Sport Specialization and Participation Characteristics of Female High School Volleyball Athletes

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ABSTRACT

Purpose: To compare participation metrics by level of specialization in volleyball players and to determine if motivational factors were associated with level of specialization.

Methods: Female high school volleyball players (n = 102) between 13 and 18 years of age were surveyed from two local high schools. The survey questions were about participation metrics, influential factors, and sport specialization.

Results: Highly specialized athletes had a significantly higher training volume than lower specialized athletes in variables including months per year and hours per week playing volleyball. Obtaining a college scholarship was an influential factor for volleyball participation in highly specialized volleyball athletes (P < .001).

Conclusions: Highly specialized players were participating at levels that exceed safe sport recommendations, which may increase their risk of injury. These habits may be influenced by the potential of a collegiate volleyball scholarship.


Volleyball has the highest participation rate among female team sports in the high school setting. In 2016-2017, the National Federation of State High School Athletic Associations reported that more than 440,000 females participated in volleyball, which accounted for 13% of overall female participation in high school sports. Volleyball is a sport where year-round participation is increasingly common and has one of the highest rates of club sport participation. One of the inherent risks associated with sports is the potential for injury. A study of middle school female athletes observed that 28% of athletes reported an injury, with a large number of injuries in volleyball occurring to the lower extremities. However, another study observed that 40% of high school volleyball players experienced shoulder pain unrelated to a traumatic injury. Overuse injury rates are higher in female volleyball athletes than male volleyball athletes at the collegiate level, demonstrating that female volleyball athletes may be at a higher risk of overuse injuries. Similarly, at the high school level, girls’ volleyball has the fifth highest overuse injury rate. Potential causes of this phenomenon may be year-round participation and sport specialization.

Sport specialization is increasingly common in volleyball athletes. It is defined as “year-round intensive training in a single sport at the exclusion of other sports.” Recent advances in methodology allowed for the classification of athletes into specialization categories (low, moderate, and high), and associations with injury risk have been observed with increasing levels of specialization. Several studies have concluded that highly specialized athletes are at increased risk of sustaining overuse injuries. Research in sport specialization found an increased risk of overuse injury in young athletes who participated in more hours per week of organized sport than their age in years and in a single sport for more than 8 months. Further research found that participating in any sport more than 16 hours per week increases the risk...
of sustaining an injury threefold compared to individuals who participate in a sport for 3 to 6 hours per week.\textsuperscript{12} However, the main limitation of this body of research is the use of broad cohorts of participants from many different sports rather than a gender- and sport-specific investigation. Sport-specific investigations are a crucial step to better understand the participation metrics that may increase the risk of injury and specialization.

Identifying an athlete’s motivation for participation is equally important because individual sports have different participation demands and cultures. Certain influential factors that drive sport specialization and overparticipation may also lead to early sport drop-out, which is a concern because individuals who are less active as adolescents tend to be more sedentary as adults.\textsuperscript{13} A survey of young athletes reported that sport drop-out was influenced heavily by parents and coaches.\textsuperscript{14} Understanding the factors that drive individuals to play or specialize in volleyball can help researchers find the necessary information for parents, coaches, and players to reduce the rate of burnout in volleyball.

To date, no study has examined the sport participation volume characteristics of high school female volleyball athletes, such as hours per week or months per year of participation. Therefore, the goals of this study were to compare the participation metrics (months per year of participation in a primary sport, months per year of participation in all sports, hours per week of participation in a primary sport, and hours per week of participation in all sports) by level of specialization in female high school volleyball players and to identify the possible associations of motivational factors (parents, college scholarship, sport competence, and sport enjoyment) with the specialization level. We hypothesized that highly specialized athletes would play volleyball more months out of the year compared to low specialized athletes, but the athletes would display no differences in the number of hours per week of volleyball participation. We also hypothesized that there was an association between high levels of sport specialization, parental influence, and the desire for a college scholarship.

\section*{METHODS}

\subsection*{Participants}

This study was approved by the institutional review board of the University of Wisconsin–Madison. Female volleyball players were recruited from two local high schools as part of a larger study that was conducted during the 2014-2015 academic year. Members of the research team were required to travel to these high schools with equipment not pertinent for this study. Therefore, school location was partially determined due to their proximity to the university. Permission was obtained from the school, coaches, and athletic trainers to recruit students. Informed written consent was obtained from the athletes and parents. To be eligible for the study, individuals had to be between the ages of 13 and 18 years and a current member of a freshman, junior varsity, or varsity volleyball team.

