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New Training Program for the New Requirements of Combat of Tactical Athletes

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Abstract: Actual theaters of operations are complex contexts where soldiers must face different situations, such as symmetrical, asymmetrical, or close quarter combat. The requirements of the actual battlefield are different to the traditional conditioning military training. This new changing scenario produces an activation of the innate fight or flight defense mechanisms with large activations of the anaerobic metabolic pathways and the sympathetic autonomic nervous system. In these scenarios, the anaerobic, aerobic, and strength demands are so specific and the time to improve all training demands in the units is limited. We propose a new training periodization for the military population based on the latest research into the psychophysiological response of soldiers in actual theaters of operations (actual military missions) and actual civilian models of training and periodization to develop a specific, easy, and reliable periodization model for actual tactical athletes. This training intervention was developed in order to improve operational training according to the demands of actual theaters of operations, based on recent research in military and civilian populations. We tried to conduct a proposal that is easy to apply, with minimal use of material different to what could be found in a military base and that could be implemented in a short period of time.

Keywords: strength; endurance; concurrent training; military; conditioning

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1. Introduction

Actual theaters of operations (actual military missions where soldiers are deployed) are complex contexts where soldiers must face different situations, such as symmetrical, asymmetrical, or close quarter combats. This new changing scenario produces an activation of the innate fight or flight defense mechanism [1–3]. This response produces a stimulation of a soldier's sympathetic nervous system, increasing energy production by anaerobic metabolic pathways, increasing lactate production above the anaerobic threshold, and increasing heart rate (HR), in order to provide energy to the muscles [4–8]. However, this large organic activation is not perceived by the soldiers, since they reported low levels in the Rating of Perceived Exertion (RPE) [9–12], probably due to decreased information processing and central nervous system fatigue [1,2,13,14]. This situation is very stressful, negatively affecting the psychophysiological response and working memory of the soldiers [15,16]. In this line, other research conducted on tactical parachute jumps showed increased cortisol, heart rate, fine motor skills, sympathetic modulation, and leg strength, and decreased somatic anxiety after the jump [7], modifications that affect the psychophysiological response in posterior combat, increasing heart rate and decreasing fine motor skills [17].

These actual psychophysiological demands for warfighters who identify as "tactical athletes" [18], equip them in military training systems with essential military knowledge, military skills, and physical and psychological capabilities [19]. The psychophysiological demands in these stressful environments have been widely reported either in close quarter, symmetrical, and asymmetrical combat, or tactical parachute jumps [4,20–22], concluding in the need to include specific training models adapted to military service, which consider the specific psychophysiological needs of the tactical athlete. Current military training approaches have focused either on the increase of physical fitness [19,23] or on the decrease of soldiers' injuries and risk factors [24]. In addition, new military training programs must deal with a new population characteristic showing an increased tendency to obesity among young military personnel [25], psychological disorders [26], and a general decrease in physical capacity [27]. The psychophysiological demands for these "tactical athletes" require a new methodological and training approach [28]. Recent research postulated that the implementation of High Intensity Interval Training (HIIT) would be an important training method because it can improve both aerobic and anaerobic metabolic systems, characteristic of the new combat scenarios, since soldiers perform fast sprints while conducting anaerobic effort during combat [3,12,22,29]. Nevertheless, there is little information about the design and practical examples of training and periodization for tactical athletes. Therefore, the purpose of this article is to present a new training model based on the latest civilian training and periodization paradigms and recent military studies in psychophysiological response in combat, to prepare soldiers for the real requirements of the theater of operations.

2. Soldiers' Demands

Actual soldiering demands explosive activities such as sprinting, jumping and landing, changing direction at speed, close quarter combat, and throwing. In addition, many military tasks, such as manual material handling, working with military vehicles, casualty extraction, and performing tasks while carrying a heavy load, require a foundation of strength in order to perform them. During both field training exercises and operational deployments, soldiers will carry heavy loads including restrictive body armor, irrespective of body mass. This fact highlighted the importance of strength training, since the onset of fatigue may be a consequence of the relative muscular strength demands of the load, so the strongest soldiers may also fatigue at a slower rate [30].

