

Multilateral Training is the Basis of Transferable and Risk-Free Early Skills in Children

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Abstract

This study provides an overview of the practice of early sports diversification or Multilateral Training and the potential benefits associated with this. The main objective of this review is to investigate the literature on the effect of multilateral training on the development of bio-motor skills and mechanisms to influence the reduction of psychic, physical and social risks associated with early sports specialization. A systematic review of articles related to diversification and early sports specialization was carried out. 66 articles were identified through search in the Sports Discus and Google Scholar databases; took place between September 2017 and August 2018. The selection of articles considered the relevance and usefulness of the topic and the credibility or experience of the authors in the field. The results of the review highlight the importance of multilateral training as a basis for transferable early skills and how early specialization presents a number of risks and is no guarantee of reaching elite sport.

Keywords: Early Sports Specialization; Unilateral Training; Multisport Athletes; Bio-Motor Skills; Young Athletes

Introduction

The sport of high achievements (High Performance) requires more and more athletes with greater genetic qualities, to which high loads of training (volume and intensity) can be applied to a greater extent, an optimal development of their physical abilities (speed, strength, endurance and flexibility) and a wide repertoire of motor skills.

For this reason, sports specialization has grown over the last 15 years, with the belief that it will lead to opportunities in professional sports (Feeley and Cols, 2015), cited by Sluder B [1]. The belief that has spread between parents, coaches and children themselves, is that if younger children participate in a single sport, the greater the chance of success they will have in it.

The development of talent and sports expertise, is not only the result of deliberate practice for a period of more than 10 years (Ericsson and Cols, 1993), cited by Jones and Petlichkoff [2]. Deliberate practice is intended to improve performance and is typically monitored by a coach. The requirements to participate in this type of practice by elite athletes with high levels of performance should be approved with caution [2]. For these reasons, early training should approach the deliberate game model, which consists of a more fun, multisport practice with fewer rigid rules.

The process of dosing training in children and adolescents should not be taken lightly, because children are not miniature adults, but evolving beings. For this reason, training planning at these stages should recognize the stages of development and growth of individuals. Each stage responds to a number of biological characteristics that should not be overlooked, this means that the physical activities proposed should be coupled with children and not subjected to trainings that exceed their abilities.

In order for this process to be carried out to the best extent, the biological and motor development of children must be respected, taking into account the medical and pedagogical point of view respectively. It should be considered that children are beings growing up and that motor tasks should be adapted to their evolutionary period, not in the opposite direction. For this reason, it is of the utmost impor-

tance to evaluate the effect of early sports specialization in relation to the musculoskeletal system, the personality of young people and the control of the incidence of injuries at an early age.

Similarly, Weiss [3] in his article “Bo Knows”, quoting Goodway and Robinson, concludes that, children in elementary school need to develop a broad base of motor skills, experiencing various activities, before choosing, if they wish, a single sport in adolescence. This developmental trajectory could maximize mastery of skills that meet the unique needs and interests of all children and could facilitate participation in many physical activities throughout life. Additionally, while early specialization may be necessary to achieve excellence and peak performance in sport, there is evidence to suggest that its deliberate practice does not guarantee sporting success. In addition, studies show that children who specialize early, are at higher risk of overuse injuries, may not reach their full growth potential, and could not transfer their skills positively in adulthood.

Problem

Some studies find a close relationship between early specialization in sport and increased injuries in children under the age of 15. And not only this, but it could be synonymous with exhaustion, loss of enjoyment and motivation.

Mechanisms that refer to the onset of injuries include overuse, inadequate technique and very short times or absences of rest, in some cases of premature sports training in children and young people.

Conversely, children who play various sports simultaneously, reflect a decrease in injury episodes. It is known that there are sports that require early initiation, such as swimming and gymnastics, but the initial stages of immersion in these sports must respond to multilateral and multisport work, which allows to expand the repertoire of bio-motor qualities, form personally, lay the foundations of future sporting achievements and decrease the possibility of absent from sports practice, whether by injuries by overuse, exhaustion or loss of enjoyment and motivation.

