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Sport Participation and Specialization Characteristics Among Pediatric Soccer Athletes

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Investigation performed at the University of Wisconsin–Madison, Madison, Wisconsin, USA

Background: Soccer is an increasingly popular sport for children and adolescents in the United States. Little is known about participation patterns related to sport specialization.

Purpose: To investigate soccer participation levels and sport specialization characteristics among youth soccer athletes.

Study Design: Cross-sectional study.

Methods: Adolescent athletes aged between 12 and 18 years completed an online survey addressing participant demographics, sports and soccer participation history, and level of specialization. Descriptive analyses characterized participation, while chi-square and Kruskal-Wallis tests assessed the influence of specialization, sex, and grade on survey variables.

Results: Overall, 83.7% of 746 respondents participated in an organized soccer league outside of school, and 37% played in multiple leagues concurrently. Nearly three-quarters of respondents trained in soccer more than 8 months of the year, with those who participated in club soccer being more likely to train more than 8 months of the year. More respondents were classified as high specialization (37.5%), followed by moderate (35.6%) and low (28.6%) specialization. No differences between sexes were noted for level of specialization or quitting other sports to specialize in soccer, but male athletes were more likely to train more than 8 months per year compared with female athletes. Respondents in older grades (9th-10th and 11th-12th grades) were more likely to be highly specialized and quit other sports to focus on soccer. No differences between grade levels were found among respondents training more than 8 months per year.

Conclusion: The study findings suggest that many youth soccer athletes participated in multiple teams or leagues at the same time and trained more than 8 months of the year. Characteristics including participation on a club team, level of specialization, and male sex were associated with a greater likelihood of exceeding the 8-month training recommendation.

Keywords: sport sampling; overtraining; American development model; long-term athlete development model

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Soccer remains one of the most popular organized sports for youth participation, with over 15 million youth athletes playing annually.¹² According to US Youth Soccer, there were more than 3 million registered youth soccer players in 2014, demonstrating an almost 90% increase from 1990.²⁵ Furthermore, high school soccer participation increased 4-fold among boys and 35-fold among girls from 1973 to 2014, with 838,573 high school athletes participating in soccer in the 2016-2017 year.¹⁷ Recent data have demonstrated that 75% of soccer athletes participate in club sports and that 21% are classified as high specialized.²⁰

Early sport specialization is defined as “extensive year-round training in a single sport at the exclusion of others.”⁷ It is characterized by participating in intensive training or completion in one sport, to the exclusion of other sports, for more than 8 months of the year in athletes who have yet to

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reach puberty.^{11,13} Often, early sport specialization is encouraged by parents and coaches, who feel it is needed to improve performance and increase the chance of making a high school team or attaining a college scholarship.¹⁴ However, many sports medicine and athletic organizations have begun investigating sport specialization and the potential association with injuries and burnout.^{3,6,15,20,21}

Sport specialization has been assessed through a 3-question survey developed by Jayanthi et al¹¹ that categorizes the level of specialization as low, moderate, or high based on responses to questions regarding quitting other sports to focus on one, considering one sport more important than others, and training more than 8 months of the year in one sport. In the initial study using this classification system, a high level of sport specialization was found to be an independent risk factor for injuries, after accounting for age and hours per week participating in sports.¹¹ In addition, Bell et al³ demonstrated that highly specialized high school athletes were more likely to sustain a knee or hip overuse injury when compared with athletes with a moderate or low level of specialization. More recently, a systematic review and meta-analysis reported that highly specialized athletes were at a significantly greater risk of sustaining overuse injuries compared with those with moderate (relative risk, 1.18 [95% CI, 1.05-1.33]) and low (relative risk, 1.81 [95% CI, 1.26-2.60]) specialization.²

As a means to address concerns regarding overuse, overtraining, and burnout associated with early sport specialization, numerous medical organizations have developed recommendation for youth sports participation limits.^{5,7,13,26} While the specific recommendations may vary slightly, they generally suggest allowing some days of rest each week and taking months off from the primary sport throughout the year. Specific recommendations include allowing at least 1 to 2 days of rest per week,⁵ training fewer hours than one's age,¹³ limiting weekly training to less than 16 hours per week,²⁶ and limiting single-sport participation to not more than 8 months of the year.¹¹

To date, there is minimal information about early sport specialization in youth soccer, including the ages of specialization, sex differences, and levels of specialization. Given the popularity of soccer worldwide, there is a concern for a high prevalence of sport specialization in this population. The purpose of this study was to investigate soccer participation levels and specialization characteristics among youth soccer athletes and to determine what percentage of players exceed safe sport recommendations. A secondary purpose was to compare soccer participation and specialization characteristics by grade level and sex.