The battlefield has changed from being primarily aerobic to predominately anaerobic, characterized by quick and explosive movements on the objective. Previous authors identified the physical requirements necessary for the successful performance of various combat-relevant warrior tasks and drills, highlighting muscular strength and anaerobic endurance as fitness components essential to the performance of these various tasks and drills [8,31].

3. Training Program

To avoid overtraining and the effects of chronic stress, periodization that allows for variation in volume, intensity, frequency, and exercise mode should be adopted in the military physical development program, thereby reducing local fatigue and enhancing recovery. Because the working day of a soldier can vary dramatically, specific authors have previously recommended a nontraditional approach, rotating strength, power, and HIIT workouts on a session-to-session basis [3,30,32].

We propose a military adaptation of a civilian reverse periodization training system [33–35]. This new training model is based on specific high intensity and low volume training, some of the training methodologies being recently proposed as basic for military training in the actual theater of operations [3].

Currently, in comparison to traditional training periodization, the reverse training periodization (RTP) is emerging. This new training model is based on the concept of low volume and high intensity that has previously advocated by different authors [36–38], but it is characterized by a different paradigm compared to traditional periodization: the training program begins with high-intensity and low-volume and, in the subsequent periods, there is a decrease in intensity and an increase in volume, or the intensity is maintained and the volume increases, depending on the demands of the athletes [33,39]. The effectiveness of RTP has been studied in physical fitness, strength training, swimming, and rowing, showing significant increases in muscular endurance [40], maximum strength [33,41], and endurance performance [39]. The RTP demonstrates the efficacy of high-intensity and low-volume interval training vs. long-distance endurance training. High intensity training improves skeletal muscle fatty acid oxidation enzyme activity, muscle oxidative capacity, muscle buffering capacity, muscle glycogen and glucose transporter type 4 (GLUT-4) content, and maximal glucose transport activity of skeletal muscle at a level similar to that attained after performing low-intensity endurance training [42–44].

Since soldiers must be ready for deployment throughout the year, a short macro-cycle structure of 6 weeks was proposed. Reverse training periodization fits with these requirements since it normally structures a macrocycle with a duration of between 6 and 12 weeks [45–47]. The design of the training session was made following two parameters: to require the shortest possible time, and that the material used was accessible on military bases. Then 5 sessions per week were designed with a duration between 30 min in the first week and 50 min in the last weeks. During the first 3 weeks, the soldiers performed 2 sessions in the gym with the objective of increasing the maximal strength of the upper and lower body muscles (load between 70 and 85% of the maximum strength) and 3 sessions of short high-intensity interval training (HIIT) (Tables 1–3). The following 3 weeks they combined 2 short HIIT sessions and 2 resistance HIIT sessions with military equipment conducting military tasks.

Table 1. Training microcycles 1 and 2.