It seems that early specialization, understood as regular participation (on an annual basis), in which the development, training and competencies of that specific sport, at ages below age 13, are concentrated has associated negative consequences. It is believed that by playing a sport in which a limited number of movements inherent in its practice are performed, it has the potential to limit the development of motor skills, which in turn, could affect in the long term the likelihood of participating in alternative physical activities.

Otherwise, multilateral training or participating in various sports (sampling) during childhood increases the chances of developing “prerequisite” skills, which can contribute to the development of basic skills. This is a mechanism, by which knowledge transfer can occur, and is consistent, with the idea of acquiring basic skills, before attempting more complex skills (Arend, 1980a, 1980b; Magill and Anderson, 2013), cited by Anderson and Mayo [4].

Objective of the Study

The main objective of this review is to investigate the literature related to early specialization and diversification and how this can influence the development of bio-motor qualities. Specifically, it sought to synthesize some principles of this review, to guide the task of the coach of young athletes in physical preparation. Additionally, it seeks to determine the physical and psychosocial risks associated with early specialization, and yes, this is a guarantee of success to reach elite sport.

Methodology

This work is a systematic review, which for Ruíz and Cols [5] “synthesizes the retrospective analysis of the information collected in different studies by different researchers”. Articles were therefore sought to develop the problem situation, for the present case, multilateral training of young people according to their human and biological progress.

For the systematic search of scientific literature, the Sport Discus and Google Scholar databases were used, of which there were a total of 103 results, 89 were selected, which were published between January 2007 and December 2017 and are full text articles. In addition, it was leaked to academic publications for a total of 79 and writings in English 66, of which 2 were repeated. Finally, only 15 were considered within the research that involved psychosociological, pedagogical, motor and physical parameters.

As shown in table 1, several categories of analysis were distinguished, in terms of the impact of training on young people.

Categories or perspective	Authors	Observations
Sports health and injuries	Osorio C and Cols [6].	Sports injuries are mentioned globally. Subsequently they are discriminated against by gender and in various parts of the body, because of the sport. It is proposed that children are one of the most vulnerable populations and with higher rates of injuries.
	Brenner J [7].	It refers to the causes of organized and early sport in children. These include overtraining, overuse injuries and exhaustion, and how these could affect the short duration in sport or an active lifestyle.
	Read P and cols [8].	In the UK, elite football organisations have adopted an early specialization approach, based on an so - called "Elite Player Performance Plan". The principle is to increase training opportunities through a marked increase in field training hours. However, the accumulation of many hours of training does not guarantee success. It is analyzed that, the impact of such a significant increase in training volume for young athletes, who are experiencing a variety of growth and maturation processes, could increase the risk of injury.
	Hall R and cols [9].	The study compares girls athletes, on the one hand, those who practice various sports simultaneously and on the other, girls who specialize in a single sport. Finding a higher incidence of injuries in the first group.
Multilateral training	White J and Oatman D [10].	In previous years, children used to compete or participate in various sports throughout their development, this is mainly mediated by environmental factors. The course of this phenomenon has changed, since they are very young, both parents and sports coaches think of early specialization as the fast track for a future sporting career. Therefore, the article aims to analyze the benefits and consequences of early specialization.
	Baker J and cols [11].	This document seeks to clarify the debate between early specialization and early diversification, based on scientific evidence. Alternatively, some researchers have proposed that an early diversification approach is not a disadvantage for athletes in acquiring sports experience and is important for the development of intrinsic motivation and skill transfer. However, the evidence presented is not blunt towards any of the approaches.
	Raspberry R 2010.	This review article considers the roots, consequences and limitation in the data, about the effectiveness of specialization in sport. It also rescues the fact that a significant number of coaches, parents and children consider the best way to develop young elite athletes, lies in the fact that they are dedicated to a single sport from an early age and play it practically all the time. In addition, they highlight multiple reasons that lead to specializing children, among which is the search for sports scholarships.
	Ginsburg R and cols [12].	The study consists of a survey of professional baseball players, in which they are asked the age at which they specialized in their sport. Among the results that were found are, that only 25% of respondents specialized before the age of 12 and that the average age of specialization was found in the age of 15. On the other hand, the most significant result was that those who specialized after those ages, had more options to find sports scholarships. What this study reflects is, that early diversification increases the chances of success at the university and professional level.
	Street S 2010.	Today there are more children participating in competitive sport and many of them at very young ages as part of sports specialization. Some concerns have arisen about the development of these children, as the risk has increased at the physical and psychosocial level.
	Cote and cols [13].	The authors' task for this document is to propose seven principles regarding the role of early diversification or "sampling" and deliberate play, as opposed to early specialization, in promoting continuous participation and elite performance in sport.

