A Retrospective Study of the Results of the Best Portuguese Female Gymnasts in a Period of 40 Years

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Abstract   The main objective of this study was to determine whether the Portuguese female gymnasts who achieved the highest results at senior level had also obtained results equally important in the early stages of their sporting careers, looking further to analyze the possible relation between those results would be different depending on the representativeness of the results achieved in seniors. Additionally, it also was purpose of this study to examine the longevity of their sporting careers, considering the times in which they obtained their first and the latest high-level sport results. To this end, it were analyzed the paths of all female gymnasts (n = 67) who represented the national team of Portugal in official competitions at senior level between 1971 and 2011 and formed three groups, depending on the highest level of international competition they represented Portugal. In general, when considering the results of all the gymnasts seemed evident that, throughout their different stages of their sport careers, almost all succeeded places in the top six places in the overall classification of nationwide competitions in all age groups. However, the results also showed that athletes who have reached the highest sport results in the highest stage of their careers (i.e., participating in the Olympic Games) had already obtained better results than their competitors at the beginning of their careers. Similarly, it was found that the sports careers of these athletes showed the longest periods between the first and the last high level sports results. These results seem therefore stress the importance of paying attention to athletes who excel early, as well as for the benefit of developing programs for detection and selection of talent in early ages, at least in artistic gymnastics. However, it is also important to alert to the need to know precisely how many are the gymnasts who, despite having shown talent at an early stage of their sporting careers, achieving outstanding sporting results, cannot later maintain that athletic performance in later stages of their careers.

Keywords   Female Artistic Gymnastics, Sport Results, Talent and Excellence

1. Introduction

The increasing recognition of the multiple benefits of physical activity and sport in the populations has led to policymakers in many countries to gradually place its promotion as one of the central points of their agendas and action programs. However, the importance assumed by sport, such as the demand for the highest performances and results, also spreads to other areas and occupies a prominent place in the priorities of politicians, for other reasons. For example, it is particularly evident that almost all countries have sought, over time, to gain prestige and international recognition through the sporting results of their athletes and teams in competitions of greater importance and significance.

In this sense, cannot be regarded as surprising that the debate on how to better identify the sports, teams or athletes that may get better international sports results and

consequent prestigious is intense and is permanently on the agenda of the bodies and organizations responsible for the sport development in each country. Thus, the problem of the identification and development of individual talent in the field of sport to its highest expression, with the search for understanding the characteristics that are the basis of a performance of merit to establish itself as a cornerstone of sport science[2]. Indeed, particularly in situations of searching for the highest sports performance, it appears common sense not to waste human and financial investment with athletes who do not meet the criteria required to achieve the desired sporting success.

However, currently it also seems that the existence of talent, required as a basic condition, is not sufficient to achieve success, being also determinant the existence of a correct and efficient technical support so that the talent can evolve as much as possible[6]. In this context, it seems relevant, at an early stage of young athletes' sporting careers, to effectively identify those who have   the characteristics needed to meet the demands of that particular sport, as well as to ensure that they benefit from a training process that provides all the conditions to help them attaining their sport

potential in order to later achieve high levels of sports success[20].

On the other side, but still in this regard, it is also important to take into account that the available empirical evidence suggests that some of the highest levels of sporting success only happen after 8-12 years of practice, equivalent to about 10.000 hours of training, properly oriented for this purpose[5, 13, 14].

Therefore, it emerges the importance of managing a process that, in addition to requiring a high dedication by athletes that exhibit remarkable talent, it also requires along-term involvement in this process on their part. In this context, becomes the question about the importance for these athletes to achieve early, or not, high sports results. This comes in line with what was found in a study by Carlson[11] with tennis players, which identified a correspondence between the results obtained by the players at the time they were between 12 and 14 years of age and their later results, at senior level. Nevertheless, there is an increasing number of authors who question the existence of this correspondence between results obtained in the early sporting career and senior level[3, 4, 7 9, 12, 15, 17, 18, 21]. Hahn[17] defends that only 10-20% of athletes who excel at younger ages achieve competitive elite level at a senior age.

