

Sports Training

Developmental pathway routes to achieve expert performance in portuguese track and field athletes

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Abstract - Aim: The aim of this study was to characterize the developmental pathway undertaken by Portuguese expert track and field athletes considering the quantity and type of structured and unstructured activities. **Methods:** The sample was composed of 24 experts and 35 non-expert athletes who completed a questionnaire designed to gather information about their previous experiences in sports. **Results:** Results reveal key factors which distinguished expert from non-expert athletes' developmental pathway were related to a greater commitment within track and field in relation to years ($U = 251.000, p < 0.01$) and hours ($U = 212.500, p < .01$), as well as with the number of years spent in unstructured activities ($U = 284.500, p < .05$). Furthermore, a significant association ($\chi^2 = 27.131, p < 0.01$) was found between the number of unstructured activities practiced and an expert performance attainment. **Conclusions:** These findings revealed that more successfully track and field athletes had an early diversified pathway with greater involvement in structured and unstructured activities. Overall, the study provides an insight into the developmental pathway of Portuguese track and field athletes.

Keywords athlete development, deliberate practice, diversification, unstructured activities, expertise.

Introduction

The analysis of long-term athletic development has provided interesting features to promote more sustainable environments that support the athletes' expertise¹⁻⁴. Despite the lack of consensus in the concept of expert sport performance⁵, the available research highlights the playing level attained during the players' sports career as the ultimate criteria⁶⁻⁸. Hence, expertise is dependent on several interacting factors incorporated during the sport pathway^{9,10}. Accordingly, distinct pathways are usually highlighted in well-established development models⁸. Several theoretical models have been proposed, however, the Developmental Model of Sports Participation (DMSP) is considered more indicated since it provides clear assumptions and practical applications that are aligned with theories of youth development. The DMSP explains athlete development underpinned in three sport trajectories: i) recreational participation through early diversification and deliberate play; ii) elite performance attainment through an early diversification and deliberate play, and iii) elite performance attainment through an early specialization and deliberate practice^{11,12}. The early specialization pathway is associated with a commitment to one single sport from a young age and the activities practiced are

highly effortful, specific, and structured (i.e., deliberate practice). On the other hand, early diversification includes the involvement in several sports, during the early years of development, in which the activities are less structured (i.e., deliberate play)^{11,13}. Indeed, deliberate play promotes fun and enjoyment activities which are proposed to lead to higher intrinsic motivation and possibly prevent an early sport dropout^{14,15}. This developmental sport pathway allows the experience of several environments that stimulate physical, cognitive, affective, and psychosocial aspects, as well as promotes a higher movement exploration, which is considered fertile ground to trigger creative behaviours¹⁶⁻¹⁸.

In this vein, one of several criteria used to differentiate the previous pathways are related to the early structure of practice. Thus, the structured sports activities are recognized as formal adult-led practices, including all kinds of organized training and direct instruction, which are intended to lead to explicit learning and skills acquisition^{19,20}. On the other hand, unstructured sports activities include informal youth-led activities such as street games (i.e., football and basketball), backyard activities, and school playground play²¹. These types of activities provide an opportunity for children to spend time together and have fun by playing games, which are normally freely

created and adapted to different environments. The singular form of these activities leads children to create, adapt and negotiate rules, which stimulates the development of important characteristics, such as innovation, creativity, adaptability, and flexibility²²⁻²⁴. Considering this line of reasoning, Côté and colleagues^{11,12} suggest a balance between both types of practices, mostly unstructured during early years, with the proportion of structured hours gradually increasing. Despite the evident importance of unstructured activities, little attention has been given to their benefits in athlete development and expertise achievement²¹.

Considering the previous assumptions, researchers have been debating on the benefits of diversified practice and unstructured activities' involvement, during the early years, in the ability to recognise patterns of play and promote skills transfer across sports²⁵⁻²⁷. This possible transfer derived from an early diversification commitment, which may lead to greater learning and adaptive ratings displayed by the athletes in advanced sports requirements. Accordingly, Santos and collaborators²⁸ research intended to understand the magnitude of the effects of a specific training program on the development of motor, technical and tactical skills when accounting with different sport pathways (specialized or diversified). Results revealed that early diversification displays the most significant benefits when compared to the specialization path, providing evidence of how sports experiences affect skill acquisition in adulthood. Furthermore, Güllich's study²⁹ emphasizes the early diversified practice benefits in learning experiences and the boost of long-term acquisition among international medallists. Evidence has demonstrated that early diversification can lead to expert performance and also provide additional outcomes, such as a higher likelihood for continued sport participation during one's lifespan and a more well-sustained personal development³⁰⁻³³. Alternatively, there is a growing concern that early specialization may lead to dropout or burnout of sports practice^{34,35}, as well as the athletes' propensity for injuries is higher due to excessive movement repetition^{32,36,37}.

