PRIORITIZING INDIVIDUAL DEMANDS IN SPORTS TRAINING: INSIGHTS FROM GPS DATA ANALYSIS

PRIORITÀ ALLE ESIGENZE INDIVIDUALI NELL'ALLENAMENTO SPORTIVO: INTUIZIONI DALL'ANALISI DEI DATI GPS

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ABSTRACT
Athletic conditioning is crucial in sports education and is enhanced by tech tools for optimal results. Sport Science students used GPS data to design two training sessions for 22 individuals. One session included a ball, the other didn't. Findings showed that including a ball reduced time spent running over 16km/h, suggesting physical conditioning should prioritize physiological demands over sport-specific skills. GPS technology proves valuable for future Sport Scientists to customize training effectively.

L'allenamento atletico è fondamentale nell'ambito sportivo. Gli studenti di Scienze Motorie hanno progettato due sessioni di allenamento per 22 partecipanti. Una sessione includeva una palla, l'altra no. I risultati hanno mostrato che l'inclusione di una palla riduceva il tempo trascorso a correre oltre 16 km/h, suggerendo che l'allenamento fisico dovrebbe dare priorità alle esigenze fisiologiche rispetto alle abilità specifiche dello sport. L'uso della tecnologia GPS si rivela un prezioso strumento per incrementare l'efficienza dell'allenamento.

KEYWORDS
Sport; Training; Technology
Sport; Allenamento; Teconologia

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Introduction

Athletic training transcends mere physical fitness. It encompasses mental resilience, agility, and the intricate interplay between body and mind (Gameiro et al., 2023; Martín-Rodríguez et al., 2024). As athletes strive for excellence, the quest for optimal performance demands a holistic approach-one (Taber et al., 2024) that extends beyond the treadmill and weight room.

Undoubtedly, technical and tactical aspects play a pivotal role in enhancing sports performance(Kolman et al., 2019; Modric et al., 2022; Ungureanu et al., 2021). However, given the often limited time and pace of training sessions, there emerges a pressing need to maximize the effectiveness of each individual session. To this end, it becomes imperative to integrate the strength and conditioning components of the training with its technical and tactical elements. Training can be tailored by adjusting the speed during the execution of exercises or by altering the duration or pace of recovery periods. This approach appears to enable simultaneous work on sport-specific aspects, thereby eliciting physiological adaptations within the body (Iaia et al., 2009; Maggioni et al., 2019). In essence, this method promotes a more holistic and efficient approach to sports training, potentially leading to improved performance outcomes.

Despite the emphasis on technical and tactical training, the importance of general physical fitness and the development of its key macro areas cannot be overstated. These areas include cardiorespiratory fitness, muscular fitness, flexibility, and body composition (Caspersen et al., 1985). Each of these components plays a crucial role in an athlete's overall performance and contributes significantly to their success. However, it is often observed that the focus of the strength and conditioning coach may not align perfectly with that of the technical coach. This misalignment can lead to a disjointed approach to training, where the development of physical fitness components is relegated to separate, dedicated sessions. For optimal results, it is essential that both coaches work in harmony to create a comprehensive training plan. This plan should incorporate both the technical and tactical aspects of the sport, as well as the physical fitness components. By doing so, they can ensure that the athlete receives a well-rounded training experience that effectively prepares them for the demands of their sport. Moreover, this integrated approach can lead to more efficient use of training time, as athletes can work on multiple aspects of their performance simultaneously. Ultimately, this can lead to improved performance outcomes and a higher level of athletic achievement.

Today, there is no distinction between a necessity and technology in the world we are in now (Guppy et al., 2023; Li et al., 2016; Windt et al., 2020). From fitness training to physical education in schools, from access to sport sites through technology services such as wearable trackers for workouts or coaching systems based on feedback from athletes themselves, they have become inseparable variants related to sports practicing. Athletes no longer rely solely on their instincts before running that next race as wearable technology has come up with sports analytics applications among other devices meant at making their work easier. These devices offer up-to-the-minute disclosures into different areas related to athletes' performance for example heart rates, distances covered and intensity levels. Athletes' training has seen a real revolution as a result of this vast information that is quickly accessible to us enabling them to be more analytical and precise in matters of health. However, is physical fitness improving as a result of this data?