It seems, therefore, not yet answered the question raised earlier about the importance of achieving high sports results at earlier stages of the athlete's career, which may not be indifferent to the choice from the technical and sporting organizations, continuing to emphasize the need to identify as early as possible, the athletes in whom they will focus all their attention and support, using for this purpose in most cases, the athletes' sporting results obtained in the competitions they participate in.

Previous studies that have investigated this issue also indicate that the magnitude of the relationship between the results obtained early in young ages and adulthood depends on the type of sport. Aspects such as, for example, the age of attainment of maximum performance, or the type of factors (biological, technical, tactical and psychological) that have the most impact on achieving this performance seem to play an important role in this regard. Therefore, it seems to be a precipitation to generalize to all sports what have been found in sports that often do not show great similarities between them. Moreover, in studies in which these issues were analysed simultaneously in different sports[3, 4] was evident the existence of clear differences in this area.

In this sense, it is important to extend such studies to a wider range of sports, so that, based on a wider and representative knowledge of the existing diversity, it would be possible to get a more correct and based perspective of this subject. And, in this context, it's important to highlight the lack of studies with gymnastic athletes.

Indeed, the artistic gymnastics is one of the oldest sports, being part of the cast of Olympic events since the first Olympic Games and mingling sometimes with other events of social nature (e.g., views of groups), artistic (e.g., activities circus) or school (e.g., physical education). Being a sport with its own characteristics, its practice is usually started at a very young age, between 6 and 8 years[8, 16], and being also one of the sports in which the highest performance levels are reached earlier, between 15 and 17 years of age[2].

As underlined by Baker and Côté[2], in artistic gymnastics early specialization is a normal occurrence, to which will certainly contribute the number of hours of weekly training (usually three to four times higher than what is common to see in athletes of other sports, such as the team sports) but also the fact that the performance is more dependent from variables such as speed/quickness, flexibility, strength, and motor coordination (whose peaks occur early in life) when compared to what is seen in other sports, as it has been highlighted before by Schulz and Curnow[19]. Additionally, the aesthetical high demands usually lead to the highest scores being achieved before the end of the biological maturation process.

This results, therefore, that in general gymnastic careers, having a smaller lifespan, present different characteristics from the other sports, with natural implications regarding the need to manage this process, namely in respect to the issues earlier discussed.

Considering all the aspects previously discussed, the present study sought to examine if the Portuguese female gymnasts who achieved the highest results at senior age level, had also achieved outstanding sporting results during their sport development process. It was also purpose of this study to investigate if there whether the association between the results obtained at the beginning and at the peak of sporting careers would vary according to the representativeness of the results achieved at senior level. Additionally, another purpose of this study was to examine the longevity of their sporting careers, especially from the time they achieved their first high level results.

2. Methods

Initially, the results of all female athletes enrolled in the Portuguese Federation of Gymnastics (PFG) who participated in national and international official events, between 1971 and 2011 were analysed. However, and considering the objectives of this study, only results of the 67 gymnasts who represented the Portuguese senior national team in official competitions during that period were included in the analyses.

Also in accordance with the objectives defined for this study, those 67 gymnasts (which correspond to all the gymnasts who integrated the senior national teams during the study period; i.e., they constitute the total population) were distributed in three groups depending on the highest level of international competitions they competed in:

i) the group of the gymnasts (n=3) who participated in Olympic Games, identified in this study as 'OG';

ii) the group of the gymnasts (n=24) who did not participate in Olympic Games, but participated in World and/or European Championships, identified in this study as 'WC/EC';

iii) the group of the gymnasts (n=40) who did not participate in Olympic Games, World or European Championships, but participated in other Official International Competitions identified in this study as 'OIC'.