METHODS

Participants

Youth athletes across the United States were recruited to complete an online survey (Qualtrics Lab Inc). The inclusion criteria were athletes between 12 and 18 years of age who had participated in organized soccer in the previous 12

months and had submitted the survey. Respondents who partially completed the survey but did not hit "submit" were excluded. The study was approved by an institutional review board.

Instrumentation

The anonymous and nonvalidated online questionnaire (see the Appendix) included participant demographics (age, sex, grade, state), soccer participation (age at which participant started organized soccer, participation in other sports, levels played, timing of participation), level of specialization (specialization scale, training volume), and musculoskeletal injury history (not analyzed for these research questions). The survey took approximately 10 minutes to complete. The level of specialization was determined by participant responses using the 3-point scale described by Jayanthi et al,¹¹ which includes 3 questions with binary yes/no answers: (1) Have you quit other sports to focus on soccer? (2) Do you consider soccer more important than your other sports? (3) Do you train more than 8 months a year in soccer? Respondents were awarded 1 point for each "yes" response, and specialization was classified along a continuum from low (0-1 points) to moderate (2 points) to high (3 points). The survey questions included yes/no and single/multiple choice responses. Members of the Pediatric Research in Sports Medicine (PRiSM) Sports Specialization Research Interest Group modified the initial survey questions from previously used surveys.^{11,21} After development, the survey was validated for content validity by a subset of Sports Specialization Research Interest Group members, which included athletic trainers, pediatric orthopaedic surgeons, physical therapists, and primary care physicians.^{1,4,21} Because the questions had been modified from previous surveys, piloting and reliability were not performed. In most cases, responses were limited to the previous 12 months to limit recall bias.

Procedures

Youth athletes from across the United States were recruited to complete the online survey. The survey link was distributed by Sports Specialization Research Interest Group members via email and through personal and PRiSM social media accounts (Twitter, Facebook). The survey link was also shared via email with youth sports advocates, sports medicine groups, youth soccer organizations, and high school coaches via publicly available email addresses. These organizations were asked to share the link with parents of youth athletes and on their own social media channels. Therefore, our sampling strategy was one of convenience, and we are unable to calculate an accurate survey response rate. The survey was available from May 2017 to March 2018.

Statistical Analysis

This study analyzed survey responses related to participant demographics, soccer and other sports participation, and level of specialization. Data were summarized via

TABLE 1
Age at Which Respondents Started Playing Soccer
(n = 744 [17 Missing])

Age Group, y	n (%)
≤5	418 (54.9)
6-10	273 (35.9)
11-15	38 (5.0)
>15	15 (1.8)

means and standard deviations, frequencies, and percentages as appropriate. Statistical significance was set a priori at $P < .05$. All analyses were performed in SPSS (version 24.0; IBM).

For our primary purpose, we analyzed the influence of participation in club soccer on training more than 8 months of the year using the chi-square test. The Kruskal-Wallis test was used to assess differences between levels of specialization (high, moderate, low) with training more than 8 months of the year. The post hoc Mann-Whitney U pairwise test with the Bonferroni correction was used to determine differences between the 3 levels of specialization.

To assess the influence of sex on levels of specialization and the training variables, separate chi-square tests were used. The chi-square test was also used to evaluate the relationship between grade level group and training more than 8 months per year and quitting other sports to focus on soccer, while the Kruskal-Wallis test was used to assess grade level group differences and levels of specialization. Significant findings were further assessed with pairwise comparisons with the Bonferroni correction.