The key lies in personalization (Hardy et al., 2015; Wackerhage & Schoenfeld, 2021). When such detailed information is available, trainers can customize workout routines depending on what individual athletes require in terms of capability and performance. Progress can be checked at any one time while necessary modifications may be made; thus making sure that an athlete remains in his/her best training form. Additionally, this data is utilized for averting injury through spotting signs like excessiveness as seen through trends on practice time and poor technique (Ghasem et al., 2021; Li et al., 2016; Quistberg, 2024). It could also assist in recuperation by yielding clues about how the body responds to different sorts of exercise (Temm et al., 2022). Basically, with technology in sports training one can expect improved physical conditioning through individualized quicker training that is also safe for health. There are prospects for future sports training where athletes will reach new heights instead of simply following their instincts.

Thinking about a ball. This small object complicates every sports training program, despite looking simple at first. We look specifically at those individuals that take Sport Science as a course; particularly at students therefrom who have a tough task of ensuring training sessions are effective essentially, creating a nightmare for the instructors. Throughout our research we analyze two distinct scenarios: one that involves the use of a ball and another that does not. These do not only vary in equipment; they are completely different training strategies, each having particular challenges and chances. When a ball is present, the unpredictable nature is introduced and forces oneself to physically get involved in addition to engaging with one's cognitive abilities. This means that there must be quickness as well as the

ability to move quickly at the same point in time that one needs to make decisions on what they want either. However, it should be noted that even when no balls are used during practice sessions; only concentration on increasing how fast an individual can run occurs rather than using any kind of mental strength. The inclusion of a ball during an athlete's training sessions could either speed up or slow down his or her progress, but whether it does any good at all remains largely unknown. This could revolutionize the creation of training programs because trainers will have new ideas on how to enhance athletic performance efficiently.

1. Methods

The challenging assignment of designing two distinct training sessions was given to the students specializing in Sport Science. These were designed for a group of 22 persons equipped with advanced GPS systems to monitor their performance metrics. The primary aim for both of the training sessions was to improve the speed of the participants, which is an important trait that leads to success in numerous sporting activities. However, the way this goal was achieved differed markedly across the two sessions. The training program designed a session having a ball. It was meant for the exercises to be more complex so that the speed was not the only aspect of focus for the participants but also the ball. In this way, it was aimed at copying actual game situations when players must move very fast yet still retain possession of the ball. Conversely, the second session was planned to exclude the use of the ball. Doing away with the ball was a way of having the participants concentrate on their speed only and not on ball control. By so doing, they were encouraged to see how fast they could go with none of the disruptions around them. Basically, in this research this was a unique situation of comparing and contrasting how effective was sprint training using these two different approaches. The results could provide significant knowledge on designing prospective training programs hence making athletes' performance better potentially.

The statistical analysis was performed using paired t-test to evaluate if any difference exists between time or distance spent above 16 km/h with and without a ball. Pearson's correlation was used to find any correlation between the maximal speed and the time, or the distance spent above 16 km/h without a ball.

2. Results

The prime focus of the training sessions was to increase participants' speed which is an essential aspect in most sports. When it comes to the results, they showed that people reached quite high maximal velocities that could make them go even faster under two different situations. For example, on average, people had run at speeds of 24.0±2.01 km/h when they were not using any balls during their training sessions while people had run at 21.4±1.80 km/h while practicing with balls. However, despite this positive result, there was a significant time difference above 16 km/h which the participants run. They spent 14.6±4.35 s running beyond this speed during ball less training as opposed to only 5.6±4.71 s when playing using such packing ($p<0.001$; Figure 1b). The relative distances covered above this velocity were similarly quite different, and 83.5±26.50 m were recorded without any balls while in possession of one they could only manage 31.1±24.00 m ($p<0.001$; Figure 1a). The time and distance covered at higher speed significantly reduced upon introduction of a ball in the training session. This means the players concentration might have been taken up by the ball such that they ended up running slowly for shorter distances.