Week	Monday	Tuesday	Wednesday	Thursday	Friday
1	Performance evaluation test • Upper and lower limb strength tests • Aerobic and anaerobic running tests	5′ LAR 5′ RTE Strength training 4 × 15(20)/90″ Bench press, quadriceps curl, 30 × abdominal crunch with 10 kg, military press, Jalon, 20 × lumbar crunch with 10 kg, hamstring curl 5′ LAR 5′ LS	5′ LAR 5′ RTE Endurance Training 6 × 20″ sprint + lay down + 6′ LAR 5′ LAR 5′ LS	5′ LAR 5′ RTE Strength training 4 × 15(20)/90″ Bench press, quadriceps curl, 30 × abdominal crunch with 10 kg, military press, Jalon, 20 × lumbar crunch with 10 kg, hamstring curl 5′ LAR 5′ LS	5′ LAR 10′ RTE Endurance Training 6 × 20″ sprint + lay down + 6′ LAR 5′ LAR 5′ LS
2	5′ LAR 10′ RTE Endurance Training 6 × 30″ sprint + lay down + 6′ LAR 5′ LAR 5′ LS	5′ RTE 2 × 50 m PIR/30″ Endurance training 10 × lay down + 15″ sprint/45″ LAR Strength training 4 × 10(12)/90″ Bench press, quadriceps curl, 30 × abdominal crunch with 10 kg, military press, Jalon, 20 × lumbar crunch with 10 kg, hamstring curl 5′ LAR 5′ LS	5′ LAR 5′ RTE 2 × 50 m PIR/30″ Endurance training 3 × (12 × 20″ sprint/40″ LAR)/3′ LAR: 1° series with combat backpack (5 kg); 2° series with combat backpack (5 kg), impar running in zig-zag, par 2 squat and sprint; 3° series with combat backpack (5 kg), 40″ rest crawling 5′ LAR 5′ LS	5′ RTE 2 × 50 m PIR/30″ Endurance training 10 × lay down + 15″ sprint/45″ LAR Strength training 4 × 10(12)/90″ Bench press, quadriceps curl, 30 × abdominal crunch with 10 kg, military press, Jalon, 20 × lumbar crunch with 10 kg, hamstring curl 5′ LAR 5′ LS	5′ LAR 10′ RTE 2 × 50 m PIR/30″ Endurance Training 3 × (12 × 20″ sprint/40″ LAR)/3′ LAR: 1° and 3° series running; 2° series 10″ sprint + lay down and change of direction + 10″ sprint 5′ LAR 5′ LS

First week: training conducted with sportswear; Second week: training conducted with sportswear, excepting Friday, when it is performed with combat uniform; LAR: Light Aerobic Running; RTE: Running technical exercises; LS: Light stretching; PIR: Progressive Intensity Running.

Table 2. Training microcycles 3 and 4.

Week	Monday	Tuesday	Wednesday	Thursday	Friday
3	5′ LAR 10′ RTE 2 × 50 m PIR/30″ Endurance Training 3 × (10 × 30″ sprint/30″ LAR)/3′ LAR, all with combat backpack (5 kg): 1º and 3º 2 burpees + 30″ sprint; 2º 3 obstacles + 30″ sprint 5′ LAR 5′ LS	5′ LAR 5′ RTE 2 × 50 m PIR/30″ Endurance training 10 × lay down + 20″ sprint/40″ LAR Strength training 4 × 8(10)/90″ Bench press, quadriceps curl, 30 × abdominal crunch with 10 kg, military press, Jalon, 20 × lumbar crunch with 10 kg, hamstring curl 5′ LAR 5′ LS	5′ LAR 10′ RTE Endurance Training 6 × 40″ sprint + lay down + 6′ LAR 5′ LAR 5′ LS	5′ RTE 2 × 50 m PIR/30″ Endurance training 10 × lay down + 20″ sprint/40″ LAR Strength training 4 × 8(10)/90″ Bench press, quadriceps curl, 30 × abdominal crunch with 10 kg, military press, Jalon, 20 × lumbar crunch with 10 kg, hamstring curl 5′ LAR 5′ LS	5′ LAR 10′ RTE 2 × 50 m PIR/30″ Endurance Training 3 × (16 × 30″ sprint/30″ LAR)/3′ LAR: all with combat backpack (5 kg) and body armor (3 kg): 1º and 3º 15″ sprint + lay down + 15″ sprint; 2º carrying the backpack in the arms 5′ LAR 5′ LS
4	5′ LAR 10′ RTE Endurance Training 6 × 40″ sprint + lay down + 6′ LAR 5′ LAR 5′ LS	5′ LAR 5′ RTE 2 × 50 m PIR/30″ Endurance training 12 × lay down + 30″ sprint + lay down/30″ LAR Strength training 4 × 7(9)/90″ Bench press, quadriceps curl, 30 × abdominal crunch with 10 kg, military press, Jalon, 20 × lumbar crunch with 10 kg, hamstring curl 5′ LAR 5′ LS	5′ LAR 5′ RTE 2 × 50 m PIR/30″ Endurance training 4 × (5 × 1′ MAS/30″ LAR)/3′ LAR: all with combat backpack (5 kg) and body armor (3 kg): 1º and 3º series, in recuperation they have to take off body armor in impar and in pairs put it on; 2º and 4º series 4 lay downs during running 5′ LAR 5′ LS	5′ LAR 5′ RTE 2 × 50 m PIR/30″ Endurance training 12 × lay down + 30″ sprint + lay down/30″ LAR Strength training 4 × 7(9)/90″ Bench press, quadriceps curl, 30 × abdominal crunch with 10 kg, military press, Jalon, 20 × lumbar crunch with 10 kg, hamstring curl 5′ LAR 5′ LS	5′ LAR 5′ RTE 4 × (5 × 1′ MAS/30″ LAR)/3′ LAR 5′ LAR 5′ LS