RESULTS

Respondents

Participants included 761 adolescent athletes with a mean age of 14.7 ± 1.9 years (range, 12-18 years) and mean grade level of 9.0 ± 1.9 (range, 5th-12th grades) who submitted the survey. The majority of participants were female (56.5%, $n = 431$), with 41.4% ($n = 315$) being male and 2.0% ($n = 15$) not responding to the question about sex. Not all respondents included a response for each question. Missing responses varied by question and ranged from 13–30.

Soccer Participation

The majority of respondents (54.9%) started participating in soccer before the age of 5 years (Table 1). Of those responding, 83.7% ($n = 637/761$) indicated that they played soccer in an organized league outside of school. Over 50% of respondents (52.7%, $n = 401$) indicated that they participated on both club and school teams. Figure 1 identifies the levels of soccer in which respondents participated. Just over one-third of respondents (35.1%, $n = 267$) selected 1 level, while nearly half of respondents (49.5%, $n = 377$) selected 2 levels, followed by 13.1% ($n = 100$) participating in 3 levels, and less than 1% ($n = 1$) selecting all

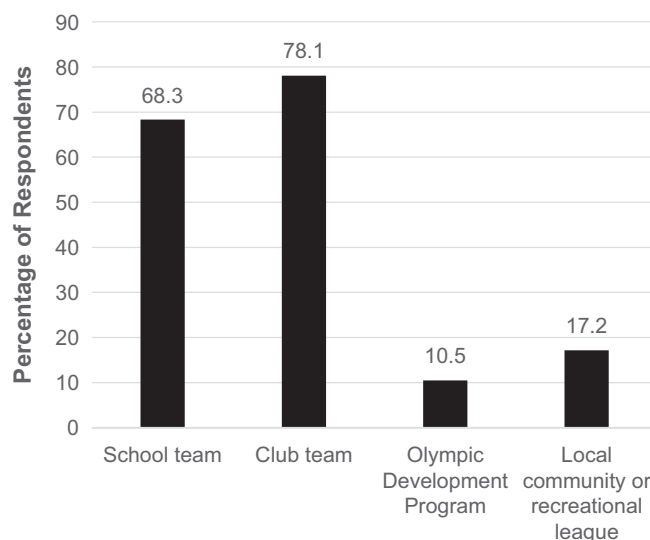


Figure 1. Levels of organized soccer participation. Respondents could select all applicable categories.

4 levels of soccer. Furthermore, 37% ($n = 282$) of respondents indicated that they played organized soccer in multiple leagues at the same time; 59% ($n = 445$) of respondents indicated that they played multiple sports but only participated in 1 sport at a time, whereas 37.6% ($n = 286$) reported that they played in multiple leagues of different sports at the same time.

Competition Volume and Specialization Level

On average, respondents indicated that during a typical competitive season, they participated in organized soccer 4.6 ± 1.0 days per week (range, 1-7 d/wk) and 10.7 ± 5.3 hours per week (range, 2-31 h/wk). Figure 2 presents the number of soccer games in which respondents participated during the past 12 months reported by level of specialization. In addition, we compared the number of hours of training per week during a typical competitive season with the athlete's age. A majority of athletes (86.1%, $n = 655$) did not play more hours per week than their age, with fewer (11.2%, $n = 85$) exceeding that recommendation.

The majority of respondents (56.6%, $n = 431$) did not quit other sports to focus on soccer, but most (78.3%, $n = 596$) did consider soccer more important than other sports. About three-fourths of respondents (74.8%, $n = 569$) indicated that they train in soccer for more than 8 months per year. Of these respondents, those who participated in club soccer (92.3%, $n = 525$) were more likely ($\chi^2 = 265.9$; $P < .001$) to train more than 8 months of the year than respondents who did not participate in club soccer (7.7%, $n = 44$). Those who participated in both school and club soccer (64.0%, $n = 364$) were more likely ($\chi^2 = 115.1$; $P < .001$) to train more than 8 months of the year than those who did not participate in both school and club soccer (36.0%, $n = 205$).

