\%VO_{2R}$ (vigorous intensity).[32] Additionally, Ratamess et al. (2018) determined that sixteen minutes of Tabata exercises with a sandbag created similar HR responses as running at $80\%VO_{2R}$.[33] Specifically, the Tabata protocol created an average HR 169.7 ± 11.2 beats per minute (BPM), with a peak HR of 183.0 ± 8.7 BPM, while running at $80\%VO_{2R}$ yielded an average of 170.5 ± 13.5 BPM with a peak HR of 177.4 ± 14.4 BPM.[34] However, running at $60\%VO_{2R}$ and $80\%VO_{2R}$ caused greater oxygen consumption and energy expenditure compared to the sandbag routine.[35]

Does It Have to Be a 20:10 Ratio?

As described, the Tabata protocol consists of a 20:10 work-to-rest ratio, where an individual exercises at a maximum effort for twenty seconds, followed by ten seconds of rest. However, to stimulate fitness adaptations, one does not have to use a 20:10 ratio. For example, Falatic et al. (2015) discovered that using a 15:15 ratio (i.e., 15 seconds of exercise, with 15 seconds of rest) through a twenty-minute exercise session performed three days a week for four weeks using a kettlebell snatch for female Division I Collegiate soccer players, increased their VO_{2max} by approximately 6 percent, while losing an average 0.9 kg of body weight.[36] This is a notable improvement as these athletes were already engaged in a fitness program.

Moghaddam et al. (2021) studied the effects of 10:5 work-to-rest ratio compared to a 20:10 work-to-rest ratio using two groups of seventeen individuals (sixteen males and eighteen females) that completed six cycles of six exercises (kettlebell snatches, step-up jumps, jumping jacks, goblet squats, burpees, high knees) for three days a week for four weeks.[37] The 10:5 work-

to-rest ratio group rested for one minute between sets, while the 20:10 work-to-rest ratio used a two-minute rest.[38] Moghaddam et al. (2021) concluded that the two protocols "induced adaptations to a similar extent" for both anaerobic and aerobic adaptations, with the 10:5 work-to-rest ratio requiring 50 percent less time.[39]

In a separate study by Moghaddam et al. (2023), the researchers studied the effects of a 10:5 work-to-rest ratio (three sets of eight intervals, with a two-and-a-half-minute recovery between sets), a 20:10 work-to-rest ratio (three sets of eight intervals, with a five-minute recovery between sets), and thirty minutes of MICT (i.e., 75 percent of maximal HR reserve) on cardiovascular adaptations over a four-week period.[40] The participants conducted twelve total sessions, as they exercised three days per week using a stationary air bike.[41] The authors concluded both the 10:5 and 20:10 work-to-rest ratios induced similar cardiorespiratory adaptations to the thirty minutes of MICT, while becoming more time efficient (i.e., less volume and duration).[42]

Practical Application

Cin and Cabuk state that calisthenic-based HIIT or Tabata programs are optimal for military and law enforcement professionals, as they require minimal time, space, equipment, and cost, while replicating elements associated with job performance.[43] When applying the concepts of the Tabata, and/or HIIT training, numerous factors will impact the adaptations to the training, such as previous training history, training status, genetics, the intensity and duration of the sets, active or inactive rest periods between or after the working sets, number of sets in a session, and exercise mode.[44,45] Figure 1 demonstrates the twelve primary variables that you one can manipulate in a HIIT session, according to Martin Buchheit and Paul Larsen.[46]

Tactical professionals can achieve fitness gains applying a variety of exercises, work-to-rest ratios, rest periods, with minimal time and equipment. Of note, the training volume needed to maintain fitness is significantly less than the volume needed to increase one's fitness levels.[47] Meaning that applying the Tabata protocol a few times per week with minimal working sets will maintain fitness adaptations. However, applying a Tabata protocol by either using calisthenics or running has been shown to improve fitness in numerous categories with only three sessions per week for five weeks.[48] Lastly, provided that the tactical professional is pushing themselves during the working set, work-to-rest ratios of 10:5, 20:10, and 15:15 have all proven beneficial.

Conclusion

The Tabata protocol can create positive musculoskeletal, metabolic, cardiorespiratory, and health adaptations.[49] While the Tabata protocol is an efficient and effective training modality for the tactical population, it should be supplemented with other forms of training. For example, running at 60%VO_{2R}(i.e., the low end of vigorous activity) and 80%VO_{2R} (vigorous activity) cause greater energy expenditure and oxygen consumption than a sandbag Tabata protocol of equal time (sixteen minutes).[50] Additionally, cycling for thirty

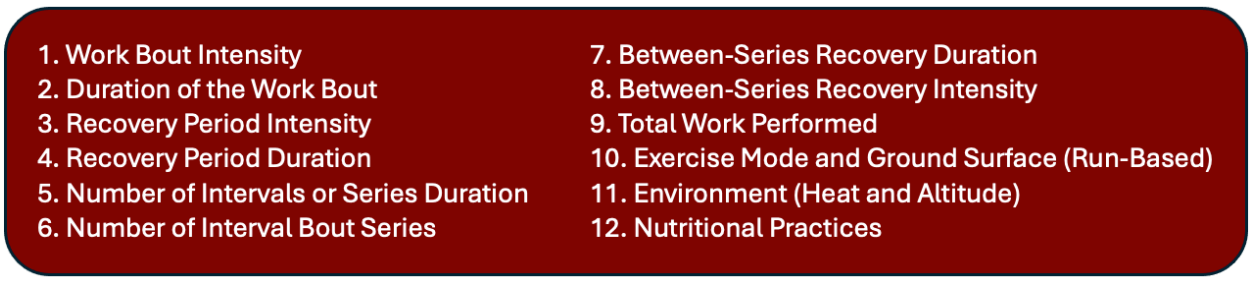


Figure 1—Twelve Primary Variables that Can Be Manipulated in High-Intensity Interval Training.

minutes at moderate intensity will cause greater energy expenditure compared to both a 10:5 and 20:10 work-to-rest ratios that complete three sets of eight intervals, with a two-and-a-half- and five-minute recovery between the 10:5 and 20:10 work-to-rest ratios, respectively. However, unlike running or cycling, which require space and equipment, the Tabata protocol can be applied with no equipment and minimal space, making it ideal for tactical professionals with time-compressed schedules. Subsequent articles in this issue of the *TPRAJ* will provide recommendations on how to apply the Tabata protocol for various tactical populations.

Author Biography



Jeremy Carter (featured right) is the Founder, Owner, and President of True Performance Realization (TPR), and serves as the Editor-in-Chief for the *True Performance Realization Applied Journal* (*TPRAJ*). With over eighteen years of experience in human performance, Jeremy has earned numerous certifications, including the National Strength and Conditioning Association's (NSCA's) Certified Strength and Conditioning Specialist with Distinction and the American College of Sports Medicine's Exercise Physiologist. He is a current reviewer for the NSCA's *Strength and Conditioning Journal* (*SCJ*), a founding member and editor for the *Journal of Sport and Human Performance*, and a recipient of the NSCA's *SCJ*'s 2023 Editorial Excellence Award.

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