\subsection*{Questionnaire}

A sport specialization survey was completed by all participants prior to the fall 2014 school semester. Surveys were filled out independent of influential individuals, such as coaches, parents, or current and past teammates. A 3-point sport specialization scale was used to determine participants’ classification of sport specialization (low, moderate, or high). This scale has been used in previous research and contains three questions: “Have you quit other sports to focus on one sport?”; “Do you train more than 8 months out of the year in one sport?”; and “Do you consider your primary sport more important than other sports?”\textsuperscript{10} These questions were based on the general definition of sport specialization as “year-round intensive training in a single sport at the exclusion of other sports.”\textsuperscript{8,15} Based on these questions, sport specialization was assessed using a categorical classification system (yes = 1, no = 0), where a score of “1” or “0” classified a participant as low specialization, a score of “2” classified a participant as moderate specialization, and a score of “3” classified a participant as high specialization.

Influential factors for focusing on volleyball were also included on the baseline survey and participants selected a level of influence for 11 different factors (Table 1). Influential factors were placed on a 5-point Likert scale from “did not influence at all” to “was extremely influential” for each factor. Using these responses, athletes were then categorized into “no influence,” “low influence,” and “high influence” groups (Figure 1). Additionally, participants were asked, “which had the MOST influence on you focusing on volleyball” and were also instructed to select one of the factors (Table 1).

Participation metrics were gathered from survey responses and based on the previous 12 months of volleyball participation. Athletes were asked to mark all of the months that they participated in organized volleyball and

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|}
\hline
Factor & Low Influence & High Influence \\
\hline
Parental Influence & No & Yes \\
\hline
Scholarship Influence & No & Yes \\
\hline
Competition Influence & No & Yes \\
\hline
Enjoyment Influence & No & Yes \\
\hline
\end{tabular}
\caption{Influential factors and their levels of influence.}
\end{table}
all of the months they played any sport, including volleyball. These answers were used to calculate the months per year participating in volleyball and in any sport. Additionally, athletes were asked to mark how many hours per week they participated in organized volleyball and in any sport, including volleyball. To assist participant understanding, the hours per week were grouped into categories that demonstrated hours per day.

**Statistical Analysis**

All statistical analyses were completed using SPSS software (version 21.0; SPSS, Inc., Chicago, IL) and R statistical software (version 3.4.2; The R Foundation for Statistical Computing, Vienna, Austria). Statistical significance was set a priori at a *P* value of less than .05 for all analyses. Participation metrics (months per year and hours per week) were compared between specialization levels using a one-way analysis of variance (ANOVA) with Fisher’s least significant difference post-hoc analysis. Responses for the motivational factors were categorized into three groups (Figure 1), and chi-square analyses were used to investigate associations between specialization and motivational factors. Fisher’s Exact test or Pearson correlation coefficient were calculated when appropriate.

**RESULTS**

There were 102 volleyball participants recruited in this study (age = 15.4 ± 1.1 years, grade = 10.3 ± 1.0).
On average, female volleyball players were participating in organized volleyball for 6.9 months per year and 15 hours per week. There was no significant difference in age ($F_{2,99} = 2.657, P = .08$) or grade ($F_{2,99} = 1.8, P = .17$) between the three specialization categories. Of the 102 participants, 51 were classified in the low sport specialization category (50%), 28 in the moderate sport specialization category (27%), and 23 in the high sport specialization category (23%).

The one-way ANOVA demonstrated that months per year in volleyball, total months per year in any sport, hours per week in volleyball, and total hours per week in any sport were significantly different between specialization groups (Table 2). Highly specialized athletes had a significantly higher training volume than low specialization athletes in all four of the training volume variables. Additionally, highly specialized athletes participated in more months per year of organized volleyball and all sports combined than moderately specialized athletes.