The level of specialization among the sample was closely split, with 37.5% ($n = 272$) classified as high

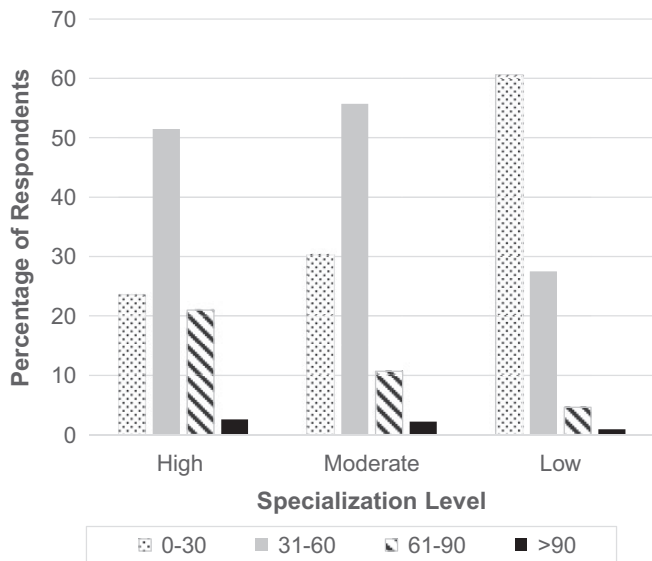


Figure 2. Number of soccer games in the past 12 months (n = 740 [21 missing]) by level of specialization.

specialization, 35.6% (n = 271) as moderate specialization, and 28.6% (n = 218) as low specialization. A significant difference was noted between specialization levels for training more than 8 months of the year ($\chi^2 = 347.1$; $P < .001$), with those in the high specialization group (100.0%, n = 272) more likely to train more than 8 months per year compared with the moderate (85.6%, n = 232) and low (29.8%, n = 65) specialization groups. Respondents in the moderate specialization group were more likely to train more than 8 months of the year compared with the low specialization group.

Sex-Based Differences in Specialization

There were no differences between the sexes for quitting other sports to focus on soccer ($\chi^2 = 1.67$; $P = .196$; male: 47.0%, n = 148/315; female: 42.2%, n = 182/431) or level of specialization ($P = .054$); however, male athletes (81.6%, n = 257/315) were more likely ($\chi^2 = 10.154$; $P = .001$) to train more than 8 months of the year compared with female athletes (71.5%, n = 308/431).

Grade-Based Differences in Specialization

Respondents were categorized by grade level: 5th-6th (n = 106), 7th-8th (n = 159), 9th-10th (n = 301), and 11th-12th (n = 177). The degree of specialization differed between groups ($\chi^2 = 9.17$; $P = .027$), with post hoc tests indicating that the 5th-6th grade group was distributed significantly differently than the 9th-10th ($P = .031$) and 11th-12th ($P = .039$) grade groups (Figure 3). Specifically, the respondents in the 5th-6th grade had fewer highly specialized respondents and more classified as low specialization. Differences were noted between grade level groups in the percentage of respondents quitting other sports to focus on soccer ($\chi^2 = 16.35$; $P = .001$), with a greater

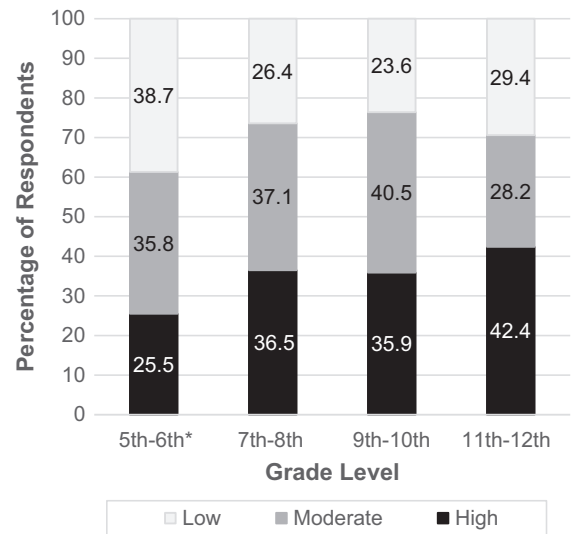


Figure 3. Degree of specialization by grade group. *Significantly different distribution in the 5th-6th grade compared with the 9th-10th and 11th-12th grades.

