THE INFLUENCE OF BOBSLEDDING ON THE ACCELERATION CAPACITY IN SPRINT RUNNING EVENTS

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Abstract
The present work tries to identify and measure the dynamic benefits of the bobsledding in the sprint runners training. We were encouraged in our research by the worldwide tendency of the athletes to practice bobsledding and also, by the fact that Romanian bobsledding female team participating in 2016 World Championship was exclusively made of athletes practicing, during the summer, sprint running, long jumps or combined events. Furthermore, in the 2016 Bobsledding Skeleton National Championship the podium belonged mostly to the girl athletes (17 sportswomen out of 24).In this present paper, studies were made on the acceleration parameters within the two disciplines and the tools that could result in an improvement of the time records on short distances and could be implemented in the athletic training were identified. The aim of this study is to encourage the symbiosis of these sports disciplines that, in our opinion, are complementary.

Keywords: *track and field, sprint, bobsledding, training similarities*

JEL classification: *I20; I25*

1. Introduction

The experts (as Schiffer, J., 2009) show that acceleration capacity is the most influencing parameter of the competitive results in sprint running events. It is known that sprint runners cannot reach a speed value greater than the one they get at the end of acceleration phase. Differently said, the maximum speed is always reached as a result of the preceding acceleration step.

Strict information about the sprint running have existed since the last century, both from the biomechanical, speed-measuring and movement's acceleration point of view; the law from 1936 is still applicable today establishing that a sprint runner cannot reach the maximum speed before the first 6 seconds (Ivan, C., 2015).

The real time measurement and displaying of the sleigh speed in bobsledding was not possible until the 2015-2016 championship, despite the technological development. The speed of the sleigh at the exact time the sportsmen are going up

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can be precisely determined today using quite sophisticated methods; in other words, the maximum speed reached by the sportsmen during the running over the ice and also the time frame, as well as the necessary number of steps, can be determined nowadays.

We encounter enough similarities between the sprint running and bobsledding so as to allow us to say that these two sports are complementary; so, both have the main neuromuscular component, the same type of physical effort (alactacid and anaerobic, force-speed type) and the same somatic component (long-waist, mezomorfic type).

Considering the reciprocal relation between the two sports, the presumption of our study comes here naturally expressed: the practice of bobsledding offers the necessary improvement conditions for the acceleration ability in sprint contests. The specific training methods and tools used in bobsledding will bring new values to the acceleration ability in the athletic sprint training.

2. The concept of maximum speed and acceleration ability

Usain Bolt, the fastest man of the planet, achieved the world record of 9.58 sec at 100 m sprint event and a speed of 12.27 m/s (43.92 km/h) (Gomez, et al, 2009). The cheetah, the fastest animal on the planet, can comparatively achieve 28.61 m/s (102.99 km/h) (Gonzales, 2013).

In this context, we define the maximum speed as the highest speed the sportive can reach in a straight line movement, in standard conditions of training (excluding here the supramaximal running conditions as the down-slope running or with special traction devices).

The ideal goal in sprint-events training is the speed improvement up to the level of the speed limit and maintaining it as long as possible with maximum efficiency (ensured by an appropriate running technique). The acceleration slope is best associated with the physical power, requesting the best force-speed ratio for the same individual.

A kindred concept is the *starting force,* representing the ability of the neuromuscular system to dispatch a maximal tension just at the beginning of the muscular contraction (Tudor, Crisan, 2007). This concept is closely related to the breaking of inertia in any type of motile activity, in our case, the starting block for runners and the start with the sleigh in bobsledding.

2.1 The acceleration parameters in sprint and bobsledding

The main characteristics of sprint running are the acceleration ability and the maintenance of the reached speed. The fig. nr.1 displays these characteristics in several athletic sprint events. If the hurdles disciplines have the particularity of last- meters acceleration, due to the flat road part, after getting over the last hurdle, in the 100m-flat event, both in male and female events, the graph has a curved pattern. The medium speed and consequently, the final time record are better as the longer the duration of the plateau of the 3-rd phase of movement may be. It is still to determine if and, to what extent, the distance of maintaining the maximal speed is directly influenced by the moment of time when it is reached.