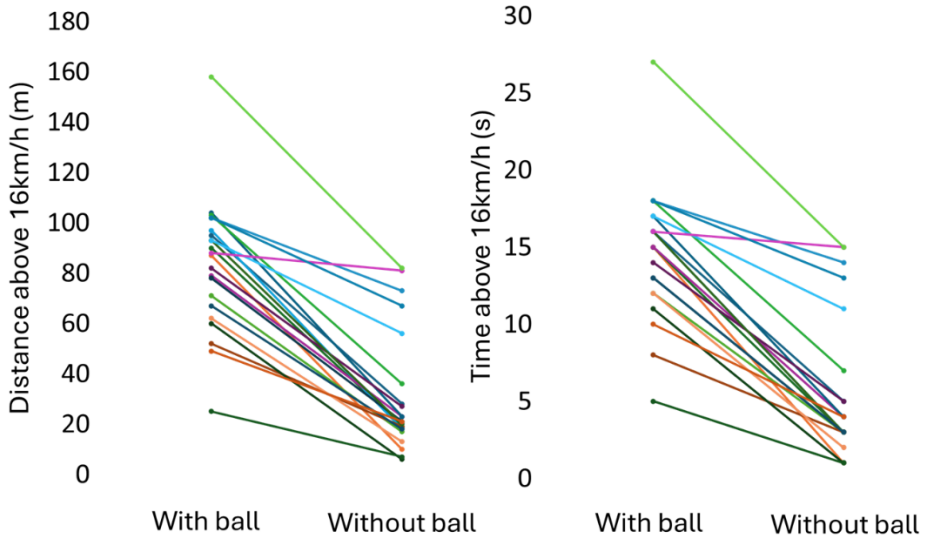

Figure 1. Distance (on the left, panel A) and Time (on the right, panel B) spent above the velocity threshold of 16 km/h. The line connects the result of each participant that perform the training with and without the ball.

Interestingly, the time or the distance run above the 16 km/h threshold with a ball did not correlate with the maximum speed achieved during the test without a ball

(r=0.035, p=0.877; r=0.064, p=0.779 respectively). This result implies that performance effectiveness substantially varies depending on the kind of test being undertaken, thus showing that it is not straightforward. It may, therefore, be argued that sport training is complicated while requiring one to understand detailed factors that affect an athlete during performance periods. In the long run it is important to give important attention when it comes to developing and adapting each year training program within the specific town aim for each competitor.

3. Discussion

This study report promising results related to training design. The participants run at nearly the same top speeds during training sessions whether the training was designed with a ball or without. It is unclear whether this celebrated finding contradicts previous research. It is suggested by previous research that peak velocity attained by a person is largely dependent on his or her own inherent physical characteristics, e.g., muscle fiber type; maximal oxygen uptake; firing rate of the motor unit involved in voluntary movement etc., rather than external factors like workout plan specifics (Bosco & Vittori, 1986; Figueiredo et al., 2021; Scott & Houmard, 1994). In light of this, despite the importance of the choice of training design, the maximum possibility of intrinsic speed development in a person could be closely, and sometimes uniquely, related to the person's individual genetic characteristics and properties. On the other hand, the features of the training help athletes and sport-persons to exploit their speediness fully. Hence it is paramount to consider the personal characteristics of the participants considering their physical fitness level and their possibility of development. This means that, regarding the exercise modality, changes related to its design, and the introduction of a specific sport tool such as the ball, may not affect the maximum speed an individual can achieve. This requires focusing on how best such inherent abilities can then be exploited other than interfering with styles used during other forms of exercise.