The constitution of these three groups was based on the recognition that the requirement criteria adopted for the selection of athletes that comprise the national teams participating in those competitions are distinct: i.e., while to participate in the Olympic Games, in addition to the criteria approved by the PFG, the gymnasts also have to be subjected to screening trials performed by the Fédération Internationale de Gymnastique (FIG) competitions, whereas to participate in WC/EC, or in other OIC, they only have to comply with the requirements defined by PFG. Yet, the demands placed by the PFG in the selection process of athletes to participate in WC/EC are much higher than the demands placed for participating in other OIC.

All theoutstanding results of the 67 athletes identified were retrospectively analysed, including national competitions, particularly those who were within the first 6 places of the overall classification in each age group (it was defined the 6th place as the minimum rank position to be considered because 6 is the number of gymnasts necessary to constitute a team for a large part of the time period covered in this study) and international (in this case, it was decided to consider all the participations in official international competitions, regardless of the final rank achieved).
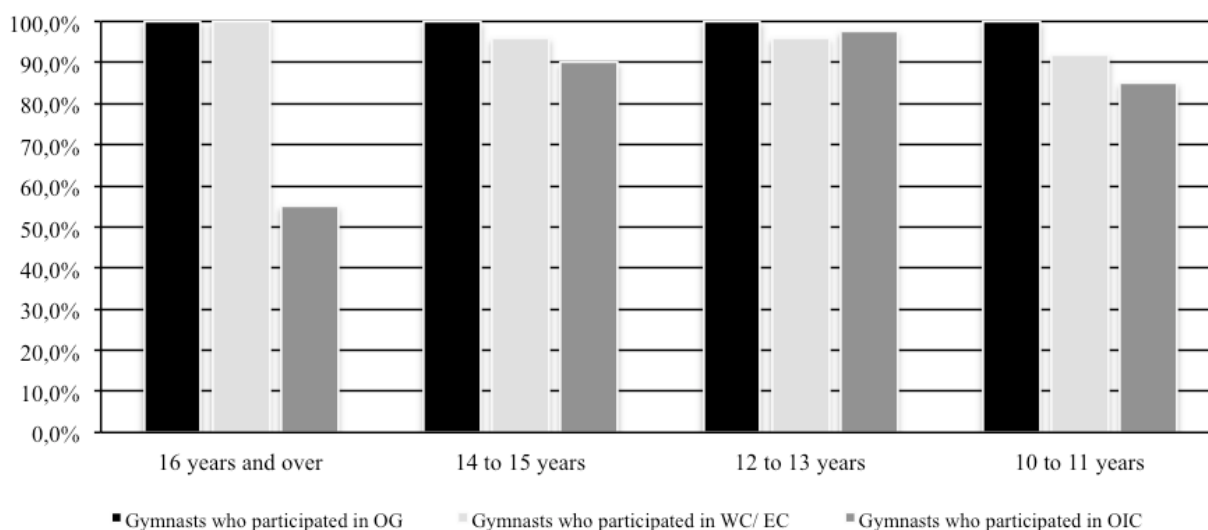
Finally, for purposes of determining the longevity of the successful careers of the gymnasts whose results were analysed in this study, the dates they obtained the first and last performance that meets the criteria presented abovewere considered.

3. Results

Table 1. Rank positions achieved by the gymnaststhroughout their careers in the official national competitions, by age group

Age group		10 -11 years			12 -13 years			14 -15 years			16+ years		
Ranking		1st	Podium	'till 6th	1st	Podium	'till 6th	1st	Podium	'till 6th	1st	Podium	'till 6th
Gymnasts who participated in OG	n	2	1	0	3	0	0	3	0	0	3	0	0
(n=3)	%	66,7%	33,3%	0,0%	100%	0,0%	0,0%	100%	0,0%	0,0%	100%	0,0%	0,0%
Gymnasts who participated in WC/EC	n	4	9	9	16	7	0	12	10	1	11	13	0
(n=24)	%	16,7%	37,5%	37,5%	66,7%	29,2%	0,0%	50,0%	41,7%	4,2%	45,8%	54,2%	0,0%
Gymnasts who participated in OIC	n	9	12	13	21	14	4	19	11	6	4	8	10
(n=40)	%	22,5%	30,0%	32,5%	52,5%	35,0%	10,0%	47,5%	27,5%	15,0%	10,0%	20,0%	25,0%

