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Mario Trindade's training method: the journey to 100 metres wheelchair gold medal at European championships in Berlin (2018)

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ABSTRACT

This article aims to present Paralympic athlete Mario Trindade's training to become the European Champion at the 100 meters wheelchair race in Berlin 2018. The lack of information on this specific training has impaired the beginning of this journey. However, the daily monitoring of this athlete over 20 years has permitted us to realise that the training methods of athletes with disabilities are not very different from those of others. Thus, it is important to understand the different responses to exercise. The degree of improvement after a training program depends on the characteristics of the vertebral-medullary lesion, the training history, and the training ability of the athlete, which is determined by the amount of active muscle mass available. Considering these aspects, we aim to describe the summer training macrocycle that is developed for the 100 metres wheelchair race, which is a combined work developed by a multidisciplinary team. We will start by providing a theoretical background on para-athletics events, specifically wheelchair competitions. Afterwards, we will characterise the athlete and discuss his track and strength training, which prepared him to obtain the gold medal in 2018.

KEYWORDS: paralympics; wheelchair; training; strength; biomechanics.

INTRODUCTION

Since 1948, when Sir Ludwig Gutman arranged the first international sports competition for World War II veterans at the English hospital of Stoke Mandeville, wheelchair sports have evolved (Bailey, 2008). What began as a military rehabilitation exercise during WWII has evolved into the world's largest sports event for people with impairments, the Paralympic Games. From as little as 400 athletes representing 23 countries and 8 sports, the Paralympic Games have increased the number of participants, countries, and sports, reaching a total of 4,500 athletes from 176 countries and 22 sports at the Paralympic Games in Rio de Janeiro [2016] (Kolotouchkina et al., 2021). The Paralympic movement has grown in the last few years, which has led to higher competitiveness among athletes and, consequently, stricter discipline and higher training specifics to become professional athletes, more support and technology (Forte et al., 2015).

Since the beginning of the Paralympic movement, wheelchair races have been one of the most spectacular events due to their highly competitive level and the high speeds athletes attain during their performances. Technological evolution has allowed modern wheelchairs to become lighter and more aerodynamic, enabling athletes to run long distances at better times than athletes without disabilities (Tweedy & Diaper, 2010). For example, the marathon's world record is 2:01:09 for walking athletes and 1:20:14 for wheelchair athletes, both male. Wheelchair championships include sprints, middle-distance running, and distance running (from 100 m to the

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marathon), with athletes distributed in four classes: T51, T52, T53, and T54. These classes are defined according to the area of the vertebral-medullary lesion: C5-6, C7-8, T1-7, and T8-S4. For Class T52, the races included in the Paralympic calendar are 100 m, 400 m, and 800 m. Each wheelchair athlete used to compete in different wide range distances. However, the increasing number of participants and improved training methods have made racing more competitive, leading to athletes' specialisation in a specific distance (Goosey-Tolfrey & Price, 2010).

This research note aims to describe the training of the wheelchair athlete Mário Trindade for the European Championship in Berlin. The 2017/2018 season goal was to win the 100 m. Mário won the European title (100 m) with a championship record of 18.53 seconds and also won the silver medal at 400 m (1.08.45 minutes). We will present the training performed by this athlete during the second macrocycle in both training domains (track and strength) and the contribution of biomechanics to increasing his performance. During this season, Mário was also monitored by a physical therapist, a sports psychologist, and a nutritionist.

MAIN TOPIC

Characterisation of the athlete

Mário Trindade was diagnosed with scoliosis at a young age. At 12, he found his passion for sports, started practising athletics, and, after, started cycling. Later, at 17, he presented respiratory issues and had to undergo spine surgery. Prior to surgery, he was informed that the medical intervention was complicated but had a great chance of success. Two days later, he woke up and could not feel his legs. He was admitted to Hospital de So Joo for a year before being transferred to Alcoitão Recovery Centre (Portugal), where he underwent a lengthy 9 month recovery process. Initially, the therapy focused on regaining walking ability and later on achieving independence while using a wheelchair. On December 3rd 2007, he broke a Guinness World Record in which he covered 182,4 km in 24 hours on a 400 m track. His goal was to make the world aware of the struggles that people with disabilities face daily in their lives.