We uncovered something important in our speed up training research that made it more difficult for us to understand it. There was a noticeable reduction in the time spent running at speeds over 16 km/h when running around with a ball as part of the training program. This implies that including other items like a ball might greatly affect how quickly someone is able to run during the activity. This new understanding shows how complex this training is in terms of speed. It is not only

about testing the highest speeds someone can run, but also about managing other factors affecting performance. In this instance, participants seem to have spent short periods at such high running rates simply because they had to control a ball. Therefore, this result makes us reconsider traditional methods used for developing high-speed skills (Beato et al., 2021; Loturco et al., 2023). It stresses the need to incorporate sport-specific skills such as ball-handling in the training programs. Although such skills may make things more difficult sometimes and even prevent one from maintaining maximum velocity for too long periods, they also allow for better mimicry of the real-life situation characterizing competitions (Chuang et al., 2019).

We have found that the urgency of an appropriate design for training programs is emphasized in our study results. Specifically, such design must effectively blend the sport's physiological requirements with the necessary sport-specific skills. As the understanding of the various factors involved is not difficult, our research suggests that integrating these skills with speed training may not produce the anticipated results. This is a significant finding that questions the established norms and necessitates a comprehensive reappraisal of current practices of training. Our research shows a two-part approach is essential in training through three key aspects: that is separate physiological conditioning and personal skill development sessions. Therefore, the athlete's speed, strength, endurance can be improved in physiological conditioning sessions (Beattie et al., 2014). In contrast, skill development sessions would center on reinforcing an athlete's sport-specific abilities like, for instance, ball handling, technical decision-making, and technique. This approach ensures that every aspect of the athlete's performance gets the right amount of attention without one aspect being more important for the other. This in turn can pave way for improved performance.

This study demonstrates the remarkable promise of the application of GPS technology in sports, by providing exact results (Aughey, 2011; Theodoropoulos et al., 2020). This makes training more personal as it becomes possible for the sessions to be tailored around an athlete's individual requirements and capacities in terms of practice targets. In this regard, every athlete's personal requirements as well as their potential are taken into account when developing such a regimen. Using GPS technology provided data an athlete can get his speed, distance covered and patterns of movement. It is information that is really important when evaluating an athlete's present performance levels, monitoring his progress as time goes by and knowing where he needs to work on so as to improve himself. Furthermore, it can be used in creating workout programs for an athlete where he/she would be made

to work just below his/her ability level hence provoking improvement while at the same time preventing injury cases. Furthermore, the application of technology, for instance, GPS, in sports training, is consistent with a general move towards data based sports science (Aughey, 2011; Theodoropoulos et al., 2020). In doing so, the use of technology ensures that training becomes more efficient and effective since it has been used to ensure this happens. Hence, this implies that during training one can take a scientific minded standpoint based on facts and not intuition or guess work. Regarding technology integration in sports training, an increasing amount of studies propose it. This underlines how significant technology is in improving the efficiency and effectiveness of training. It also highlights a period that lies ahead such that technology together with data is intertwined in sports training processes hence fostering creativity as well as breaking human performance limits.

Conclusions

In sport science, we analyzed the results of training aimed at boosting speed by students. The study was meant to discover what happens when you use a ball for this activity as opposed to when you do not. The analysis disclosed that the maximum speeds attained by the trainees while running were almost indistinguishable in both cases such that presence or absence of a sphere made little difference. On the other hand, the addition of a ball in the training program resulted in reduction of time spent running beyond 16km/h. This may lead to a reconsideration of the goals of training. It therefore reveals that while enhancing speed, the emphasis should be laid on physiological requirements rather than mainly concentrating on sport-specific skills. The study not only indicated how GPS technology could be useful in athletics but also showed its enormous potential. Through offering precise instantaneous data, the GPS technology makes it possible for training to be personalized hence enabling sessions to be adapted to the specific needs as well as capabilities of every player. Nevertheless, it is pertinent to highlight that the conclusions reached in conducting this research may not apply in all settings. Thus, generalizability analysis purposes may be restricted by the limited number of people who volunteered themselves as respondents and by the test environment that was controlled. Overall, this study is an extraordinary step forward in sports science has led to the development of certain techniques of enhancing speed through training. The relevance of physiological demands when pitted against sport specific skills in structuring training regimens for speed enhancement is a new idea that it introduces. One way in which technology may revolutionize the way athletes train is through GPS technology.

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