Note: OG: Olympic Games; WC/ EC: World Championships/ European Championships; OIC: Official International Competitions

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Figure 1. Percentage of gymnasts ranked in the first 6st in the official nationwide competitions along their careers, by group

The analysis of the paths of the 3 gymnasts who represented Portugal at the Olympic Games (see Table 1), show above all the fact that all they have achieved, since the beginning of their competitive career, results that we consider as reference. Indeed, all the gymnasts who participated in the OG had achieved, from the age of 12, first place at least once, in the overall individual classification in nationwide competitions at all ages. Furthermore, also at the initial level (i.e., between 10-11 years), two of these gymnasts achieved the first place in the overall individual rankings, and the other achieved a podium position (i.e., in both places immediately following; to note that this gymnast, who failed to get at least a first place in the overall individual position at that age group, was a contemporary of one of the other two gymnasts also later participating in the Olympic Games, with who she lost in that category).

Similarly, the analysis of the competitive paths of the gymnasts who did not participate in the Olympic Games but represented Portugal at the World and/or Europe Championships revealed that most of those gymnasts had been classified in the first six places of the overall classification of the official nationwide competitions in all age groups. More, if considered only the categories of juveniles (ie, 12-13 years) and following, was evident that over 90% of them reached even one of the top 3 spots of the overall classifications, if only just over half have achieved the first place.

Finally, in the case of the group of gymnasts who only represented Portugal in official international competitions other than the Olympic Games, World or Europe Championships, the reality is slightly different, because the percentage of gymnasts who, throughout their sport development process, achieved such high results, particularly with regard to the first, or even the first three places, in the overall classifications, is slightly lower than for the gymnasts of the other two groups. More specifically, only half of this group of gymnasts achieved at least a first place in the overall classifications of the nationwide competitions between ages of 12 and 15 years, and in the other two levels the proportion was clearly lower: while in the initial category only 2 out of 10 achieved it, later, in the
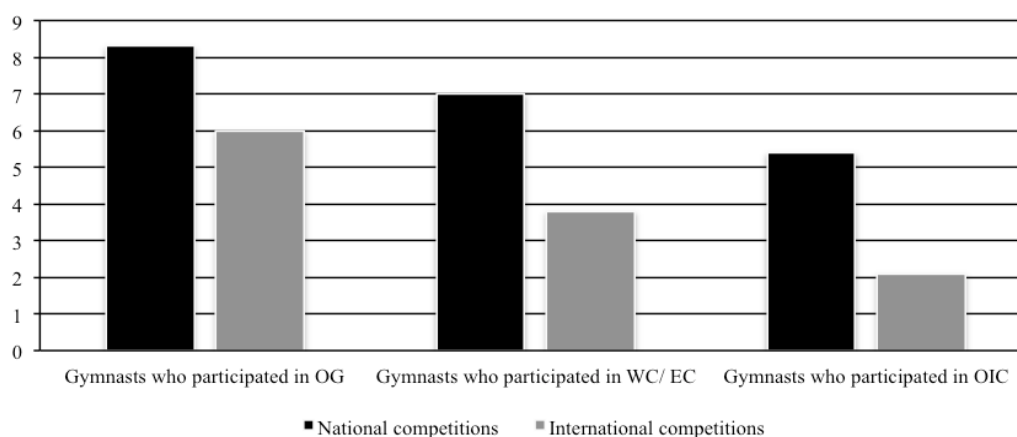
senior category, this was achieved by only 1 in 10. Similarly, when considering the first three places in the overall classification, and not only the first, the percentages are naturally higher, but still lower than that found in the first two groups. Thus, even in the intermediate age group (i.e., in the 12-13 and 14-15 years) the percentage does not reach 90%, being significantly lower than in the other two age levels: approximately 50% in the first age group and 30% in the senior level.