In 2013, Mário had the opportunity to participate in the International Wheelchair & Amputee Sports Federation (IWAS World Games) and competed in the 100 m, 200 m and 400 m. In that competition, they redefined Mario's classification category, and from that moment, he was in T52 class, where he was finally able to compete with people with a similar disability. Mario's track goals for competition were redefined, and he was able to compete in the 100 m and 400 m trials at the 2014 European Championship (Swansea, England). Afterwards, Mário conquered the following accolades in 100 m races: a bronze medal in 2016 (Swansea, Wales), a silver medal in 2017 (Grosseto, Italy) and a golden medal in 2018 (Berlin, Germany). He has achieved 6th place at the Rio de Janeiro Paralympic Games (2016).

A qualitative study conducted on Mário Trindade found that his most notable psychological characteristics are resilience, focus, and motivation to maintain high performance levels and attain his goals (Celestino & Pereira, 2018).

The training method

When Mário started training, there was not much information on wheelchair training, which made the challenge harder. Throughout our work, we found two important aspects to consider in these athletes' training: i) wheelchair athletes suffer no osteoarticular impact from the strength produced on the ground; ii) when they stop pulling the chair, it continues to move. These two points are crucial for training planning because, although these athletes are sprinters, they can tolerate more training volume with active recoveries. It is also noteworthy that these athletes' training is often impaired by comorbidities associated with paraplegia, which frequently affect and make daily training planning difficult.

The daily follow-up has taught us that these athletes' training is not very different from any other. Generally speaking, most training rules applied to wheelchair athletes are the same as those applied to other athletes (Cooper, 1990). Therefore, it is important to understand the different responses to exercise (Goosey-Tolfrey & Price, 2010). Athletes with a vertebral-medullary lesion present changes in metabolic, cardio-respiratory, neuromuscular, and thermoregulatory systems, which reduce their general physiological ability when compared with athletes without disabilities or other types of disabilities (Bhambhani, 2002). Strong evidence suggests that wheelchair athletes have physiological adaptations to aerobic and anaerobic training, similar to athletes without disabilities. However, after a training program completion, the degree of improvement depends on the characteristics of the vertebral-medullary lesion, the training history, and the training ability of the athlete, which is determined by the amount of active muscle mass available (Goosey-Tolfrey & Price, 2010).

According to Goosey-Tolfrey and Price (2010), wheelchair athletes' performance depends on three factors: the athlete, the chair, and the athlete/chair interaction. Tweedy and Diaper (2010) add that the main factors that contribute to the success of these events are physiological and depend on the technical ability to reach and maintain high speeds. Bhambhani (2002) affirms that anaerobic ability, power, and a high strength/weight ratio are fundamental for succeeding in these distances.

For a better understanding of this paper, we divided the training methods into i) track training (on an athletic track) and ii) strength training (in a gym). Due to the lack of information about training for athletes with disabilities, these plans have been developed taking into account the specific characteristics of this athlete.

Track training

Considering the duration of 100 m in a wheelchair (it ranges from 16 to 18 seconds) and the world record in class 52, which is 16.41 (Raymond Martin, EUA), this is a speciality that mainly demands the alactic anaerobic source of energy (Adenosine triphosphate — ATP, and Phosphocreatine — CP). It is also evident that the training of these athletes should focus on the upper body; nevertheless, the available muscle mass and functionality depend on the lesion's level.