In this line of reasoning, as supported by the European Athletics Report³⁸ the youth Portuguese track and field athletes' background are commonly enrooted in several disciplines related to athletics before their specialization. Portuguese Athletics Federation has enjoyed relative success in youth programs and many talented athletes have emerged from the ranks. Hence, there is a need to specifically explore the previous sports experiences and training structure of Portuguese track and field athletes towards to better understand the integrated factors that contribute to their development. Using retrospective methodologies in this type of research have contributed to important advances in the field³⁹. Thus, understanding the developmental activities of expert and non-expert Portuguese track and field athletes will reinforce the con-

sistency and robust findings within the very top margin of the success continuum. Consequently, this study aimed to characterize the developmental pathway undertaken by expert Portuguese track and field athletes considering the quantity and type of structured and unstructured activities. Based on theoretical evidence, it was expected that experts spent more time on structured and unstructured activities, compared to the non-expert track and field athletes.

Method

Participants

The sample was composed of fifty-nine Portuguese male and female Track and Field athletes who participated in the 2014, 2015, and/or 2016 National Championships. The non-expert group was composed of thirteen female and twenty-two male participants ($n = 35$; age: 21.8 ± 2.5 years old; 5.5 ± 2.2 years of experience) included athletes who never reached the first eight places in these competitions and the expert group composed of 13 female and 11 male participants ($n = 24$; 24.5 ± 3.3 years old; 7.6 ± 3.2 years of experience) was composed of 24 athletes who reached the podium, at least twice, between 2014-2016 National Championships at the time of data collection. Thus, the main criteria used to select the athletes were related to the place obtained in several National Championships. Participants received a clear explanation of the nature and the demands of the study and completed an informed consent prior to testing. The study protocol was approved and followed the guidelines stated by the local Institutional Research Ethics Committee (UID/DTP/04045/2019) and according to the recommendations of the Declaration of Helsinki.

Procedures

In order to examine the sports path of Portuguese track and field athletes, the procedure included an adapted questionnaire designed to collect information on the acquisition of high-level performance in sport validated by Leite, Baker, and Sampaio⁴⁰, supported on the Côté and collaborators³⁹ assumptions about general issues related to experiences across sports career. Each participant completed a questionnaire designed to gather qualitative and quantitative information about their previous sports experiences under supervision. The researchers provided a brief explanation of the questionnaire and its completion was designed to take 30 to 60 minutes, according to the level of the athlete, in a quiet environment. The questionnaire was intended to obtain detailed information regarding, i) main sport starting age: age at starting track and field practice; ii) Age of sports initiation: the age of beginning and cessation of practice involved in other sports; iii) specialization age: age at exclusive specialization in track and field; iv) number and amount of time

spent in unstructured activities such as, playing street football or spontaneous practice; v) number and amount of time spent in structured activities or other sports (formal adult-led sports activities that include all kinds of organized training), and vi) type of structured activities taking into consideration individual, collective and combined sports in a year-by-year description. Following this procedure, a detailed examination of the participants' sports career was obtained considering the DMSP guidelines, as athletes progress through the sampling stage (6-12 years old); specialising stage (13-15 years), and investment stage (16-19 years)⁴¹.

Statistical analysis

The Kolmogorov-Smirnov test was used to verify the normal distribution of variables. The *t*-test was applied to compare groups with normal distribution and the Mann-Whitney test was used with a non-normal distribution of the variables. Measurements with categorical variables (presented in Table 1) were expressed as percentages (%) and analysed using the chi-square test (χ^2). All data were analysed with the statistical package SPSS for Windows, version 21 (SPSS Inc., Chicago, IL). The level of statistical significance was set at $p < 0.05$.

Results

Descriptive statistics for the track and field and age of sports initiation, specialization age, years and amount of practice in track and field, other sports, and unstructured activities are presented in Table 1. Regarding the age of sports initiation, track and field starting age, and specialization age, no differences were found between the expert and non-expert groups. However, the Mann-Whitney test results demonstrated significant differences in the number of years committed with track and field ($U = 251.000$, $p < 0.01$) for the expert group, and, consequently, the number of total hours spent on the track and field was also higher in this group ($U = 212.500$, $p < 0.01$). In addition,

the previous trend was similar regarding the unstructured activities analysis, since the expert group spent more years in these type of activities ($U = 284.500$, $p < 0.05$). These results reveal that expert athletes invest more years and time in the track and field, as well as, spent more years involved in unstructured activities. Despite the lack of statistically significant results, the total number of hours spent in unstructured activities disclose a disparity between both groups, in which, the expert athletes largely accumulated more hours.