Physical maturation and motor development	Goodway and Robinson [14].	The study examines the discussion between early specialization and early diversification, from a perspective of physical maturation and motor development. It also discusses the risks of early specialization such as overuse injuries and long-term growth concerns. And it advocates early diversification as the broad foundation for acquiring fundamental motor skills to apply in different sports.
Psychological	White M 2015.	This review examines the benefits and disadvantages of early specialization from multidisciplinary perspectives. Academics in sports history, motor learning, development psychology of sport, motor development, among others, reviewed theories, empirical research and case studies addressing pros and cons of early specialization versus the practice of multiple sports. Within this context, they address issues such as acquiring skills, biological maturation, self-esteem, injuries, aerobic fitness and the ability to stay physically active for life.
	Nunomura M and collars. [15].	The study focuses on the point of view of artistic gymnastics coaches, developing athletes and the attitude of gymnasts towards competition. And it highlights the concern of the coaches regarding motivation, the ability of athletes to set their own goals and provide extrinsic rewards, taking the latter as a tool to keep athletes engaged. However, we must know how to dose these rewards because otherwise this would lead to losing the pleasure of participation and would detract from the sport's ability to shape positive values.
	Wall and Coté [16].	The study seeks to confirm or deny the hypothesis that children who often leave sports, for the present case ice hockey, often practiced less variety of sports at an early age, had less opportunity to play deliberately and spent more time in the deliberate practice of a specific sport. In order to respond to hypotheses, a survey was conducted on parents of children who still play sports and some who abandoned it.
Pedagogical	Hastie P [17].	The study examines the literature on pedagogical perspectives in early specialization and divides it into two phases. The first, a series of common-sense questions examined from a pedagogical perspective; and second, an investigative agenda to answer these questions.

Table 1: Main articles on training in children, benefits and disadvantages of early specialization.

Systematic Review

The following will be some authors' views on the benefits and disadvantages of early sports specialization and the positive effects of multilateral training or early diversification, the review is carried out, through the following categories of analysis:

- Sports injuries.
- Multilateral training vs sports specialization.
- Psychological factors.
- Pedagogy.

Possibility of sports injuries

In one study, related with predisposition to femoral patello pain injury, 546 female athletes were examined, of whom 357 practiced various sports and the other 189, performing 66 basketball, 57 football and 66 volleyball.

Athletes were included due to their diagnosis of pathofemoral pain (PFP) on the physical exam. Tests consisted of a standardized history and a medically administered physical exam to determine the presence of PFP. Early specialization in adolescent athletes was found to be associated with increased risk of anterior knee pain and other alterations, compared to athletes who play various sports.

Additionally, in the same studio (Fransen J, Pion J, Vandendriessche J, y cols, 2012), cited by Randon and Cols (2015), claim that sports specialization may be related to the reduction and acquisition of motor skills and competencies. Reduced diversity in young adolescent activities could break the development of a wide range of comprehensive motor skills, gained through diversified participation in sports.