TABLE 2
Respondents Who Quit Other Sports and Who Train More Than 8 Months per Year^a

Grade	Quit Other Sports	Train >8 mo/y
5th-6th	29 (27.4) ^b	79 (74.5)
7th-8th	67 (42.1)	126 (79.2)
9th-10th	137 (45.5)	234 (77.7)
11th-12th	91 (51.4)	126 (71.2)

^aData are reported as n (%).

^bSignificantly fewer respondents quit other sports compared with the 9th-10th and 11th-12th grades.

percentage of respondents in the 9th-10th and 11th-12th grade levels compared with the 5th-6th grade level. However, there were no differences in the percentage of respondents who trained more than 8 months per year in soccer, with close to three-quarters of all respondents, regardless of grade, training more than 8 months per year in soccer (Table 2).

DISCUSSION

This study is the first, to our knowledge, to examine sport participation and specialization trends in youth soccer in the United States. Previous studies have suggested a growing trend toward year-round training in young athletes, sport specialization starting at an earlier age, and participation on multiple teams simultaneously, often of the same sport.^{5,9,10} In our study, the main findings were that most athletes started playing soccer before they were 5 years old, most soccer athletes trained longer than 8 months per year regardless of the level of specialization,

and older athletes were more likely to quit other sports to focus on soccer.

There is growing evidence that sport specialization may increase an athlete's risk for overuse-related injuries.^{2,6,11,15} One recommendation to avoid specialization is to take a season off from a single sport during the year.^{1,2,9,12} According to our survey, there seems to be a large number of youth soccer players exceeding these single-sport participation recommendations, even at young ages. A key finding in our study was that it agrees with the current trend in the culture of sports toward decreased child-driven "free play," with structured organized sports starting at an early age, as more than half of the participants in our study reported the initiation of soccer participation at younger than 5 years.¹⁴ This further agrees with prior research, which showed 78% of high school athletic trainers reporting an increasing trend in sport specialization, with select and travel leagues starting at a young age on the rise.^{10,16}

Several contributing factors with respect to young athletes participating in soccer more than 8 months of the year were noted. These included participation in club soccer, participation in club and school soccer, greater level of specialization, and male sex. Interestingly, age group did not play a role in exceeding the training recommendation, as close to 75% of all age groups reported participating in soccer more than 8 months of the year, even though the level of specialization did vary among age groups. In general, youth soccer players were found to play at a high volume that also exceeded the safe sport recommendations of sport sampling and limiting the overall volume of participation. On average, it was reported that they played nearly 5 days of soccer per week and trained about 11 hours per week.

Many prior studies have alluded to an increased risk of injuries with increased training volumes such as training in an organized sport more than 11 hours per week or participating in more organized sports compared with free play at a ratio greater than 2:1, as well as an increased risk for shoulder and elbow surgery in young baseball athletes pitching more than 8 months per year.^{11,18,22} In the current study, 37% of respondents indicated playing in multiple soccer leagues simultaneously, with another 37.6% reporting participation in multiple leagues of different sports simultaneously. Participation in numerous leagues may increase the risk of injuries, as it limits time off within a season or between seasons. This relates to injuries in a number of ways, including not having days of rest in which to recover as well as being more likely to exceed the hours/week recommendation.

There are several participation metrics of note. A majority of study respondents (71.4%) reported that they did not quit other sports to focus on soccer; however, just over three-fourths (78.3%) considered soccer more important than other sports. Older athletes (9th-10th and 11th-12th grades) showed a higher tendency to quit other sports to specialize in soccer, with approximately 50% of respondents reporting having quit other sports. In addition, we found that older athletes were more likely to be specialized in soccer compared with those in the 5th-6th grade. Both the long-term athlete development model⁸ and American

development model²⁴ recommend a staged approach that promotes early sport diversification or sampling and delayed specialization.⁵ The goal of the models is to promote physical literacy and fundamental movement patterns in the youngest athletes to learn the basic skills of athleticism before introducing basic sports skills and more technical sport-specific training. Both models suggest that technical development and competition-specific training should occur between the ages of 13 and 18 years,^{8,24} during which time an athlete may focus on 1 sport.

