

Specialization in Youth Athletes and How it Affects Their Development

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Specialization in Youth Athletes and How it Affects Their Development

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Abstract

Youth sport specialization has been a growing concern over the last decade. While parents feel the need to specialize their kids at a young age, they may not be fully aware of the potential risks associated with sport specialization. As youth athletes age, they need proper growing and maturation throughout early, mid, and late adolescence to achieve proper development. Prior review of literature from this study proves how sport specialization can cause negative effects through overuse injuries and dysfunctions, psychological issues, and lack of sleep which may disrupt proper development. Preventative measures such as diversity of activity, neuromuscular training interventions, and specializing at the proper age may help lower the severity of risks that sport specialization present. The purpose of this synthesis study is to review literature on youth sport specialization to determine the effect that it has on overall youth athlete development.

Chapter 1

Introduction

Youth sport specialization has been trending upwards in the United States recently, as extremely young athletes continue to specialize in a single sport year-round (Hall et al., 2015). Athletes that are highly specialized spend more time year-round participating in their sport than those who are not specialized (Post et al., 2020). This time lost from specialization demands could force them to compromise their normal sleep routine, to socialize, catch up on homework, etc. (Post et al., 2020) and could also lead to burnout, academic stress, and social isolation (Stockbower et al., 2022). Highly specialized youth athletes feel pressured into focusing on one sport with not enough time to do normal childhood activities, such as hang out with their friends or families, etc. The inverse relationship between time management, and normal childhood activities could negatively impact the psychological stress and wellbeing of youth athletes who want to be able to enjoy sports while living a normal life. Highly specialized athletes risk higher levels of depressive symptoms, anxiety, and fatigue when compared to moderately specialized athletes (Stockbower et al., 2022). Less than one third of the high school students who participated in a study done by Stockbower et al. (2022) averaged 8 hours of sleep per night. Athletes who average less than 8 hours of sleep per night have a 70% higher chance of getting injured than those who sleep more than or equal to 8 hours of sleep per night (Milewski et al., 2014). Not only is lack of sleep a possible negative effect of sport specialization, but it may act as a predictor of injuries. Murday et al. (2024), found that high levels of specialization were associated with a higher level of overuse injuries when compared to low to moderate levels of specialization. A combination of lack of sleep and high levels of

specialization may increase the risk of a youth athlete attaining an overuse injury. Garinger et al. (2018) revealed that highly specialized athletes had higher levels of stress when compared to athletes who sampled sports. Highly specialized athletes with perfectionistic concerns were associated with high levels of burnout (Garinger et al., 2018). Post et al. (2020) revealed a correlation between high levels of specialization and daytime sleepiness in youth athletes. Those who specialize in a single sport lack social interaction and diversity that one would receive from participation in other sports which could lead to attractions towards non-sport alternatives, reduced enjoyment of a sport, and a smaller social buffer (Waldron et al., 2020). These potential negative side effects are the exact opposite of healthy youth development. Prior literature has proven a positive relationship between highly specialized youth athletes and the risk of potential overuse injuries, irregular sleeping schedules, burnout, and an in-exposure to a normal social life.

Statement of the Problem

Youth athletes are often unaware of how high levels of specialization can possibly have a direct impact on their development. They're rarely educated on the potential positive and negative outcomes that could stem from early sport specialization. If more school districts across the United States could educate youth athletes on the potential risks and benefits of specialization, they would know exactly what they're getting involved in before taking any risks.

Purpose of the Study

The purpose of this synthesis study is to review literature on youth sport specialization to determine the effect that it has on youth athletes and how it may affect their overall development.

Operational Definitions

1. Specialization – High levels of participation in a single sport year-round (Waldron et al., 2020).
2. Overtraining – Training volume and or/intensity is excessive for prolonged periods of time and creates a maladaptive response (Delimaris, 2014).
3. Youth Athletes – Athletes ranging from 12 to 18 years old (Post et al., 2020).
4. Youth Development – Focusing on a youth individual's potential through interest, talent, and strength while striving to be healthy, full, and successful (Qi et al., 2020).

Research Questions

1. What risks are associated with early sport specialization?
2. What are the benefits associated with early sport specialization?
3. Does sport specialization impact the physical development of young athletes?
4. Does sport specialization impact the emotional development of young athletes?

Delimitations

1. The articles reviewed were published between 2014 – 2024.
2. The articles used in this synthesis study were full texts and peer reviewed.
3. The articles used in this synthesis related to youth sport specialization and it's affect on overall development.

Chapter 2

Methods & Procedures

The purpose of this chapter is to review the methods and procedures used to determine the effect that sport specialization has on youth athletes. Literature collected for this Synthesis was found by using EBSCO's database from SUNY Brockport's Drake Library. Using EBSCO's database, the following were used to find articles: Academic Search Complete, SPORTDiscus, & Google Scholar.

Keywords were used to limit the number of articles found. These keywords included: *specialization, athlete, & injury. Sleep, stress, burnout, & fatigue* were additional keywords used to narrow the search further. The most prevalent keywords in the search were specialization, and injury. These search words were used to begin the research process.

The first search for this synthesis project was completed via Academic Search Complete using the keywords *specialization* and *injury*. The search resulted in 71 articles being listed. The first result (Murday et al., 2024) was used as one of the articles included in the synthesis. Upon reading, one of the references cited in this article was looked up through Google Scholar (Pasulka et al., 2017) and used.