The incidence of overuse injuries in young athletes has grown in parallel with their participation in sports. Up to 50% of all injuries seen in sports medicine in children are related to overuse (Dalton, 1992), cited by Randon and Cols (2015). The risk of overuse injuries is more important in child/adolescent athletes for multiple reasons, Maffuli (1992) and Carter (1988), cited by Randon and Cols (2015). Among the main reasons for this phenomenon is that the growing bones of young athletes cannot withstand as much stress as the mature bones of adults.

In the same sense, a study published by Brenner [7] mentions the potential danger of overuse injuries in children and adolescents, usually associated with early specialization. The author defines the overuse injury as a traumatic micro damage to the bone, muscle or tendon, which has undergone repetitive stress without sufficient time to heal or undergo the natural repair process. According to the author, overuse injuries are the most common etiological factors in sports children and adolescents, representing up to 50% of all injuries. The incidence of overuse injuries in young athletes has parallel growth with participation in sports.

The author adds that athletes who practice various sports are more likely to maintain an active life for longer, and the ability to enjoy physical activity more, avoiding injuries in the same way: overuse, overtraining and exhaustion.

For Osorio [6] 80% of injuries sustained during sports practice compromise soft tissues, such as muscles, tendons, ligaments and joints. Similarly, adds, that between 30 and 50% of sports injuries are caused by excessive use of soft tissues, and that the highest rate of injuries associated with sport and recreation, occurs in people from 10 to 14 years old.

Therefore, for Read and Cols [8] athletes should be aware of the possible negative implications of early sports specialization and should avoid repeated exposures only to specific sports skills, which can increase the risk of injury and limit the improvement of motor skills. In addition, an understanding of the physiological changes associated with key developmental periods during a child's growth, and how this affects movement, skills and the risk of injury, is necessary to effectively design long-term football development programs. Additionally, the physical stress associated with training has also shown injury relationships in elite youth footballers, and concludes, that intense participation in a single sport such as football before physical maturation as well, can increase the risk of overuse injuries.

Physical-motor aspects related to early specialization vs multilateral training or early diversification.

The "Power of the Law of Practice" stipulates that one increases his skill level more significantly during the initial phase of learning, according to Baker (2003) and Purcell (2007), cited by Street (2010). In general, for an individual to obtain the next level of mastery, must spend more time in goal-focused practice. Hours should be accumulated during the appropriate period of biological and cognitive development. Approximately 6 - 7 years of age, moving object tracking is mature at approximately 7 - 8 years of age, posture and balance are more controllable and in the teen years selective attention matures with the use of complex memory strategies, Stricker (2002), cited by Street (2010).

For White and Oatman [10] although early specialization generates some benefits, this phenomenon could generate gains at the motor level, because competing in various sports at an early age can contribute to the child's proper growth and development. It will improve your multilateral skills, generate greater self-esteem, grow physically and emotionally and prevent sports exhaustion in adolescence. Competing in a wide variety of sports in those ages can help future multilateral skills. Multilateral training develops bio-motor qualities, understood as strength, speed, endurance, flexibility and balance. Coté and Cols [13] proved that elite athletes participated in various sports during their childhood. The athletes described that activities during childhood were characterized by deliberate play, without in

deliberate practice. The authors define deliberate play as activities that are fun, but that do not contribute to the development of sports expertise.

Some studies suggest that the drawbacks of early specialization and getting involved in intense training activities at an early age is the fact that it may limit the development of social skills [11]. Similarly, he adds that the skills and fitness that are gained through the practice of various sports in childhood, can be transferred to the stage of sports specialization.

According to Mechelen [18], several reasons make both parents and children (especially the former) opt for specialization at an early age. Among those highlighted: getting a sports scholarship for studios, seeking professional sports contracts and sponsorships with sporting goods companies. However, for the author, early specialization is not without risks. Of which he mentions: social isolation; focusing on a single sport and associated time commitment can encourage the isolation of age and gender partners, especially during adolescence, and can alter relationships with peers, parents and family. Also, dependency is mentioned. The lives of young elite athletes tend to be highly regulated. This can encourage over-reliance on others and in many cases loss of control of what is happening in life. Exhaustion or burnout is associated with athlete perceptions, which he or she cannot meet the physical or psychological demands placed on him or her. Manipulation, because by immersing a young man in a complex world regulated by adults, could lead to become controlled by some adults with economic interests. Growth and maturation may be compromised, some complications in growth and maturation are occasionally attributed to early intensive sports training, although there is no strong evidence on this.