Still, considering the percentage of the gymnasts in this group who obtained, along their stages of formation, a place among the first six of the overall classifications, then the values are quite high, varying between 85% and 97.5%, and decreasing only (to just over 50%) in the senior level.

In summary, when considering the results of the gymnasts of the three groups, it seems evident that almost all of them, during their sport development process, achieved rank positions in the top six places in the overall classifications of official nationwide competitions in all age groups.

However, it also seems clear that, while the gymnasts who later participated in the Olympic Games obtained consistently from the beginning of their competitive careers, the first place in national competitions in which they participated and those who, not having qualified for the Olympic Games but having participated in the World and/ or Europe Championships, in general qualified in the top three of the national competitions in which they were competing, the gymnasts who represented Portugal only in official international competitions other than those mentioned above, overall, had lower ranking positions, particularly from the 12 years of age.

Regarding the analysis of longevity of the successful paths of the gymnasts in this study (see Figure 2), it was clear that longer periods of time between getting the first and last relevant sport results corresponded to the group of the gymnasts who participated at the Olympic Games, followed by the group of gymnasts who did not participate in the Olympic Games but represented Portugal at the World and/ or Europe Championships, and finally the group of gymnasts who only participated in other official international competitions.

Note: OG: Olympic Games; WC/ EC: World Championships/ European Championships; OIC: Official International Competitions

Figure 2. Longevity of the successful paths of the gymnasts of the three groups

4. Discussion

The analysis of the results found in this study emphasizes above all that the gymnasts who reached the highest sport results in the senior level, representing Portugal in the most important international competitions, distinguished themselves from their peers since the beginning of their competitive careers, invariably getting the first places of the national competitions they competed in.

Therefore, these results are very different than what has been reported in other studies that used relatively similar methodologies to analyse the paths of athletes from other sports, both in Portugal[3, 4, 9] and abroad[12, 18, 21], which showed that only a relatively small percentage of athletes who get the best results at senior level was also among the best at the start of their sporting careers.

However, it is also important to remember that, well before the present study, also Carlson[11] and Cafruni, Gaya and Marques[10] reported having found some association between results obtained at senior and at youth levels, with the latter study including female artistic gymnasts.

Actually, is important to recognize in this context that artistic gymnastics is a sport with very specific characteristics, distinguishing itself from most other sports, namely because the longevity of sporting careers is usually lower, starting early but also reaching its peak performance at a still young ages.

Therefore, it is expected that the percentage of athletes who reach high levels of athletic performance in both initial and final phases of their sports careers is substantially higher than that observed for sports with a different profile.

In addition, these results seem to provide arguments that advocate the importance of talent identification and selection programs at early ages, in the line with what was done for many years, with some success, by Eastern European countries, such as the German Democratic Republic, the Soviet Union, Romania, Bulgaria, and, more recently, in Australia, China and the United States.

In fact, there are many countries that have adopted specific programs of talent identification and development and among which we may highlight, recently developed by Australia for the Sydney Olympic Games in 2000, and England, for the London Olympic Games in 2012. Even in Australia, the way a comprehensive program of talent identification and development was developed and implemented, resulted in an overall improvement of 27 to 41 medals from 1992 to 1996, and to 58 in 2000; i.e., an increase of 114% in only eight years[2].

The sooner the athletes are identified the more potential they have to perform at a particular sport, since more possibilities exist that their skills development process becomes more sustained and more predictably successful.

However, it is important to remember that not always the identification of an athlete with high potential is followed by his/her full and effective development towards sporting excellence. Indeed, there are multiple evidences that many athletes who exhibited higher levels of performance in the early stages of their sporting careers do not come back later to achieve similar results[3, 4, 7, 9, 12, 15, 17, 18, 21].

In this context, we believe that for a better understanding of this subject, it would be important to access another information, such as the percentage of gymnasts who, having obtained high results in the early stage of their careers, fail to achieve similar results at senior level.