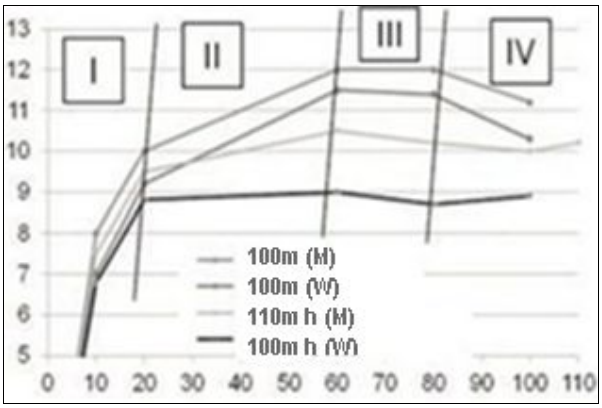

Figure 1 The sprint running phases, after Bauersfeld K. H., Schroder G., 2016

Regarding the startup in bobsledding, ideally, the maximal speed is reached at the point when the sportsman gets into/mounts the sleigh.

In figure 1 is comparatively exposed the acceleration pattern/graphic of two exceptional sprinters: Usain Bolt in his world record of 100 m sprint race and Johannes Lochner, the bobsledding pilot with the best start time at the 2016 World Bobsledding Championship. We mention that the bobsledding track used in this championship presents a progressive increasing of the slope from the start, theoretically, requesting from the sportsmen, an acceleration similar to the "pick-up" acceleration used in sprint races.

The data about the speed of the bobsleigh pilot have been registered using the Omega measure device (a Swiss product) which comprises 3D sensors for speed and acceleration and a gyroscopic 3D sensor both operating in real time. Thus, the live transmissions on IBSF official channel furnished the necessary data about the bobsleigh speed in real time, allowing a subsequently analysis of the images.

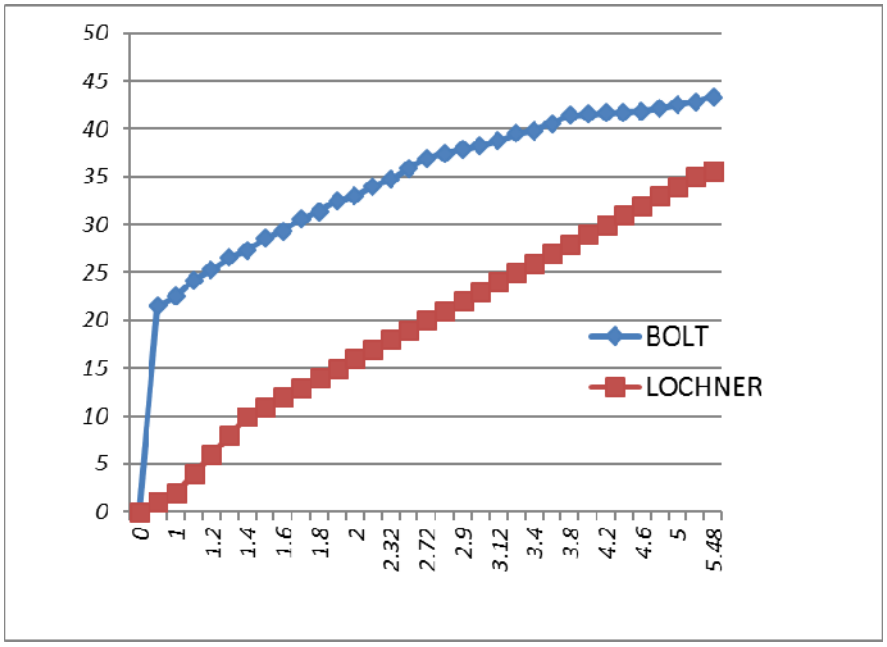

Figure 2: Start acceleration – bobsledding vs. 100m plat[3]

We observe here an obvious discrepancy between the speed of 20 km/h reached by an athlete after the first second and the speed of 5 km/h or less attained by a bobsleigh pilot. The initial acceleration of the pilot continues then up to 1.4 sec, attaining 10 km/h. These differences are due to the supplementary heaviness of the bobsleigh weight.