The first search using SPORTDiscus showed 10 results. This search used the keywords *specialization, sleep, & injury*. One of the search results was used in the study (Post et al., 2020). Upon reading the article by Post et al. (2020), two other articles were found within the references and used in the study. The two articles found were Hall et al. (2015) & Milewski et al. (2014). Another search was done via SPORTDiscus using the keywords *specialization* and *dysfunction*. This displayed 14 results. Among the 14 results, two articles were found and used

in the synthesis. These two articles were Sheppard et al. (2020) & Rauh et al. (2020). A third search was done using SPORTDiscus using the keywords *specialization* & *burnout*. A total of 60 results appeared upon entry. Two articles were selected to be used. These two articles were Waldron et al. (2020) & Garinger et al. (2018).

The first and only search via Google Scholar used the keywords *specialization*, *sleep*, & *fatigue*. Upon searching, 25,500 results appeared, and the first article that appeared was used in the study counting towards the 10 (Stockbower et al., 2022). Two additional searches were made to support operational definitions. The first additional search was done via Google Scholar using the keywords *overtraining* and *healthy individuals*. Approximately 31,200 search results appeared, and the first article was used (Delimaris et al., 2014). The second additional search was also done via Google Scholar, this time using the keywords *youth development* and *trends*. The second search result was used to support one of the operational definitions (Qi et al., 2020).

A total of twelve articles were selected from the research process. The articles selected had to relate to specialization, youth athletes, injuries, sleep, stress, burnout, or fatigue. Each article selected was carefully reviewed to ensure they were appropriate to the synthesis.

Articles selected were from 2014-2024.

The articles were selected from various journals including *Anxiety Stress & Coping* (1), *Journal of Sport Rehabilitation* (1), *Acta Medica Martiniana* (1), *The Journal of Pediatric Orthopaedics* (1), *Journal of Athletic Training* (3), *The Physician and Sportmedicine* (2), *Athletic Training & Sport Health Care* (1), *Applied Research in Quality of Life* (1), & *Journal of Clinical Sport Psychology* (1).

The critical mass for the synthesis study consisted of a total of 4,697 athletes. Among the 4,697 athletes, 3,916 (83.3%) of the participants were youth athletes, while 781 (16.7%) of the participants were non-youth athletes. The non-youth athletes consisted of former and current athletes from different colleges. Out of the 781 non-youth athletes, 538 (68.8%) were current NCAA athletes. Almost all studies from the synthesis stated they were conducted in the United States. Among the studies that specified location, it was revealed that states such as Kentucky, Wisconsin, & California were included. Descriptive statistics, bivariate analysis, bivariate correlations, statistical analysis (via IBM SPSS, Stata 12.0, Stata 15, & SAS Software), univariate analysis, multivariate analysis, p-value statistical significance, standard deviation, & 1-way variance analysis were all used to analyze the data.

Chapter 3

Review of Literature

The purpose of this chapter is to present a review of literature on how specialization of youth athletes affects their overall development. Intense youth single sport specialization has been consistently increasing in the United States (Hall et al., 2015). Over the past 30 years, sport specialization in youth athletes has increased by 300% (Garinger et al., 2018). While intense specialization in youth athletes continues to compound, increased levels of youth specialization is an underlying reason for increased injury rates within this population (Milewski et al., 2014). Injuries attributed from specialization may include overuse injuries and adverse conditions (Rauh et al., 2020). Not only does specialization yield the chance of sustaining these injuries, but one could be susceptible to burnout (Stockbower et al., 2022). While the trend of youth sport specialization continues to rise exponentially, athletes should be educated on the risks of specialization before they begin. The following topics will be discussed in this chapter: Relationship Between Sport Specialization, Sleep Deprivation, and Injury, Sport Specialization's Correlation with Overuse Injuries, and Psychosocial Outcomes of Sport Specialization.

The Relationship Between Sport Specialization, Sleep Deprivation, and Injury

Youth athletes who specialize in a single sport year-round often have limited time compared to a normal adolescent due to intense training demands, practices, and games. Hall et al. (2015) discusses how the time demands of intense specialization year-round may force athletes to have different relationships with family and friends, thus resulting in social isolation. Not only do youth athletes have to meet these intense specialization demands, but they are also held responsible academically. Time demands from specialization and academics may force

them to put sleep lower on their current priorities and even lose sleep. Milewski et al. (2014) surveyed 112 student athletes ages 12-18 from a large metropolitan school district regarding sport participation and overall sleep. Average age for the athletes was 15.2 years old. The purpose of the study was to examine the impact of sleep deprivation on injury rates in youth athletes. Data were collected via an online survey once written consent was provided at preseason meetings. To coincide with this, the injury log from the school's athletic training room was reviewed over a 21-month period from June 2010 to March 2012. The survey data was compiled then compared with the injury log using Stata 12.0. Milewski et al. (2014) found that athletes who slept less than 8 hours per night on average had a 70% higher chance of sustaining an injury than those who slept more than or equal to 8 hours of sleep per night. Another significant finding reported that lack of sleep and increasing grade in school appear to be associated with increased injury risk in adolescent athletic populations (Milewski et al., 2014). Similarly, Stockbower et al. (2022) discusses how athletes that sleep for shorter durations risk the chance of injury, negative athletic performance, and mood disorders.