Ginsburg and Cols [12] highlight benefits related to deliberate practice, linked to early diversification, because it gives the child the opportunity to experiment with different movements and tactics while learning to improvise and respond strategically in athletic situations. In addition, the evidence suggests that players who specialize later not only achieve similar levels of expertise in relation to athletes who specialize early but have greater athletic success.

In their study they show that, although most athletes became involved with the sport at approximately age 6, it was not until adolescence (around the age of 15) that they devoted themselves exclusively to one. The data indicate that most athletes-maintained participation in other sports until advanced ages, suggesting early diversification as a viable method and a successful path to reach the professional level. The sample showed that when comparing the sports history of more highly qualified athletes with less skilled athletes, highly qualified athletes typically report participating in a larger number or a higher volume (in terms of total hours of participation) in other sports.

For Goodway and Robinson [14] constructive use of youth sport should be an important part of each child's education and a mean through which key development processes can occur, from a growth and motor development perspective, the development of motor skills across a wide range of fundamental motor skills is key to a positive development trajectory.

And while sports specialization may have some benefits, the risks associated with injuries and long-term growth, high exhaustion rates, and the fact that early and intense practice schedules do not differentiate elite athletes from non-elite athletes, it provides evidence to support that the basis for the development of fundamental motor skills learned through sports diversification, is necessary and important before sports specialization. Therefore, sports diversification in the formative youth years is clearly superior to early sports specialization.

Psychological considerations

In addition, psychological consequences are also found in young athletes physical effects of early specialization programs, such as exhaustion syndrome or over-training. Over-training syndrome can be defined as a "series of psychological, physiological and hormonal changes that result in lower athletic performance." The most common manifestations may include chronic muscle or joint pain, personality changes, high resting heart rate and decreased athletic performance. The athlete child may also have fatigue, lack of enthusiasm for

practice or competition, or difficulty successfully completing the usual routines. Exhaustion should be recognized as a serious outcome to over-training syndrome, recognize Small (2002) and Budgett (1998), cited by Randon and Cols (2015).

Similarly, it should be noted that many athletes decide to abandon their activity as a side effect of early specialization. Among the most common reasons to do so are: conflict of interest with other activities, too much commitment time, loss of playing time, too much pressure, matters inherent with competition and loss of fun, the latter being the most frequent reason [16].

In this same study, which was conducted with ice hockey players, the authors conclude that one aspect that significantly differentiates athletes who leave, from those who do not, is the fact that the former, initiated off-ice training at an earlier age (12 and 13 years), suggesting a form of early specialization, which supports the postulate that early participation in specific training programs can ultimately undermine motivation to continue in the sport.

For Weiss [3] applying concepts and extrapolating the findings of studies on motor learning, - social psychology of sport, growth, motor development and exercise physiology in children, - contributes to the merits of developing a broad base of fundamental motor skills during childhood. When skills are taught within a supportive environment and an environment domain oriented, children are likely to achieve positive self-receptions, intrinsic motivational guidance, sports skills and fitness levels that allow them to be physically active and accumulate holistic health benefits in adolescence and adulthood.

There are sports where early specialization and high training loads are the norm. That is the case with artistic gymnastics, where, for example, in Brazil, children can officially compete since the age of seven. Therefore, a critique has emerged aimed at youth sport and is its potential as a source of stress, because competition increases the expectations of both the athlete and the circle of athletes. In youth competition, the set of external pressures that the athlete self-imposes, can produce a “turning point” that leads an unmotivated athlete to suffer exhaustion and abandon completely. While stress is a normal part of life, regardless of age, with young people, however, there is a duty of care to ensure that the stresses encountered are manageable synthesize Nunomura and Cols [15], supported by De Rose Jr., (2002); Weinberg and Gould (2001); Bompá (2000), Hedstrom, Gould (2004); and Rose Jr., Butcher and Linder (2004).