It is notable the following evolution due corresponding to the pick-up acceleration. We may observe a constant increasing of the bobsleigh pilot speed, with a slight tendency to stop on the last inter-time interval before climbing into the bobsleigh. The two slopes corresponding to the second phase of acceleration become here almost parallel (suggesting a similar speed gain per time unit), showing then a further progressive convergence.

Thus, the athlete, compared to the bobsleigh pilot, accelerates less and less, having the second phase of acceleration less extensive. This fact is more significant if we consider the second phase of acceleration (the pick-up acceleration) more important than the first one, following immediately after the startup in sprint events.

[3] http://berlin.iaaf.org/news/kind=101/newsid=53084.html

3. Training similarities

We chose from the specific range of the training sessions, the elements educating speed and force, and we refer to the bobsleigh startup, regarding the influence of the bobsledding training on the acceleration capacity.

The difference between the tools and dosage used in the speed training are insignificant, as it is shown in table 1:

Table 1: Tools for speed improvement and the dosage depending on the sportsman discipline

		Dosage	
	Tools	**Bobsledding**	**Athletics**
Reaction speed	Startups from different positions	At the signal of breaker / coach (no more than 20 startups)	At the signal of coach (no more than 20 startups)
	Integral startups from block or thematic	Occasionally for variation and CNS stimulation	At the signal of coach (no more than 20 startups)
	Startups from standing position	At the signal of the team breaker (3x10m/ 3x30m)	----------
Displacement speed	Running Intensity 87-97%	2x3x30/ 2x3x50/ 2x80/ 1x120m • long break between series for complete recovery (min. 7 minutes) • break for complete recovery between repetitions (max. 5 min)	3x30 / 3x50/ 3x80 / 2x150m • long break between series for complete recovery (min. 7 minutes) • break for complete recovery between repetitions (max. 5 min)
Speed in resistance	Running Intensity 80-87%	3x (1x100m / 1x120m /1x100m) • break for complete recovery between series; • break for incomplete recovery between repetitions	3x (1x150m / 1x200m/ 1x150m) • break for complete recovery between series • break for incomplete recovery between repetitions
Acceleration speed	Running "released" Intensity 100%	3x10/ 3x30/ 3x50m • break for complete recovery between series and repetitions	2x2x10 /2x2x30 /2x2x50m • break for complete recovery between series and repetitions

Extra-speed	Running negative slope track	----------	3x30m p 1.30 3x50m p 2.30 2x80m p 3.30
	Startups with bobsleigh	15 runs with the bobsleigh on the start track	----------
	Running with traction device Intensity 100%	2x3x30/ 2x3x50/ 2x3x60m • break for complete recovery between series and repetitions	2x2x30/2x2x50/2x80/2x100 • break for complete recovery between series and repetitions

The training tools and dosages for force improvement are common for both disciplines, as we exemplify in the table 2:

Table 2: Dosages for force improvement

Bobsledding	Athletics
Squat	
• 1x100%; 2x2x90%; 3x3x85%; 3x5x75% • 1x60% up to exhaustion (once per micro cycle) • maximal force improvement	o 1x4x75% o muscular and ligament warming up o tool for progressive load regarding the warming up for demi squat
Demi-squat	
• 3x3x80% with quick rising on toes • tool to discharge of accumulated force	o 1x100%; 3x3x85%; 3x5x75%; 1x 60% up to exhaustion (once per micro cycle) o maximal force improvement
Snatch	
• 1x100%; 2x2x90%; 2x3x80%; 1x6x70% • tool for warming up and trunk stabilization; • tool for nervous excitement and whole muscular chain involvement	o 2x6x60%; 2x4x75%; 1x3x85% o the focus is not on 1RM, which is determined once per mezzo cycle; o tool for warming up and trunk stabilization; o tool for nervous excitement and whole muscular chain involvement
Clean and jerk	
• 1x100%; 2x2x90%; 2x3x85%; 2x5x75% • bobsleigh snatching simulation; • tool for warming up and trunk stabilization	o 1x6x60%; 1x4x75%; 1x3x85% o the focus is not on 1RM, which is determined once per mezzo cycle; o tool for warming up and trunk stabilization