In a comparable study done by Post et al. (2020), 647 youth athletes ages 12-18 from Wisconsin filled out a questionnaire regarding specialization status, daytime sleepiness, regular travel, demographics, and sport related injuries within the past 12 months. The purpose of the study was to examine the relationship between sport specialization and daytime sleepiness in youth athletes. Data were collected in person through self-administered questionnaires at practices, competitions, and tournaments. Daytime sleepiness was assessed using the Pediatric Daytime Sleepiness Scale which ranged from 0-32 (higher score signifying higher levels of sleepiness). Data was analyzed through univariate analysis and multivariate regression, then summarized by means, standard deviation, frequencies, and proportions. Results indicated that 38.9% of the athletes were

highly specialized, 15.1% sustained an overuse injury within the past calendar year, and 40.8% regularly traveled out of state for sport competitions. Findings indicated that regular travel out of state, high specialization levels, and overuse injury history within the past 12 months were all associated with higher levels of daytime sleepiness among youth athletes. Sleep was also found to be both a risk factor and consequence of injury (Post et al., 2020). While lower amounts of sleep commonly result in negative well-being and cognitive function (Post et al. 2020), napping during the daytime may improve cognitive tasks and athletic performance (Milewski et al., 2014). Daytime naps should be used sparingly rather than a habitual crutch among youth athletes. It may be more beneficial to have a healthy sleep routine to yield steady levels of cognitive function and athletic performance (rather than negative and positive spikes). Stockbower et al. (2022) studied how youth athletes and their parents could benefit from being educated on the positive outcomes associated with adequate amounts of sleep, a regular bedtime, caffeine intake reduction, and limited electronic use before bedtime.

Another study by Stockbower et al. (2022) had 186 high school athletes ages 13-18 from a single school district fill out multiple questionnaires regarding amount of training hours per week, competition level, concussion/injury history, sport participation, sleep quality, and psychosocial function. Athletes also filled out the Pittsburgh Sleep Quality Index (PSQI), which assesses sleep quality and habits. The purpose of the study was to determine if psychosocial outcomes vary among high school athletes who report different levels of sport specialization (low, moderate, and high). Data were collected in person upon completion of written consent forms filled out by parents and participants during enrollment. Data were analyzed through statistical analysis (Stata 15), one-way variable analysis (ANOVA), t-tests, and PSQI scores. Among the athletes, 49% were low specialized, 34% were moderately specialized, and 16% were highly specialized athletes. Stockbower et al.

(2022) found that athletes who were highly specialized reported substantially greater depressive symptoms, anxiety, and fatigue levels when compared to moderately specialized athletes.

Sport Specialization's Correlation with Overuse Injuries

The most prevalent issue with sport specialization at an early age is the increased chance of overuse injuries and other health defects. Hall et al. (2015) recommended that youth athletes should wait until their bodies are fully developed to prevent the risk of injuries and psychological stress. Other health defects may include impaired skeletal tissue (Rauh et al., 2020).

Early Sport Specialization, Overuse Injuries, & Dysfunctions

In a study done by Hall et al. (2015), 546 youth athletes (357 multi-sport athletes, & 189 specialized athletes) from Kentucky completed multiple forms including the Anterior Knee Pain Scale (AKPS), the International Knee Documentation Committee form, maturational estimates, and anthropometrics. Athletes were also tested by physicians during a physical examination and prior medical history. Lower scores on the AKPS represent a higher amount of pain. The purpose of the study was to determine if sport specialization has any correlation to increased risk of patellofemoral pain (PFP) in youth athletes. Data were collected prior to the start of the season and following parental and athlete consent. Data were analyzed via statistical analysis (SPSS v21), statistical significance, group differences (ANOVA), and confidence intervals. It was found that those who specialized in a single sport were at a 50% greater risk of PFP incidence than those who were multi-sport athletes (Hall et al., 2015). Another significant finding from Hall et al. (2015) revealed that when compared to multi-sport athletes, youth female athletes who specialize in a single sport are at a greater risk for PFP.

In a similar study, Rauh et al. (2020) tested and surveyed 64 female cross country and track & field athletes ages 13-18 from southern California relating to menstrual history and sport involvement levels. All participants in the study underwent X-Rays, were measured, and had their Bone Mineral Density (BMD) evaluated. Athletes completed a questionnaire regarding menstrual history which classified their menstrual dysfunction as either amenorrhea, oligomenorrhea, or secondary amenorrhea. The purpose of the study was to investigate the correlation between sport specialization and low BMD in high school female distance runners. Data was collected at the start and throughout each participant's sport season upon written consent acquired from parents and athletes 18 and older. Athletes were classified as either low specialization (40.6%), moderate specialization (37.5%), and high specialization (21.9%). Data were analyzed using variance and covariance analysis, univariate odds ratios, and multivariate logistic regression. After the data were analyzed, Rauh et al. (2020) found that high sport specialists had significantly higher rates of low BMD (57%) when compared to moderate (42%) and low specialists (19%). It was also found that low BMD was strongly correlated with menstrual dysfunction (Rauh et al., 2020). Hall et al. (2015) briefly discusses how incorporating an integrative training program for athletes could limit the risk factors associated with PFP. Rauh et al. (2020) makes a similar remark, discussing how diverse activities away from running may be important during peak bone mass accrual.

In a relevant study done by Sheppard et al. (2020), 187 collegiate hockey players (116 male, and 89 female) from the NCAA & ACHA ages 18-30 completed 3 questionnaires regarding demographics, specialization levels, and hip & groin dysfunction. Specifically, the Hip and Groin Outcome Score (HAGOS) questionnaire was used to assess participants hip and groin

symptoms. The purpose of the study was to examine the effects that specialization has on ice hockey athletes before high school via surveying collegiate ice hockey players regarding current hip and groin dysfunction. Data were collected by providing participants written consent in person. Athletes were classified in low (32%), moderate (34%), or high (34%) specialization groups. Data were analyzed via 1-way variance, Mann-Whitney U tests, Kruskal-Wallis tests, & Spearman ρ correlations. Upon analyzing the data, Sheppard et al. (2020) found that ice hockey players that were highly specialized prior to high school reported greater levels of hip and groin dysfunction, experienced lower groin-related quality of life when compared to the low specialization group. Among highly specialized ice hockey players, it was also found that females experienced worse hip and groin dysfunction than males (Sheppard et al., 2020). Findings from Hall et al. (2015), Rauh et al. (2020), and Sheppard et al. (2020) all provide evidence that early sport specialization may increase the chance of sustaining short & long-term injuries and dysfunctions.