Optional repeat performance evaluation test on third week Sunday. Third week: training conducted with sportswear, excepting Friday; fourth week: training conducted with sportswear, excepting Wednesday, when it is performed with combat uniform; LAR: Light Aerobic Running; RTE: Running technical exercises; LS: Light stretching; PIR: Progressive Intensity Running; MAS: Maximal Aerobic Speed.

Table 3. Training microcycles 5 and 6.

Week	Monday	Tuesday	Wednesday	Thursday	Friday
5	5′ LAR 5′ RTE 2 × 50 m PIR/30″ Endurance Training 4 × 4′ ATS/90″ LAR 5′ LAR 5′ LS	5′ LAR 5′ RTE 2 × 50 m PIR/30″ Endurance training 15 × 15″ sprint + lay down + 15″ sprint/30″ LAR Strength training 4 × 6(7)/90″ Bench press, quadriceps curl, 30 × abdominal crunch with 10 kg, military press, Jalon, 20 × lumbar crunch with 10 kg, hamstring curl 5′ LAR 5′ LS	5′ LAR 5′ RTE 2 × 50 m PIR/30″ Endurance Training 4 × (3 × 2:30 MAS/60″ LAR)/3′ LAR 5′ LAR 5′ LS	5′ RTE 2 × 50 m PIR/30″ Endurance training 15 × 30″ sprint with combat backpack (5 kg)/30″ LAR Strength training 4 × 10(12)/90″ Bench press, quadriceps curl, 30 × abdominal crunch with 10 kg, military press, Jalon, 20 × lumbar crunch with 10 kg, hamstring curl 5′ LAR 5′ LS	10′ LAR 10′ RTE 8 × 100 m PIR/60″ 10′ LAR 5′ LS
6	5′ LAR 5′ RTE 2 × 50 m PIR/30″ Endurance Training 2 × 3:30 MAS/1′ LAR 5′ LAR 5′ LS	10′ LAR 10′ RTE 5 × 50 m PIR/60″ 10′ LAR 5′ LS	5′ LAR 5′ RTE 2 × 50 m PIR/30″ Endurance training 5 × 30″ sprint/30″ LAR Strength training 2 × 10(12)/90″ Bench press, quadriceps curl, 30 × abdominal crunch with 10 kg, military press, Jalon, 20 × lumbar crunch with 10 kg, hamstring curl 5′ LAR 5′ LS	10′ LAR 10′ RTE 3 × 50 m PIR/60″ 10′ LAR 5′ LS	Performance evaluation test Upper and lower limb strength tests Aerobic and anaerobic running tests

Third week: training conducted with sportswear, excepting Friday; fourth week: training conducted with sportswear, excepting Wednesday, when it is performed with combat uniform; LAR: Light Aerobic Running; RTE: Running technical exercises; LS: Light stretching; PIR: Progressive Intensity Running; MAS: Maximal Aerobic Speed; ATS: Anaerobic Threshold Speed.