Bobsledding	Athletics
Lunge walking with dumbbell at chest or neck	
• 5x10 steps; 3x20 steps; • working up to 50% of 1RM knee bending	o 5x10 steps o working with maximum 50% of body weight
Pushing from lying back	
• 1x100%; 3x85%; 3x5x75% • 1x 60% up to exhaustion (once per micro cycle)	o 1x6x60%; 1x4x75%; 1x3x85% o the focus is not on 1RM, which is determined once per mezzo cycle; o tool for muscular stabilization
Bending - rising	
• 1x6x60%; 1x4x75%; 2x3x85%; 2x2x90%; 3x5x80% • 1RM and 1x60% up to exhaustion once per micro cycle	o 1x6x60%; 2x4x75%; 2x3x85% o the focus is not on 1RM, which is determined once per mezzo cycle
Tool for the trunk muscular force improvement and general improvement for safely running of other exercises (knee bending, clean, snatch)	

The difference between sprint running and bobsledding regarding strength development consists in the weight operated by the sportive. This is more reduced in athletics, due to a different competitive effort (the athlete displaces his own weight, while the bobsleigh driver has to manage an additional weight). Instead, the running distance is much shorter in the second case.

3.1 The bobsleigh running as training tool for sprint running

The system consisting in the bobsleigh and team is in on–going acceleration after the start of the race. The braking is not performed after the running phase; on the contrary, after having completed 20-30 m of sprint running, the sportsmen are subjected to 150 km/h speed and 5G acceleration.

The bobsleigh startup is a part of the competitive event (on negative slope iced track, with small load differences due to the team weight variations) and also a training tool (on horizontal or negative slope track, on ice or on bearings, with a greater or smaller load), could be also applied in sprint running.

The bobsleigh startup has two fundamental steps: the breaking of bobsleigh inertia and the accelerated launching. Thus, the first about 10 m after the startup are completed in hampered conditions, followed by an accelerated download running with bobsleigh support as dynamic resistance. This pass-over step is performed suddenly for a high slope track (Koenigsee, Sochi), or progressive, with an almost

linear increase of speed (Innsbruck, Altenberg). Consequently, the pilot accelerates fast – corresponding to the first phase of acceleration after the startup in sprint running events- or achieves a progressive acceleration on a longer distance, as in the second phase of sprint running events (the pick-up acceleration).

The downhill running with the bobsleigh eliminates the disadvantages of the free running, and, allowing a higher bend over, obviously leads to an extra-speed. The lack of arm movements which is natural in the flat-run, triggers the complementary usage of other means with additional weight that allow the natural balance of the upper limbs. The method of pulling the bobsleigh is one of them, shifting GCG at posterior and inferior level, leading to the cancellation of the flying phase and to an excessive forward- leaning/bending of the trunk.

The bobsleigh startup therefore blends the development of an explosive force with the extra-speed and acceleration capacity. However, bobsledding cannot substitute for a complex and various training, but must be included in the training, together with other tools so as to ensure the complex development towards perfection of the speed running.

3.2. Study participants and the evolution of results in sprint running events after the bobsledding debut

The participants of our research were sportsmen and sportswomen of C.S.O. bobsledding club of Sinaia who have developed their competitive activity in athletics, participating also in sprint running events (4 girls and one boy aged between 18 and 26). For them, (L.E.G, M.D.G., H.E.A., G.A., M.D.I.) data regarding all their athletic career, before and after the bobsledding debut, were gathered.

The chronological evolution of the season records of 3 sportsmen of C.S.O. Club of Sinaia has been registered in order to measure the bobsledding influence on the sprint running performance.