Specialization & Correlation to Injury Risk

Murday et al. (2024) surveyed 1,171 youth athletes ages 12-17 regarding sport participation levels. All participants electronic medical records were acquired. The sport participation survey classified athletes as either exclusive highly (14.4%), evolved highly (21.1%), or low-moderately (64.4%) specialized athletes. The purpose of the study was to determine if injury types (overuse vs acute) differentiated among highly specialized athletes based on their path to specialization. Data were collected once approval was received from a large academic institutional review board. Data were then analyzed through statistical analysis (SAS software), bivariate analysis, & 1-way variance analyses. Once the data was analyzed,

Murday et al. (2024) discovered that 59% of all injuries that occurred within the highly specialized group were overuse injuries. Another significant finding revealed that when compared to athletes who specialized in team sports, athletes who specialized in an individual sport were at a 95% greater risk of sustaining an overuse injury (Murday et al., 2024).

In a similar study done by Pasulka et al. (2017), 1,190 injured and uninjured athletes from two university hospital medicine clinics completed a survey regarding specialization levels, sport background and involvement, and demographics. Sports were categorized as either an individual or team sport based. Through the medical clinics, each participant's medical records were acquired. All injuries were diagnosed as serious overuse, overuse, or acute injuries. Athletes were classified in either low, moderate, or high levels of specialization. Data were collected upon securing consent forms filled out by parents and participants (if ages 12-17), and participants who were 18 years of age. Data were then analyzed through statistical significance (STATA & p-value) descriptive statistics, variance analysis (ANOVA), chi-squared analysis, and logistic regression. Subsequently, Pasulka et al. (2017) findings indicated that single sport specialized individual athletes experienced a greater amount of overuse, and serious overuse injuries, but less acute injuries (when compared to single sport specialized team athletes). Another significant finding revealed that the lowest average age of athletes specialized in a single individual sport was 8.9 years old (Pasulka et al., 2017). One could argue that this could be too early of an age for specialization. Children don't reach early adolescence until ages 10-13. Repeated stress and load on the same regions of the body with reduced diversity of movement attained by specialization can increase the chance of attaining an overuse injury (Hall et al., 2015). It's applicable to argue that it's not appropriate for extremely young athletes

as young as 8.9 to risk the possibility of sustaining overuse injuries through early sport specialization. While parents continue to specialize their children in sports, they could potentially be underestimating the potential injury risks that are associated with sport specialization (Murday et al., 2024). Sheppard et al. (2020) proved how early sport specialization in ice hockey players can cause hip and groin dysfunction later in life. Rauh et al. (2020) & Hall et al. (2015) proved that early specialization could cause knee pain or low BMD in specialized female youth athletes. What gives parents the right to specialize their children at an extremely young age without them knowing the risks involved? All athletes at every age deserve the right to understand the risks of specialization prior to involvement.

Psychological Outcomes of Sport Specialization

Garinger et al. (2018) had 351 NCAA track and field athletes complete 4 different questionnaires regarding perfectionism, stress, burnout, and demographics during mid to late track & field season. An email was sent out to head coaches from 62 different D2 & D3 programs. Data were collected after verbal consent was received. Athlete responses remained confidential. Data were then analyzed through descriptive statistics and bivariate correlations. Participants were categorized as either specialized (45.2%) or multi-sport (54.8%) athletes. After the data were analyzed, Garinger et al. (2018) found that specialized athletes had statistically significant higher levels of stress when compared to multi-sport athletes. It was also found that there was an inverse relationship between burnout and perfectionistic strivings (Garinger et al., 2018).

A similar study done by Waldron et al. (2020) had 243 collegiate athletes ages 18-23 from a Southeastern university complete multiple questionnaires regarding demographics,

psychological measures, level of specialization, specialization retrospective, burnout, training volume, motivation, stress, perceived social support, and psychological resilience. Data were collected online upon completion of digital consent forms. Data were analyzed through multivariate analysis, descriptive statistics, bivariate correlations, group difference tests (ANOVA), and five chi-square tests. Participants were classified as either early specializer (27.6%), late specializers (37.4%), and samplers (35.0%). Early specializers were specialized before age 12, late specializers were specialized after or at age 12, and samplers were never specialized. Upon the data being analyzed, Waldron et al. (2020) found that when compared to samplers and late specializers, the early specializers were found to have greater levels of exhaustion, global athlete burnout, amotivation, and sport devaluation. It was also found that the highly specialized athletes felt more physical and emotional exhaustion than the samplers and late specializers (Waldron et al., 2020). Stockbower et al. (2022) findings also indicated that highly specialized athletes indicated more fatigue than those who were moderately specialized. Stockbower et al. (2022) also discusses how social isolation, academic stress, and burnout could be outcomes from the time demands needed from sport specialization in youth athletes. Both of Stockbower et al. (2022) and Waldron et al. (2020) findings indicate that there are negative psychological effects behind intense sport specialization.