Pedagogical elements

For Hastie [17], from a pedagogical perspective there are a number of elements that should be considered by the coaches (and the institutions in charge of them) running training programs of athletes with early specialization. For this reason, he guided his research with a number of assumptions such as: children who specialize early should receive training by more knowledgeable coaches, those coaches should have more sophisticated training plans, and that, according to deliberate practice, athletes who specialize early can experience motivational climates that are more task oriented. However, was unable to give definitive answers to them, as very few studies reported states of expertise in its participants.

Another guidance given by the study, showed enough evidence to suggest that participation in a single sport is not the way to elite sport, in fact, the results showed that elite athletes specialized late, trained less in childhood and diversified with more sports.

Meta-analysis

It is appreciated that early specialization, unlike early diversification or multilateral training, has a major impact on the onset of over-use injuries. One of the related factors is the low development of tissues (bones, muscles and tendons), which cannot withstand the stress given by training. Another common factor is repeated exposure of movements or skills specific to each sport.

It also highlights the fact that children who participate or practice various sports increase the likelihood of maintaining an active lifestyle in adulthood, have greater ability to enjoy physical activity and reduce the risk of aforementioned overuse or overtraining injuries and mitigate the exhaustion or abandonment of the sport.

From the physical-motor aspect, Multilateral training provides the foundation or foundations of skills, so at ages under 12, when the early stages and development of motor learning are found, they should be provided with diversification in physical activities or the possibility of various sports, as they would improve their multilateral skills and enhance many more elements, both physically, emotionally, socially and psychologically, as well as contribute to appropriate development and growth. However, while early specialization generates some benefits, competing in various sports helps future multilateral skills, transferring skills between sports, and developing biomotor qualities and/or physical abilities.

Although, one of the main reasons to start a child in early sports specialization, is the search for the sports elite or professional sport, there is no guarantee that this phenomenon can guarantee future success. On the contrary, it has been found in several studies that some elite athletes stated, they were participating in various sports in their childhood and that many of the activities in which they were involved, were more identified with deliberate play. At the same time, studies show that athletes who usually specialize later (around the age of 15) expand the possibilities of sporting success.

The psychological findings, of the negative impact of possible early specialization, are strong. It is very common to find children with exhaustion syndrome or overtraining, which has a direct and negative impact on athletic performance. This is linked to the lack of motivation towards training or sports competitions and loss of enjoyment. Which in the medium to long term could trigger in abandonment of activity?

The pedagogical field supports the findings found in the other categories, because it was found that participation and competition in a single sport is not the way to reach the sporting elite. On the contrary, results showed that elite athletes, claim to have specialized late, trained less early and had greater sports diversification. Likewise, it makes us ask several questions about the level of training, in sports training, physiology and developmental psychology, among others, that requires a professional who is in charge of the children who are specializing early, and if, this in turn, is creating a motivational environment suitable for them [19].

Conclusion

Data from this review suggest that a sports training proposal, characterized by multilateral training, based on a fun approach and a wide variety of sports activities during childhood, could undermine the physical and psychosocial effects associated with early specialization. Also, early diversification is considered to lead to sports expertise, due to the intrinsic motivation that arises from the enjoyment, fun and competition experienced with sports participation. It also suggests that the skills and fitness developed through diversified participation may be transferred to sports specialization later.

Early specialization is not the only way, nor a norm, to reach the sporting elite or professional sport, on the contrary, many of the athletes were found to leave along the way. Similarly, success in childhood does not guarantee success later in the sporting elite. However, there are sports where early specialization is required, because the peak of performance is before full maturation, such as artistic gymnastics.

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