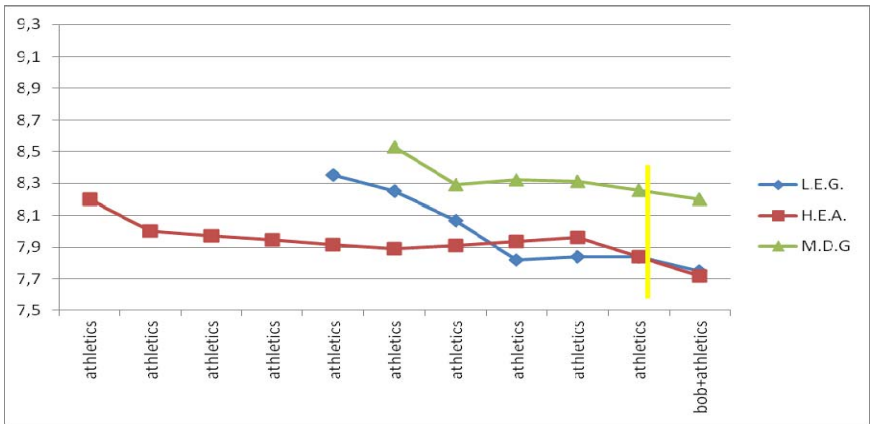

Figure 3: The evolution of the best season performance – 60 m

The figure displays the data for 60 m race event. We observe that all three subjects recorded a similar progress rating after the bobsleigh debut, more obvious in case of sportive H.E.A. comparatively to her preceding tendency.

Figure 2 shows data acquired in 100m race event. Here, another dynamics can be noted: for 3 of 4 subjects the evolution immediately following the bobsledding debut was negative, but afterwards two sportsmen have progressed in a significant way (M.D.I.) and even more obvious (G.A.). In the fourth case, an immediate improvement has been registered.

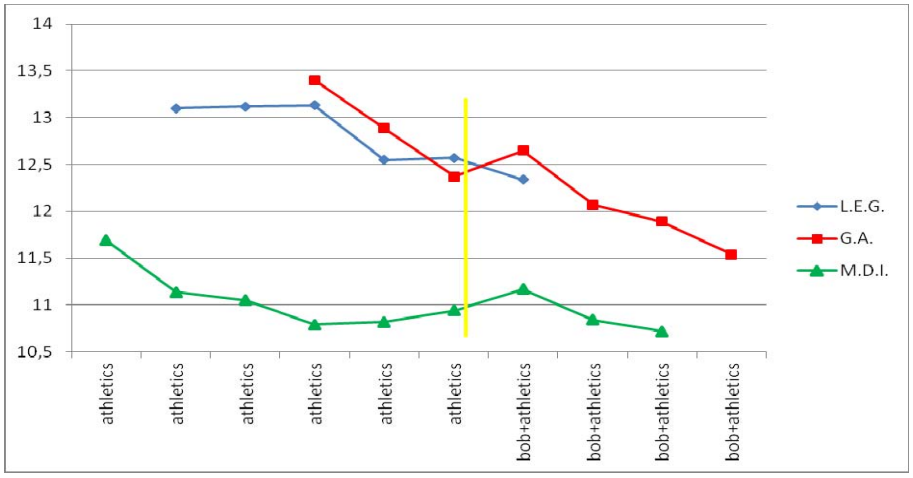

Figure 4: The evolution of the best season performance – 100 m

We consider the quick improvement of the results in the 60 m sprint running as a consequence to the force growth and acceleration capacities, while the delayed-shown acquisitions in 100 m sprint event may be due to the necessary readapting time to long distances (compared to the length of the start-up in bobsledding).

4. Conclusions

The specific winter training in bobsledding contains maximal force stimuli, departure force, extra-speed and coordination methods, simultaneously applied. It is important to keep in mind that the training program integrates efficient tools for development of speed and explosive force, having the opportunity for frequent variation of stimuli to prevent the limitation. Thus, psychomotor components that usually trigger weariness and dullness (as speed, acceleration capability, explosive force) in order to be developed, can be efficiently trained with bobsledding.

The progressive evolution of the sportsmen attending the actual study may be considered as the consequence of the development of both phases of acceleration (the initial acceleration and the pick-up acceleration), knowing the fact that the departure force was developed by performing of bobsleigh startups.

So, applying specific bobsledding stimuli resulted in the improvement of time records in sprint running. All three participants have progressed in the 60m running event by combining the athletic training with bobsledding.

We may therefore conclude that, the presumption of our work, according to which the bobsledding practice offers the necessary opportunities to improve the acceleration capacity in sprint running events, is entirely confirmed.

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