Summary

Prior literature has proven that there are multiple negative outcomes associated with early sport specialization. Those who are heavy sport specialists risk the possibility of lack of sleep due to training demands, and travel schedules. Injuries can be prevented by getting adequate sleep. While daytime naps can improve function and performance, it should only be used sparingly. Parents and athletes should be informed on the negative health effects of lack of sleep. Highly specialized youth athletes are often limited to a diverse range of motion which puts repetitive load stress on the same areas of the body. As a result, overuse injuries and other health defects may occur. To counter this, it would be beneficial to implement training programs to fix imbalances and expose their bodies to more diverse movement patterns. Athletes who play multiple sports are already exposed to different ranges of motion. Athletes should wait until late adolescence to begin specializing in a single sport. While there are negative physical outcomes associated with high levels of sport specialization, there are also negative psychological outcomes. Highly specialized athletes often have perfectionistic tendencies, which is directly correlated to burnout. These athletes feel more fatigue, social isolation, and academic stress due to the demands of high specialization levels.

Chapter 4 – Discussion, Conclusion, & Recommendations

The purpose of this chapter is to present the results of the review of literature on youth sport specialization in determining the effect that it has on youth athletes through their overall development and how these results align with the purported research questions which guided this synthesis project. In addition, recommendations for future research as it relates to youth sport specialization are presented.

The results of this review of literature revealed several different findings. First, heavy sport specialists often lack sleep. The higher the specialization level, the more likely they will get less sleep due to the intense schedule, travel, and training demands. Second, highly specialized athletes regularly face common overuse injuries due to extremely repetitive movements and a lack of a diverse range of motion. Third, athletes who are highly specialized often face psychosocial issues and challenges due to the intense demands that specialization imposes. Lastly, athletes who specialized early are subject to short and long term injuries and dysfunctions since their bodies are not fully developed, which has a direct impact on their development.

Discussion

Interpretations

As part of this literature review, several research questions were posed. The first research question was, what risks are associated with early sport specialization? The results of prior literature revealed the risks involved with early sport specialization included lack of sleep and increased chance of injury (Hall et al., 2015), negative psychological and psychosocial outcomes due to anxiety and fatigue (Garinger et al., 2018; Stockbower et al., 2022), negative

short and long term injuries and dysfunctions (Rauh et al., 2020; Sheppard et al., 2020), greater risk of overuse injuries in athletes who specialize in an individual sport (Murday et al., 2024), and a greater amount of overuse and serious overuse injuries than acute injuries in single sport specialized athletes (Pasulka et al., 2017).

The second research question was, what are the benefits associated with early sport specialization? Few benefits were found to be associated with early sport specialization as the literature primarily focused on the negative outcomes associated with early sport specialization and its effects. Although, Waldron et al. (2020) found that athletes who were highly specialized scored the highest levels of integrated and identified motivation, which are highly associated with self-determined forms of extrinsic motivation. Although, one's level of motivation may be predictive of their environment, as every highly specialized athlete has different resources around them, which could include variations in social support, coaching, practice availability, etc.

The third research question was, does sport specialization impact the physical development of young athletes? The results from the literature have proven that specialization can negatively impact the development of youth athletes. Rauh et al. (2020) findings indicated that highly specialized female high school distance runners were at a greater risk of low BMD when compared to the other groups. It was also revealed that low BMD was highly associated with menstrual dysfunction (Rauh et al., 2020). Another finding by Sheppard et al. (2020) revealed how early sport specialization in collegiate ice hockey players lead to long term hip and groin dysfunction later in life.

The fourth research question was, does sport specialization impact the emotional development of young athletes? Past literature proved how sport specialization can negatively impact the emotional development of young athletes psychologically. Garinger et al. (2018) findings revealed that specialized athletes had greater amounts of stress when compared to athletes who played multiple sports. Waldron et al. (2020) found that those who specialized earlier in life were at a greater risk of amotivation, global athlete burnout, sport devaluation, and exhaustion.

Implications

Qi et al. (2020) defines positive youth development as ‘focusing on a youth individual’s potential through interest, talent, and strength while striving to be healthy, full, and successful’. While early sport specialization does focus on maximizing youth athletes’ potential, results from prior literature argue that negative effects from early specialization don’t always result in athlete’s being physically and psychologically healthy. Prior literature that supports this argument includes correlations of physical effects of specialization between Hall et al. (2015), Rauh et al. (2020), and Sheppard et al. (2020), injury patterns in specialized athletes between Murday et al. (2024) and Pasulka et al. (2017), and psychological effects of early specialization between Stockbower et al. (2022) and Waldron et al. (2020).

Previous research prior to 2014 has suggested that sport specialization has a strong association with burnout, injuries, and negative psychological effects. The current findings from the synthesis agree with previous research and demonstrate the scope of how many athletes can be affected by sport specialization. For example, 3,916 youth athletes were part of the critical mass, which is only a small glimpse of how globalized early sport specialization has

become in the past 10 years. The findings from this study highlights how specialization can impact youth athletes in a negative psychological manor due to the extreme demands that are placed on children today. Today's generation of parents put too much pressure on their children to succeed in a particular sport that they feel the need for them to specialize, even when their children may not want to. A large proportion of athletes specialize early, but it should solely be up to them to decide if that's their desired path, and not their parents.

Other studies researching early sport specialization point to two prevalent oddities, burnout and injuries. The findings from this synthesis study are very similar to other studies but lack research in other topics such as motivation and eating disorders. The findings from this study not only confirm existing theories but also highlight how early our society is placing children into specialized circumstances that yields the possibility of sustaining burnout and injuries. Studies by Hall et al. (2015) and Pasulka et al. (2017) offer similar practical implications suggesting integrated training which includes working on adding diversified ranges of movements and neuromuscular muscular patterns to help prevent injuries in specialized youth athletes.