Our findings suggest that 35% to 42% of our respondents in the 9th-10th and 11th-12th grades were classified as highly specialized, which may be appropriate for the respondents in the 11th-12th grade but still a concern among those in the 9th-10th grade. Of greater concern is that over 25% of 5th-6th grade athletes and 36% of 7th-8th grade athletes were highly specialized. According to both development models, youth younger than 12 years should be involved in sports to "discover, learn, and play"²⁴ in which they learn the skills of athleticism and improve physical literacy.^{5,8} Early sport specialization may limit the number of athletic skills and fundamental movements to which a youth may be exposed while increasing the injury risk. Even as youth move into the second stage of the development models, they are encouraged to continue to participate in multiple sports.²⁴ Our findings suggest that there is a need for further education of youth sports stake holders to better promote the different development models.

There has been a significant increase in female sports participation in general over the past half century,²³ and our results highlight that the level of competition and sport specialization among female athletes is equal to their male counterparts. When comparing degrees of sport specialization by sex, we found no significant difference. This finding agrees with previous research in high school athletes that observed no differences in specialization rates between sexes.^{1,3} In contrast, differences between sexes was noted among current collegiate athletes, with a greater percentage of female athletes specializing before college, although there were no differences with regard to the age at which specialization began (~15 years).⁶ Sex-based differences in specialization do seem to be more common in individual sports when compared with team sports.¹⁹

Our study is not without limitations. The survey design includes an inherent potential for recall bias. The survey was distributed through a snowball mechanism via various social media platforms and direct emails to league organizers who forwarded to their constituents. Therefore, the sample is one of convenience, and we were unable to determine the exact number of athletes who may have received the survey request. Additionally, while we had a large number of respondents, it is unclear if this convenience sample of youth soccer athletes is truly representative of the youth soccer population.

CONCLUSION

This study sought to identify participation and specialization characteristics among youth soccer athletes and

identify factors that may contribute to exceeding participation recommendations. Of note, we report numerous findings that should raise some concerns about the overall volume of participation in youth soccer. The majority of respondents began their soccer career before the age of 5 years and had participated in leagues outside of school sports, with over half participating in school and club soccer during the same year. Furthermore, close to 75% of respondents trained more than 8 months of the year, exceeding current participation recommendations. Youth participating in club leagues, or club and school leagues, were more likely to be highly specialized, and male athletes were more likely to train more than 8 months of the year. Our findings suggest that specialization in soccer at an early age is common and that youth soccer players are not taking much time off from competitive soccer during the year, which may put them at risk for injuries. Educating athletes, parents, and league officials and promoting sport sampling, diversification, and reduced training volume are important to ensure healthy participation in sports.

AUTHORS

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APPENDIX

Survey Questions

1. How old are you?
2. How old were you when you started playing organized soccer?
3. In the past 12 months, in which of the following months did you participate in soccer activities (games, practice, or training)? Please check all that apply.
4. In the past 12 months, in what levels of organized soccer did you participate? Select all that apply. [Levels: school team / club team / Olympic development program / local community or recreational league]
5. Do you play soccer in an organized league outside of school?
6. In the past 12 months, did you play organized soccer in multiple leagues at the same time? For example, did you practice/play with a club team and a school team in the same week?
7. In the past 12 months, did you play organized soccer and another organized sport at the same time? For example, did you practice/play with a club soccer team and another sport team/league in the same week?
8. During a typical competitive season, about how many **days a week** did you participate in organized **soccer (practices, games, and tournaments)**?
9. During a typical competitive season, about how many **hours a week** did you participate in organized **soccer (practices, games, and tournaments)**?
10. How many soccer games did you play in the past 12 months? Select the range that fits you best. Also keep in mind that 1 soccer tournament may include several games. [Answers were broken into ranges of 10 (0-10, 11-20, etc).]
11. Have you quit other sports to focus on soccer?
12. Do you consider soccer more important than your other sports?
13. Do you train more than 8 months a year in soccer?
14. Are you: Male Female
15. What grade are you in school (if you are taking this over the summer, what grade did you just complete)?
16. In which state do you currently live?