- Endurance training

Metabolic fitness is a vital requirement for the military population, since poor metabolic fitness, both aerobic and anaerobic, has been associated with a higher risk of training-related injuries and attrition in military trainees [48]. In the present proposal we started with high intensity training based on anaerobic tasks (sprints) but organized in the way that academic literature showed to improve aerobic performance [31]. After that we used a HIIT proposal, since it was previously an effective tool to improve both aerobic and anaerobic performance [34,41,45,49,50].

- Strength training

Progression and specificity are key factors to the success of any fitness program. A gradual introduction of exercise stress allows steady adaptation to higher levels of physical performance. Traversing rough terrain and obstacles, both in urban and mountainous environments, are current environmental barriers that a soldier must negotiate. Therefore, progressively introducing training modalities that improve strength manifestation is basic for soldiers [51]. Reaching an optimal maximal strength (1RM) is basic to improving power and resistance as well as improving fatigue tolerance; for these reasons we started the training program with high load training and after that we decreased this basic training for more specific training conducted in resistance HIIT.

- Specific military task training

Military programs that use specific tasks similar to occupational tasks and physical fitness requirements, including calisthenics, dumbbell drills, movement drills, interval training, long distance running, and flexibility training, in contrast to traditional conditioning programs that performed a warm-up, stretching exercises, push-up and sit-up exercises, and running in formation, showed no differences in improving the fitness levels of recruits [52,53]. These previous studies did not incorporate specific military tasks into the training methods, a fact that we included in the present proposal, aiming to improve these tasks in a metabolic context similar to the actual battlefield, thereby increasing the specificity of the training.

4. Performance Evaluation Tests

This training structure proposed the need to establish individual intensity zones as well as a tool to analyze the assimilation of training by the participants. Following the same principles of the training session design, requiring the shortest possible time and that the material used was accessible at military bases, we proposed the following performance evaluation test to control the training program. These evaluation tests are conducted on the first and last day of the training program (Tables 1 and 3).

- Upper and lower limb strength tests

After a warm-up consisting of 10 min of running (light aerobic), participants perform two maximal horizontal jumps with the hands on the waist, to avoid inertia of arm movement, and the best attempt is recorded [12]. After that, for the upper limb strength test, participants perform an isometric handgrip test by a grip dynamometer twice, recording the best attempt [7].

- Aerobic and anaerobic running Tests

Running performance is evaluated by the mean speed of a maximal effort around 50 m and 2000 m, which is associated with the maximal aerobic speed measured in the incremental test conducted in laboratory [54]. After the 10-min aerobic warm up and the maximal horizontal jump and isometric handgrip test, participants are instructed to run 50 m at maximal speed on a track surface and after 5 min of recovery they are again instructed to run 2000 m at maximal speed on a track surface [50]. Final heart rate and speed are recorded.

5. Training Zones

For the 2000 m running test we can structure different intensities according to the heart rate and running speed recorded. Then, for light aerobic running and running technical exercises, 60–70% of the speed and heart rate; for anaerobic threshold speed, 70–90% of the speed and heart rate; and for maximal aerobic speed, 90–>100% of the speed and heart rate evaluated in the 2000 m running test would be proposed [34].

For the strength training at the gym, we would propose the use of effort character [34], that is, the participant would receive a number of repetitions to do over a maximal repetition that he could do with a determined load. For example, in the first week the first strength training is: 4 × 15(20)/90″, where they have to perform 4 series of 15 repetitions with a load that they could move a maximum of 20 times.

6. Future Research Lines

The necessities of soldiers for actual theaters of operations have continually changed, with an increase in asymmetrical conflict and with different requirements from the traditional symmetrical warfare. In this manuscript we present a training proposal based on current literature on the psychophysiological demands of actual combat scenarios. Future research should test the efficiency of this proposal and adapt it for specific conditions such as combat in high temperature, high humidity, or low temperature, high altitudes areas.

7. Conclusions

The present training intervention was developed in order to improve operative training according to the demands of actual theaters of operations, based on recent research in military and civilian populations. We attempted to put forward a proposal that is easy to apply, with a minimum use of material different to what could be found on a military base and that could be implemented in a short period of time.

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