Prior to the synthesis study, burnout was one of the expected results. One of the results that was not expected was the significance and scope of how many specialized youth athletes sustain injuries almost every single year. These results did meet prior expectations and were of significant finding through psychological results. Youth athletes are children first, students second, and athletes third. Too often in our society, children are athletes first, students second, and children third, which prohibits them from living a normal childhood. Injuries and psychological issues prior to late adolescence due to early sport specialization often interfere

with the development of youth athletes since it prohibits them from doing childlike activities (hang out with friends, learn through experience and mistakes) that aid their development and motor skills.

Recommendations for Future Research

In reviewing the data base on early sport specialization and its effect on youth development, the following limitations were noted regarding the studies under review. The studies used in this review that pertained to PFP and low BMD only included specialized youth female athletes. Another limitation was that two studies included current NCAA athletes reporting on prior and current specialization effects, compared to all eight other studies that focused primarily on specialized youth athletes. The last limitation of the study was that not all surveys and questionnaires were done in person. Some of the forms were sent out via email and completed digitally. It's not guaranteed that all forms sent out were done with accuracy, which could alter the potency of the study.

Based on these limitations and other insights related to the literature, the following recommendations for future research should be considered:

1. Future research should investigate specialized youth athletes to test whether it was primarily their decision to specialize, their parents' decision, or a mutual decision. As stated prior, too often we see athletes feel external pressure to specialize and they often cave in to outside pressures due to social influence.
2. Future research should investigate how different sources of motivation (self determination theory, extrinsic motivation, intrinsic motivation) can be affected by early sport specialization.

3. Future research should investigate the possible correlation between eating disorders and early sport specialization that often pressures youth athletes to attain a certain physique.

Summary

The purpose of this literature review was to determine the effects that youth sport specialization has on the development of youth athletes. Delimiting variables were used to do an exhaustive data-based search which yielded 10 articles. These articles were then systematically used to determine the effects that youth sport specialization has on the development of youth athletes. Research revealed that there was strong evidence to support the claim that early sport specialization may cause significant overuse injuries and dysfunctions, psychological issues, and lack of sleep. Those who specialize at an earlier age are often at a higher risk of these problems due to the body not being fully developed and it may interfere with the overall development of youth athletes.

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Appendix A

Article Grid

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/Recommendations & Research Notes
Delimaris (2015)	Potential Adverse Biological Effects of Excessive Exercise and Overtraining Among Healthy Individuals	Acta Medica Martiniana	To determine the potential adverse biological effects of excessive exercise and overtraining among initially healthy men and women.	<p>A review of literature was performed to create a narrative. Literature used was published from 1980-2014.</p> <p>All studies contained healthy men and women with no underlying health conditions.</p>	Data extracted from each study was synthesized with each other to draw correlations.	Musculoskeletal injuries, adverse cardiovascular effects, exercise induced muscle damage, exercise related immunity alteration, exercise related male & female reproductive dysfunction, chronic negative energy balance, osteoporosis, and sleep disorders are potential adverse biological affects of overtraining.	<p>Prevention programs could be created to prevent possible adverse effects and increase overtraining awareness.</p> <p>Future research could investigate high quality trials to identify probability of adverse effects.</p>

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/Recommendations & Research Notes
Garinger, Chow, & Luzzi (2018)	The Effect of Perceived Stress and Specialization on the Relationship Between Perfectionism and Burnout in Collegiate Athletes	Anxiety Stress & Coping	To examine relationships between perfectionism, stress, and burnout in specialized and multi-sport collegiate athletes.	<p>352 D2 & D3 track and field athletes (ages 17-32) from 62 different programs completed 4 questionnaires (demographics, MPS-2, PSS, & ABQ).</p> <p>Coaches agreed to participate but responses would remain confidential.</p> <p>Participants were debriefed upon completion on the study's purpose.</p>	Descriptive statistics & bivariate correlations were used to analyze the data.	<p>Specialized athletes were found to have greater levels of stress than multi-sport athletes.</p> <p>Perfectionistic concerns had a direct impact on burnout.</p> <p>13% of the sample size was burned out.</p> <p>There was a negative relationship between perfectionistic concerns and burnout.</p>	<p>Athletes who scored higher on the Perceived Stress scale may have been more intrinsically motivated.</p> <p>Perceived demands and resources for multi-sport athletes may shift since they are able to change pace going from sport to sport.</p> <p>Future research is needed to investigate the complex nature of the relationship between perfectionism, stress, and burnout in collegiate athletes.</p>

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/Recommendations & Research Notes
Hall, Foss, Hewett, & Myer (2015)	Sports Specialization is Associated with an Increased Risk of Developing Anterior Knee Pain in Adolescent Female Athletes	Journal of Sport Rehabilitation	To determine if sport specialization is associated with increased risk of patellofemoral pain (PFP) development in adolescent compared to those who do multiple sports.	546 youth athletes (female) from a Kentucky School District completed the anterior knee pain scale, international knee documentation committee form, medical history form, maturational estimates form, and anthropometrics form. Each athlete also completed a physical examination. Multi-sport athletes were compared to sport specialized athletes.	Statistical analyses (SPSS v21), statistical significance, group differences (ANOVA), and confidence intervals were used to analyze the data.	Sport specialization in female adolescents is associated with increased risk of PFP when in comparison to multi-sport athletes. Specialization in a single sport increased risk of PFP incidence by 50%.	Athletes who specialize in a single sport year-round may suffer from social isolation due to the time demands of training. Lack of diversity through activity in youth athletes may undermine the development of comprehensive motor skills acquired from diverse sport participation. Integrative training can attempt to fix repetitive load stress by incorporating general and specific strength and conditioning training. Further research is needed to investigate relationships between sport specialization and other knee pain disorders.