Considering the 4 year cycle of Paralympic preparation, the athlete's health and functional status, the tests and competition results, and, finally, the athlete's readiness for training, the cycle was divided into annual plans with intermediate goals. Hence, the annual plan was divided into two macrocycles designed according to the athlete's characteristics. The winter macrocycle took place from September to March, targeting several track competitions in Dubai. Afterwards, the athlete had a week of transition. The summer macrocycle started at the end of March and ended at the European Championship in Berlin (August 2018), and it was divided into 4 periods: general preparation, specific preparation, pre-competition and competition. The second macrocycle is the only one described since it was the most critical to achieving the established goals. Considering that the athlete had a winter macrocycle in which he reached a high level, he started the second macrocycle after two weeks of general preparation. In the third week of April, the specific preparation period was introduced, aiming at the development of anaerobic alactic (repetitions 60-100 m) and lactic (repetitions 150-300 m) capacities, as well as acceleration ability (30-50 m starting from stationary), flexibility, and chair propulsion technique (Table 1).

The pre-competition period took place during the months of June and July, and it was focused on developing the alactic (repetitions 60-100 m) and lactic (repetitions 150-300 m) power, the starts, and finally, the resisted, overspeed, and maximum speed. These can be observed in Table 2.

Table 1. Example of a week from the specific preparation period.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Morning	Strength			Strength		20′ cr 3× 2× 300 *R*= 8′ *r*= 2′	30′ cr
Afternoon	20′ cr 50-60-80-60-50	20′ cr 2× 3× 150 *R*= 6′ *r*= 2′	30′ cr	20′ cr 2× (30-40-50)	20′ cr 2× 5× 60 *R*= 6′ *r*= 1′30″		

cr: continuous running; R: r -rest time.

Table 2. Example of a week from pre-competition period.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Morning	Strength			Strength		20′ cr 2× 5× 60 *R*= 6′ *r*= 1′
Afternoon	20′ cr 5× 50 sl 5× 50	20′ cr 300-200-150	20′ cr	20′ cr 8× (40 st+ 30 rx+ 30)	20′ cr 4× 60 dc+ 2× 80-100	20′ cr

R: r -rest time; cr: continuous running; sl: sled; st: start; rx: relaxed; mt: momentum; dc: descent.

Finally, the competitive period, in which we intend to correct some details on the starts, acceleration speed, and maximum speed, can be observed in Table 3.

Strength training

Strength training (ST) integrates Mário's preparation with two specific purposes: improving performance and reducing injury risk. His planning was divided into general and specific preparation periods, and within each period, training blocks were designed with specific purposes. The general preparation period (12 weeks) was divided into an introduction block (4 weeks) and a muscle hypertrophy block (8 weeks). The specific period (12 weeks) was split into a maximum strength block (4 weeks) and a muscle power block (8 weeks). ST sessions were performed twice a week, with a 72-hour interval between them. The preparation was divided into winter and summer periods, respecting an identical structure as described before, with a small change in the general preparation phase (summer period), where the introduction block was reduced to two weeks.

An assessment was carried out to measure the ability to generate tension in the different body segments (trunk, upper limbs, and neck), and the athlete was asked to express his difficulties in the context of the competition. All ST sessions were initiated by one exercise for increasing body temperature and two exercises for isometric muscle activation of the flexor, adductor, and extensor muscles of the shoulders.

We will not mention which exercises were used because every athlete has their own individual characteristics, and the exercise choice must be individualised. Thus, we will describe goals, volume, and training intensity.

Each exercise load was determined by the number of repetitions, as it is well known that completing maximum repetition tests for determining training load is unnecessary. The load varies according to the readiness of the athlete in each session and the accumulated fatigue per set of exercises. In certain blocks, we have asked the athlete to use the load that would allow him to perform the established number of repetitions without allowing the execution of one more repetition; in other blocks, he should have the feeling that he could perform two more repetitions. The athlete would record the load used in each training session to control his progression. To progress the training load, the athlete was asked to increase the load used in the previous week for each exercise every two weeks in each block. One week before each event, the volume and intensity established for that week were reduced by 50%. The following points will characterise Mario Trindade's ST in more detail by period and block regarding the goal, volume, and training intensity.