In fact, the information in this study allows us to understand to what extent the 'radar' in the artistic gymnastics is effective; i.e., notice that the system (i.e. coaches, managers, officials, clubs, etc.) is able to detect early enough, the gymnasts who have the necessary requirements to achieve a high competitive level at senior level.

However, other information that we consider to be equally important to gather, will allow us to realize the effectiveness of the system of talent development towards attaining excellence; i.e., realizing the capability of the system to help the gymnasts who get high levels of performance in the starting stages of their careers to fully develop their skills in order to continue achieving high levels of performance at senior level.

Analyzing the results of this study, it is possible to realise that it in the case of athletes who achieved the highest sports results in seniors, because they achieved it from the beginning of their careers, which is why it was also clear that the longevity of their careers (indexed to the achievement of high levels of performance) was also higher than that of their colleagues.

As mentioned earlier, these data are different from the one found in other studies with athletes of different sports, which have shown that a large proportion of athletes who reach the highest levels of performance in senior was indistinguishable from their colleagues at the beginning of their sport careers.

In this sense, there is some support for the usefulness of talent detection systems in artistic gymnastics, since it was clear that all athletes who competed in the senior national team at the highest competitive level (i.e., Olympic Games) were identified (i.e., began to stand out from their peers) at an early stage of their careers, and there was no one that had achieved it in a later stage of her career.

However, as also mentioned earlier, it will also be important to determine how many other female gymnasts with similar potential (i.e., which also have obtained better sport results than their colleagues in the early stage of their careers) failed, for one reason or another, to develop that potential and get high sport results throughout their sport careers and, if possible, also try to understand the reasons why this has happened.

Furthermore, we believe that it is also important to try to understand if this reality is limited to Portugal, or resemble that of other countries.

Indeed, regardless of this study having included all athletes who represented Portugal in official international competitions (including European and World Championships and Olympic Games) in a very extended period of time, the fact remains that Portugal isn't a world

reference in the field of the artistic gymnastics and this may have also influenced the results of this study.

For example, the absence of a high level competition at an early stage of their careers may have allowed the athletes who earlier revealed a high potential to benefit from increased support in developing their sporting careers while also creating the foundation for the longevity of careers of these athletes were superior to the athletes who just revealed their potential later.

To be true this hypothesis, it would be important to alert coaches and sports officials to the possibility that concentration of attention and support in the athletes who stand out sooner might impact negatively the development of other athletes with similar potential, or even higher, but who achieve it later.

On the other hand, if the results found in this study simply reflect the quality of coaches and sports leaders to identify early the athletes with the highest potential and to help them to develop it in time, then it is obviously important to know deeply which indicators they used to carry out this identification as well as the processes and strategies they adopted for their development.

5. Conclusions

The main purpose of this study was to investigate if the Portuguese female gymnasts who achieved the best results at senior age level had also achieved outstanding performance when they were at the beginning of their careers. Furthermore, were also goals of this study to seek if the relationship between the results obtained at the beginning and at the peak of their careers would vary according to the importance of the results achieved at senior level and to compare the career longevity of gymnasts with different levels of success.

The results clearly demonstrated that the gymnasts who reached the best performances in the highest stage of their careers had already achieved it at the beginning of their careers, as well showed that those gymnasts had longer succeed careers. Thus, this study provides support for the notion that is important to be aware of athletes who excel early, giving them the necessary conditions in order to reach best performances throughout their careers, as well to suggest the utility of the programs for talent identification and selection in early ages, at least as regards in the artistic gymnastics.

Still, it is important to know how many gymnasts have demonstrated particular talent for artistic gymnastics, by achieving high results in the early stages of their careers, but were not able to achieve at senior level, as well is important, considering the specific context in which this study was developed (i.e., artistic gymnastics in Portugal), to investigate whether these results have also been found in other countries with distinct sport performances in artistic gymnastics.