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/Recommendations & Research Notes
Milewski, Skaggs, Bishop, Pace, Ibrahim, Wren, & Barzdukas (2014)	Chronic Lack of Sleep is Associated with Increased Sports Injuries in Adolescent Athletes	The Journal of Pediatric Orthopaedics	To examine the impact of sleep deprivation on injury rates in youth athletes.	<p>112 student athletes from a large metropolitan middle/high school completed a survey regarding sport participation and sleep.</p> <p>Written consent was obtained from parents and student athletes at preseason meetings.</p> <p>Students participating in the study were sent an email link to the survey following consent.</p>	Statistical analysis (Stata 12.0), univariate analysis, and multivariate analysis were used to analyze the data.	<p>65% of athletes who got 8 hours of sleep per night were injured.</p> <p>Athletes who slept on average < 8 hours per night had a 70% higher chance of injury than those who slept ≥ 8 hours per night.</p> <p>By each additional grade in school, the risk of injury increased by 40%.</p>	<p>Increasing age is a predictor of injury in youth athletes.</p> <p>Lack of sleep and increasing grade in school appear to be associated with increased injury risk in adolescent athletic population.</p>

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/Recommendations & Research Notes
Murday, McLoughlin, Wild, Kwon, Burgess, & Labella (2024)	Injury Patterns in Highly Specialized Youth Athletes: A Comparison of 2 Pathways to Specialization	Journal of Athletic Training	To determine whether the distribution of injury types (acute vs overuse) among highly specialized athletes differed based on the pathway taken to specialization (evolved vs exclusive).	<p>1,171 youth athletes ages 12-17 completed a sports participation survey.</p> <p>Participants information was collected from an electronic medical record (age, sex, race, date of injury, diagnosis, & injury type).</p> <p>Participants were classified as low, moderate, or highly specialized.</p>	Statistical analysis (SAS software), bivariate analysis, and 1-way variance analyses were used to analyze the data.	<p>Overuse injuries accounted for 59% of all injuries in the highly specialized group.</p> <p>Athletes specializing in individual sports (vs team sports) had a 95% greater chance of having overuse injuries relative to acute ones.</p>	<p>High specialization is associated with a greater proportion of overuse injuries (compared to low-moderately specialized athletes).</p> <p>Injury type was similar between evolved and exclusive highly specialized athletes.</p>

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/Recommendations & Research Notes
Pasulka, Jayanthi, McCann, Dugas, & LaBella (2017)	Specialization Patterns Across Various Youth Sports and Relationship to Injury Risk	The Physician and Sportmedicine	To reexamine the framework for classifying sports specialization by focusing on the sub-sample of single-sport-specialized athletes and to describe relationships between sports type patterns of specialization, and injury risk for single-sport-specialized athletes.	1,190 participants from two university hospital-based sport medicine clinics completed a baseline survey. Those who experienced a sport injury completed additional surveys to describe their injury. Injuries were classified as acute, overuse, or serious overuse.	Statistical significance (STATA & p-value) descriptive statistics, variance analysis (ANOVA), chi-squared analysis, and logistic regression were used to analyze the data.	Individual sport specialized athletes had higher injury rates (81%) than those specializing in team sports (73%). Single sport specialized athletes individual sports started specializing at a younger age (11.2 ± 2.4) than single sport specialized athletes (12.0 ± 2.7). The greatest proportion of all injuries was tennis (58%), baseball/softball (50%), and volleyball (42%).	The data suggests that single sport specialization is more common in individual sports and tends to start at a younger age. Most individual sports are extremely repetitive in terms of sport specific skill, which may lead some to feel the need to specialize. Team sports are more likely to involve acute injuries while individual sports are more likely to involve serious overuse injuries. Patterns of specialization appear to vary by sport. Neuromuscular training may help to improve motor skills and performance while decreasing risk of injury among athletes specializing in a single sport.

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/Recommendations & Research Notes
Post, Trigsted, Schaefer, Cadmus-Bertram, Watson, McGuine, Brooks, & Bell (2020)	The Association of Sport Specialization, Overuse Injury, and Travel with Daytime Sleepiness in Youth Athletes	Athletic Training & Sport Health Care	To examine the relationship between sport specialization and daytime sleepiness in youth club sport athletes.	647 youth club sport athletes (ages 12-18) were recruited across the state of Wisconsin and completed a questionnaire regarding demographics, specialization status, daytime sleepiness, regular travel, and sport related injuries within the last calendar year.	Univariate analyses, & multivariable regression were used to analyze the data.	<p>Highly specialized athletes had greater Pediatric Daytime Sleepiness Scale (PDSS) scores than both moderate and low specialized athletes.</p> <p>Athletes who reported an overuse injury within the last calendar year had greater PDSS scores than those who didn't.</p> <p>Highly specialized athletes had significantly higher PDSS scores compared to low specialization athletes.</p>	<p>Sleep is both a risk factor and consequence of injury.</p> <p>The increase of travel leagues requires youth athletes to travel for longer periods of time and thus catch up on missed sleep during weekends.</p> <p>High levels of specialization, overuse injury history in the last calendar year, and regular travel out of state for sport were all associated with higher levels of daytimes sleepiness among youth athletes.</p>

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/Recommendations & Research Notes
Rauh, Tenforde, Barrack, Rosenthal, & Nichols (2020)	Sport Specialization and Low Bone Mineral Density in Female High School Distance Runners	Journal of Athletic Training	To examine the association between sport specialization and low bone mineral density in high school female distance runners.	64 female cross country/track and field distance runners (ages 13-18) from 6 high schools in Southern California completed an x-ray absorptiometry scan, and completed questionnaires regarding sport involvement and menstrual cycles at the beginning and throughout their seasons. All athletes were measured, and weighed. Each athlete had their Bone Mineral Density (BMD) calculated.	Variance analysis, covariance analysis, univariate odds ratios, & multivariate logistic regression were used to analyze the data.	High sport specializers had a greater percentage of low BMD (57%) than moderate (42%) and low specializers (19%). 36% of the distance runners met criterion for low BMD. Menstrual dysfunction was strongly associated with low BMD.	Menstrual dysfunction is more common in endurance sports and sports emphasizing leanness. High sport specialization in long-distance running may be a risk factor for impaired bone health. Encouraging diversity of sport activities outside of running, addressing menstrual dysfunction, and promoting optimization of nutrition may be important during adolescence (peak time for bone mass accrual).