Descriptive statistics, for the type and number of non-specific and unstructured activities practiced during the sports career, are presented in Table 2. Despite the lack of statistically significant differences in the type and number of other sports practiced by the expert and non-expert athletes, a significant association ($\chi^2 = 27.131$, $p < 0.01$) was found between the number of unstructured activities practiced and an expert performance attainment.

Discussion and Conclusions

This study aimed to characterize the developmental pathway of Portuguese expert track and field athletes considering the quantity and type of structured and unstructured activities. Results showed that expert athletes practice more years and dedicate more hours to track and field training, as well as spent more years practicing a higher number of unstructured activities comparatively to the non-experts' counterparts.

Analysis of age structure of the track and field career and volume of activity types among expert and non-expert revealed that the sport starting age was around the age of 10, and they started to practice track and field when they were 14 years old. Furthermore, both groups specialized in track and field at 17. This is consistent with the recent Gullich's⁴² study, which revealed that the German expert track and field pathway is characterized by an early start in other sports, at age of 9, in track and field, at age of 10, with a specialization at age of 16. Considering the practice

Table 1 - Descriptive and inferential statistics for the sport career milestones (mean, SD, minimum and maximum in years of age) for the expert and non-expert track and field athletes.

Variables	Expert (n = 24) (M ± SD)	Non-Expert (n = 35) (M ± SD)	p	test
Sport starting age	10.13 ± 4.32 [5-18]	11.09 ± 4.20 [5-21]	0.397	t = -0.853
Main sport starting age	14.08 ± 2.62 [8-19]	14.51 ± 2.94 [7-21]	0.566	t = -0.577
Specialization age	17.29 ± 2.24 [13-21]	16.66 ± 1.70 [14-21]	0.220	t = 1.239
Years in the specific sport	7.58 ± 3.17 [3-18]	5.51 ± 2.20 [2-10]	0.009*	U = 251.000
Total hours in the main sport	6383.50 ± 4103.90 [2250-20328]	3484.44 ± 1743.11 [768-7056]	0.001*	U = 212.500
Years practicing non-specific sports	7.26 ± 3.94 [1-16]	6.97 ± 3.13 [1-13]	0.755	t = 0.313
Total hours of non-specific sports	2285.35 ± 1611.29 [63-5964]	2438.48 ± 1665.78 [126-7602]	0.727	t = -0.351
Years of unstructured activities	7.71 ± 3.84 [4-21]	5.72 ± 3.24 [1-13]	0.035*	U = 284.500
Total hours in unstructured activities	3451.04 ± 3992.32 [300-15050]	1872.00 ± 1576.32 [150-7500]	0.142	U = 325.500

*Significant differences at $p < 0.05$.

Table 2 - Descriptive and inferential statistics for type and number of practice sports (frequency and %) for the expert and non-expert track and field athletes.

Variables		Expert (n = 24) Freq. (%)	Non-Expert (n = 35) Freq. (%)	p	χ^2
Types of non-specific sports	Individual	12 (50)	15 (46.9)	0.629	0.927
	Group	2 (8.3)	1 (3.1)		
	Combined	10 (41.7)	16 (50)		
Number of non-specific sports	0	0 (0)	3 (8.6)	0.327	3.450
	1	5 (20.8)	9 (25.7)		
	2	8 (33.3)	13 (37.1)		
	> 3	11 (45.8)	10 (28.6)		
Number of unstructured activities	0	0 (0)	14 (40)	0.000*	27.131
	1	4 (16.7)	13 (37.1)		
	2	11 (45.8)	8 (22.9)		
	> 3	9 (37.5)	0 (0)		

*Significant differences at $p < 0.05$.

of additional sports between expert and non-expert, the results of the Portuguese athletes were quite similar, since the experts practiced other sports for 7 years and accumulated around 2,400 hours of experience. In fact, they also practiced their main sport for several years, as well as unstructured activities. However, the accumulated hours were distinct between experts (track and field: 6.300 hours; unstructured: 3.400 hours) and non-experts (track and field: 3.400 hours; unstructured: 1.800 hours) groups. Therefore, the analysis clearly showed that the track and field athletes had an early diversified type of sport involvement with greater participation in unstructured activities. Similar findings were found by Huxley and collaborators⁴³, confirming that most track and field athletes had a diversified path without specialized in intense training until the 17 years old (investment stage). These findings provide further support to the DMSP model recommendation, taking into consideration the commitment with several sports sustained upon unstructured activities during the early years^{11,12,41}. In fact, substantial literature claims that an early diversification is a suitable pathway to excel at higher levels of performance⁴⁴⁻⁴⁶. The commitment to an early diversification, commonly supported in unstructured activities, is typically connected to several beneficial outcomes, related to the boost of physical literacy (fundamental movements), where important athletic skills such as running, jumping, and throwing are stressed and, consequently, it is associated with a prolonged engagement in sports practice. This type of enrichment environment also fosters intrinsic motivation for later investment in the track and field with more structured requirements. Moreover, it also favours the perceptual-motor skills, physical conditioning, psychological, motor, and behaviour transfer, and reduces susceptibility to over-use injury^{1,29,36,37}.