REFERENCES

[1] Baker, J. and Côté, J., 2006, Shifting training requirements during athlete development: Deliberate practice, deliberate play and other sport involvement in the acquisition of sport expertise. In D. Hackfort and G. Tenenbaum (Eds), Essential processes for attaining peak performance (pp.92-109). Oxford: Meyer and Meyer Sport.

[2] Baker, J. and Schorer, J., 2010, Identification and development of talent in sport: Introduction to the special issue. Talent Development & Excellence, 2(2), 119-121.

[3] Barreiros, A, Côté, J. and Fonseca, A. M., 2012, From early to adult sport success: Analysing athletes' progression in national squads. European Journal of Sport Science, DOI: 10.1080/17461391.2012.671368.

[4] Barreiros, A, Côté, J., and Fonseca, A. M., 2013, Training and psychosocial patterns during the early development of Portuguese national team athletes, High Ability Studies, 24(1), 49-61.

[5] Bloom, B., 1985, Generalizations about talent development. In B. Bloom (Ed.), Developing talent in young people (pp.507-549). New York: Ballantine Books.

[6] Bloomfield, J., Fricker P., and Fitch K. (Eds), 1992, Textbook of science and medicine on sport. Melbourne: Blackwell Scientific Publications.

[7] Bompa, T., 1999, Periodization: Theory and methodology of training. Champaign, IL: Human Kinetics.

[8] Bompa, T., 2000, Training guidelines for young athletes in total. Training for young champions. Champaign, IL: Human Kinetics.

[9] Brito, N., Fonseca, A.M., and Rolim, R., 2004, Os melhores atletas nos escalões de formação serão igualmente os melhores atletas no escalão sénior? Análise centrada nos rankings femininos das diferentes disciplinas do atletismo ao longo das últimas duas décadas em Portugal. Revista Portuguesa de Ciências do Desporto, 4(1), 17–28.

[10] Cafruni, C., Marques, A., and Gaya, A., 2004, Análise da carreira desportiva de atletas das regiões sul e sudeste do Brasil. Estudo dos resultados desportivos nas etapas de formação. Revista Portuguesa de Ciências do Desporto, 4, 218.

[11] Carlson, R., 1988, The socialization of elite tennis players in Sweden: An analysis of players backgrounds and development. Sociology of Sport Journal, 5(3), 241-256.

[12] Durand-Bush, N. and Salmela, J., 2001, The development of talent in sport. In R. Singer, H. A. Hausenblas, and C. M. Janelle (Eds), Handbook of sport psychology (pp. 269-289). New York: John Wiley.

[13] Ericsson, K.A. and Charness, N., 1994, Expert performance: Its structure and acquisition. American Psychologist, 49, 725-747.

[14] Ericsson, K. A., Krampe, R. T. and Tesch-Romer, C., 1993, The role of deliberate practice in the acquisiton of expert

performance. Psychological Review, 100, 363-406.

[15] Feuillepain, C., 1997, Le devenir des jeunes. Revue de l'Association des Entraineurs Français d' Athlétisme, 145, 5-16.

[16] Filin, V., 1996, Desporto juvenil: Teoria e metodologia. Londrina: CID.

[17] Hahn, E., 1988, Entrenamiento con niños. Barcelona: Ediciones Martínez Roca.

[18] Régnier, G., Salmela, J., and Russel, S., 1993. Talent detection and development in sport. In R. Singer, M. Murphey,

M. and L. K. Tennant (Eds.), Handbook of research on sport psychology (pp. 290-313). New York: Macmillan.

[19] Schulz, R. and Curnow, C., 1988, Peak performance and age among super athletes: Track and field, swimming, baseball, tennis and golf. Journal of Gerontology Psychological Sciences, 43(5), 113-120.

[20] Thieß, G. and Schnabel, G., 1986, Grundbegriffe des trainings. Berlin: Sportverlag.

[21] Vaeyens, R., Gullich, A., Warr, C., and Philippaerts, R., 2009, Talent identification and promotion programmes of Olympic athletes. Journal of Sports Sciences, 27(13), 1367–1380.