The general preparation introduction block aims to build an adaptation to ST and minimise the gaps noticed in muscle activation. In this block, nine exercises were conducted in the foundational phase (3 global and 6 isolated), considering the deficits detected. In the first week, the athlete was asked to use a load in each series that allowed him to perform the number of established repetitions but in which he felt he could perform two more repetitions. From the second to the fourth week, he was

Table 3. Microcycle of the competitive period that ends with participation in the European Championship (August 13-26, 2018).

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Morning	Strength			TRIP			20′ cr Training starters: 60+ 80+ 100+ 150
Afternoon	20′ cr 6× (40 st+ 30 rx+ 30 mx) 100	20′ cr 3× 150	20′ cr		20′ cr 6× 100 rx	20′ cr 8× (40 st+ 30 rx+ 30 mx)	
Morning							
Afternoon	20′ cr	20′ cr Starts	Competition: 100 m FINAL				

cr: continuous running; st: start; rx: relaxed; mx: maximal.

Table 4. Variables for the period of general preparation, introductory block.

Number of exercises	Number of series	Number of repetitions	Rest time	Load
9	3	12	90 sec	12 RM

Table 5. Variables for the period of general preparation, hypertrophy block.

Number of exercises	Number of series	Number of repetitions	Rest time	Load
1st to 4th week				
7	3	12	90 sec	12 RM
2 postural	3	15	60 sec	body
5th to 8th week				
7	3	6/8/12	90 sec	6 RM/8 RM/12 RM
2 postural	3	15	60 sec	body

Table 6. Variables for the period of specific preparation, maximum strength block.

Number of exercises	Number of series	Number of repetitions	Rest time	Load
1st to 2nd week				
3	8	4	180 sec	4 RM
2 postural	3	15	60 sec	body
5th to 8th week				
3	8	2	180 sec	2 RM
2 postural	3	15	60 sec	body

Table 7. Variables for the period of specific preparation, muscle power block.

Number of exercises	Number of series per exercise	Number of repetitions	Rest time	Load
4	6	6	150 sec	6 RM/30% of 6 RM

asked to, in all exercises where he felt that the current load would allow him to exceed 12 repetitions, increase the load for the next series and perform at least 8 repetitions. The volume and intensity variables for this block can be observed in Table 4.

The goal of the muscular hypertrophy block was to increase maximum dynamic strength through muscle hypertrophy. We kept the set in the introduction block for the first four weeks, but in terms of load, the athlete was always asked to perform the 12 RM and raise the load anytime he managed to exceed 12 repetitions. The trunk stabiliser muscles (2 exercises) were worked on with a defined number of 15 repetitions, a rest time of 60 seconds between sets, and 3 sets per exercise. We constructed a model of repetitions and load using the ascending pyramid technique for volume (Table 5), retaining the same workouts and model for the trunk stabilisers throughout the next four weeks.

The maximum strength increases with a block of specific preparation aimed at increasing the maximum dynamic strength through predominantly neural stimulation. We have chosen 3 global exercises in this block while keeping the trunk stabilisation exercises with the same characteristics as the previous blocks. The volume and intensity variables can be seen in Table 6.

The muscle power increase block aimed to increase the rate of dynamic force production. In this block, four global exercises were applied. The approach to attaining the goal was the contrast technique, which involves alternating between sets using high loads with low loads and always with a maximum execution speed. The athlete was asked to perform the first repetition of each set, reacting to as many sound signals as possible. The volume and intensity variables can be seen in Table 7.

CONCLUSIONS

Finally, we would like to underline that Mário's European Champion title was the result of a collaborative effort from a multidisciplinary team, as well as the volitional, persistent, and determined attributes that characterise this athlete. As the Paralympic movement evolves in various ways, we emphasise the importance of conducting additional studies in this specific field of adapted athletics. To conclude, this paper allows coaches and athletes to replicate the training methods of this athlete, intending to improve wheelchair-racing athletes' performance.

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