The number and years committed with unstructured activities emerged as a key factor, which usually distin-

guishes the pathway between experts and non-expert track and field athletes as demonstrated in the Huxley and collaborators^{43,47} studies. Both recommended that early diversification leads to greater success and longevity of the athletes. As previously mentioned, unstructured activities provide more opportunities to learn since children are completely free to explore the surrounding environment^{3,12,14,15,28}. Usually, this type of activity allows for children to play with greater skill and older peers, which may act as important role models²¹. In an attempt to promote such diversified environments, a recent study conducted by Cumming and collaborators⁴⁸ analysed children's experience participating in a bio-banded tournament. While the youngest ones emphasized the physical effort and the necessity to constantly adapt their technique and tactics to overcome their opponents, the oldest highlighted the opportunity to explore their skills; nevertheless, all age groups described it as an extremely positive experience. This exposure provides several experiences and stimuli for children, allowing them to adapt to unpredictable situations in a range of different environments^{22,49,50}. In the Coutinho and collaborators study²¹, several expert volleyball players were submitted to an extensive interview regarding previous sports experiences, and they highlighted the importance of unstructured activities to develop physical, technical, tactical, cognitive, and emotional skills throughout their careers. In this line of reasoning, the current findings demonstrate that the majority of track and field expert athletes were committed to more than three or with at least two unstructured activities, while the non-expert athletes were mostly dedicated to none or only one activity. According to social learning theory⁵¹, children's first experiences in the sport will later shape the type of commitment in a long-term perspective. Considering the benefits of unstructured activities for the athlete's development, sports policies and stakeholders should be aware and

adopt proper strategies to foster these experiences during the early years providing better facilities and equipment's in outdoor spaces where children can play safely, as well as increase the awareness of coaches, teachers, and parents about the related benefits.

Additionally, the expert track and field athletes dedicated more time to their specialization domain when compared to non-expert athletes. These results clearly demonstrate that expert players can attain higher levels of performance with 6,000 hours of practice, which are consistent with current literature^{6,7,11,20,40}. Furthermore, these findings indicate a relationship between sport specific practice and expertise attainment^{7,10,20,33}. Recent studies emphasize the importance of practice quality over quantity since during the early years the hours necessary to attain expertise can be accumulated in non-specific sports and unstructured activities, suggesting a functional role in the developmental path. Despite both groups corresponding to the trajectory of early diversification, the expert athletes also accumulated more hours in a specific practice. However, these results should be interpreted with caution since the expert group is older than the non-experts, possibly they are still progressing. In this vein, coaches should promote a diversified path, favouring the unstructured activities during the first phases, and, later on, move towards more structured and specific practices.

Study limitations

Nevertheless, a limitation of this study is related to the information being gathered through retrospective methodologies, since it only provides a rough explanation of athletes' path trajectory and the recall is associated with a few imprecisions³⁹. To reduce the retrospective bias, the information obtained should be triangulated with coaches' and parents' statements, and also repeating the questionnaire at different periods to obtain a more accurate data analysis. Otherwise, recent research has highlighted the importance of a contextual analysis towards examining the athletes' microstructure of practice and other relevant factors (i.e., coaches and teammates' behaviours), that can affect the sport performance²¹. The examination of the developmental context encompasses a more holistic and sustainable approach. In forthcoming studies, it would be important to address the specific impact of unstructured activities on athletes' performance by obtaining detailed information on this type of activities.

Practical application

From a practical perspective, physical education teachers, coaches, parents, and sport system should provide, during the early years, enrichment environments that promote interaction of unstructured activities with specific practice in order to facilitate the long-term attainment of expertise. These findings reinforced the theoretical assumptions that diversification may lead to several

advantages in later sports performance and contribute to the understanding of expert Portuguese track and field athletes' developmental pathway. Further, also may act as a clarification on the sport pathway that should be implemented and used as a recommendation to sustain the athlete's practice.

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