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/Recommendations & Research Notes
Sheppard, Nicknair, & Goetschius (2020)	Early Sport Specialization and Subjective Hip and Groin Dysfunction in Collegiate Ice Hockey Athletes	Journal of Athletic Training	To examine the effects of ice hockey specialization before high school on current subjective hip and groin dysfunction in collegiate ice hockey athletes.	187 collegiate hockey players (ages 18-30) from NCAA D3 & ACHA D1-D3 across midwestern colleges completed a demographics questionnaire, a 3-point sport specialization questionnaire, and the Hip and Groin Outcome Score (HAGOS) questionnaire during the middle of the 2018-2019 academic hockey season.	1-way variance analysis, Mann-Whitney U tests, Kruskal-Wallis tests, & Spearman p correlations were used to analyze the data.	<p>The high specialization group reported greater dysfunction than the low specialization group on the symptoms, pain, daily living activities, sport & recreation, and quality of life subscales.</p> <p>Females reported greater hip & groin dysfunction than the males in highly specialized athletes.</p>	<p>Cumulative stress on femur, acetabulum, labrum, articular cartilage, and adductor/iliopsoas muscle groups combined with minimal rest and movement diversity may lead to chronic inflammation, tissue degeneration, or malformation of developing musculoskeletal issue.</p> <p>Collegiate ice hockey players who were highly specialized before high school reported greater current hip and groin dysfunction during daily living activities (lower quality of life) and sport/recreation compared with low-specialization ice hockey players.</p> <p>Results may not be applicable to ice hockey athletes in more elite categories & tiers.</p>

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/Recommendations & Research Notes
Stockbower, Howell, Seehusen, Armento, & Walker (2022)	Sport Specialization, Sleep, Fatigue, and Psychosocial Ratings: Do Highly Specialized Athletes Differ from their Less Specialized Peers?	The Physician and Sportmedicine	To determine if specific psychosocial outcomes including anxiety, depressive symptoms, sleep quality, fatigue, and/or perceptions of sport specialization differ between high school athletes who reported high, moderate, and low levels of sport specialization .	186 high school athletes (ages 13-18) from one school district completed multiple questionnaires with a pre participation evaluation. The questionnaires asked questions regarding number of training hours/week, level of competition, concussion/orthopedic history, sport participation, sleep quality, and psychosocial function.	Statistical analysis (Stata 15), one-way variable analysis (ANOVA), and t-test were used to analyze the data. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI).	Highly specialized athletes reported significantly higher levels of fatigue, anxiety, and depressive symptoms compared to moderately specialized athletes.	Athletes are not immune to mental illness. A player's past injury history doesn't contribute to higher levels of fatigue, anxiety, and depressive symptoms (highly specialized vs moderately specialized) Increased demands for sports through specialization may lead to social isolation, academic stress, and burnout in youth athletes. Further research could investigate the correlation between sport specialization and psychosocial outcomes in children and adolescents.

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/Recommendations & Research Notes
Qi, Hua, Zhou, & Shek (2020)	Trends of positive youth development publications (1995-2020): A scientometric review	Applied Research in Quality of Life	To determine main contributors of positive youth development (PYD) research.	20 articles were gathered from Web of Science (through SCI Expanded, SSCI, A&HCI, CPCI-S, CPCI-SSH, and ESCI) to create a	Network analysis, co-citation analysis, & co-occurrence analysis was used to analyze the data.	Psychology was found to be the top category of involvement for PYD research (followed by social work, public health, social sciences, and education).	Those who work in environmental science, social work, psychology, and public health are coming together to increase PYD research. Future research could investigate more diverse sources for the scientometric analysis.

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/Recommendations & Research Notes
Waldron, DeFreese, Pietrosimone, Register-Mihalik, Barczak (2020)	Exploring Early Sport Specialization: Associations with Psychosocial Outcomes	Journal of Clinical Sport Psychology	To evaluate the associations between retrospective athlete reports of sport specialization and both retroactive and current psychosocial health outcomes.	243 athletes (ages 18-23) from a southeastern university completed multiple questionnaires regarding demographics, psychological measures, specialization level, training volume, their specialization retrospective, burnout, motivation, stress, perceived social support, and psychological resilience. Participants were contacted via email to complete the survey anonymously.	Multivariate analysis, descriptive statistics, bivariate correlations, group difference tests (ANOVA), and five chi-square tests were used to analyze the data.	Global burnout showcased a strong positive association with sport stress, amotivation, a negative association with perceived social support, and intrinsic motivation. Early specializers reported significantly higher levels of global athlete burnout, sport devaluation, and exhaustion than both the late specializers and samplers.	Specialization environment may contribute to burnout due to the high levels of physical investment resulting in athletes feeling of exhaustion (highly specialized athletes reported significantly higher volume of sport related training at earlier development periods). The specialization environment may contain inherent risk of maladaptive psychological outcomes for athletes younger than 13. Early specialization may carry an increased risk of burnout and amotivation. Further research could investigate more diverse samples relative to gender.