Descriptive statistics for the influential factors for focusing on volleyball are listed in Table 1. The rank order of influential factors was (1) liked volleyball the most, (2) best at volleyball, (3) parents, (4) friends, and (5) best opportunity to receive a college scholarship, regardless of the specialization level. When these factors were investigated by level of specialization, highly specialized volleyball players were more likely to rank obtaining a college scholarship as a “very” or “extremely” influential factor for participating in volleyball compared to low specialization athletes (39% vs 6%, $P < .001$) (Table 3). No other significant associations were observed between specialization category and the other influential factors. Additionally, when respondents were asked to select only one of 11 factors that were most influential for participating in volleyball, the most popular response was that they liked volleyball the most (47%) (Figure 2).

**DISCUSSION**

The most important findings of this study were that highly specialized high school female volleyball players participated in more organized volleyball activity than their low and moderately specialized counterparts. Regardless of sport specialization category, participants cited enjoyment of playing volleyball as the most influential factor for participation. However, when these results were stratified by level of specialization, highly specialized individuals were more likely to cite receiving a college scholarship as a motivating factor. To our knowl-

### Table 2

**Participation Metrics by Specialization Classification**

<table>
<thead>
<tr>
<th>Classification</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>$F$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Months per year in volleyball</td>
<td>$5.2 \pm 2.7$</td>
<td>$7.4 \pm 2.9$</td>
<td>$10.1 \pm 2.6$</td>
<td>26.1</td>
<td>.001a</td>
</tr>
<tr>
<td>Months per year in all sports</td>
<td>$9.0 \pm 3.2$</td>
<td>$9.1 \pm 3.4$</td>
<td>$11.1 \pm 1.8$</td>
<td>4.1</td>
<td>.02b</td>
</tr>
<tr>
<td>Hours per week in volleyball</td>
<td>$14.8 \pm 3.4$</td>
<td>$16.9 \pm 5.1$</td>
<td>$18.3 \pm 5.3$</td>
<td>6.5</td>
<td>.002c</td>
</tr>
<tr>
<td>Hours per week in all sports</td>
<td>$14.8 \pm 4.4$</td>
<td>$16.9 \pm 7.0$</td>
<td>$18.3 \pm 5.9$</td>
<td>3.5</td>
<td>.04d</td>
</tr>
</tbody>
</table>

*Values are presented as mean ± standard deviation.

*Post-hoc analysis: high > moderate > low.

*Post-hoc analysis: high > low and high > moderate.

*Post-hoc analysis: high > low and moderate > low.

*Post-hoc analysis: high > low.

### Table 3

**Chi-square Analysis of the Association Between Sport Specialization Groups and the Influence of Obtaining a College Scholarship**

<table>
<thead>
<tr>
<th>Sport Specialization Level</th>
<th>No Influence</th>
<th>Low Influence</th>
<th>High Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>40 (78.4)</td>
<td>8 (15.7)</td>
<td>3 (5.9)</td>
</tr>
<tr>
<td>Moderate</td>
<td>14 (50.0)</td>
<td>4 (14.3)</td>
<td>10 (35.7)</td>
</tr>
<tr>
<td>High</td>
<td>9 (39.1)</td>
<td>5 (21.7)</td>
<td>9 (39.1)</td>
</tr>
</tbody>
</table>

*Values are presented as number and frequency (percent) of respondents.

*Fisher’s Exact test: $P < .001$.
edge, this is the first study to examine participation patterns and motivational factors associated with volleyball. These findings highlight the current landscape for female high school volleyball athletes and demonstrate that year-round participation is common in this population.

On average, female volleyball players reported playing volleyball approximately 7 months per year, which was important because it demonstrates that the average athlete participated at a level that did not increase her risk for injury. However, there was a stepwise increase in participation from low to highly specialized volleyball players where highly specialized athletes were participating more than 8 months of the year (Table 2). Similarly, hours per week in organized volleyball increased with each level of specialization. Overall time spent in organized sports has been associated with an increased risk of sport-related injuries. Rose et al. found that participating in organized sport for more than 11 hours per week doubled the athlete’s risk of sport-related injuries compared to individuals who participated in an organized sport for 3 to 6 hours per week. Additionally, this risk increased threefold if participants engaged in more than 16 hours per week and doubled when compared to participants who engaged in organized sports for 7 to 10 hours per week. Both moderately and highly specialized athletes participated in organized volleyball more than 16 hours per week, and highly specialized athletes participated approximately 18 hours per week (Table 2).

These participation metrics are alarming because the athletes could be at an increased risk of sport-related injuries. Additionally, when controlling for participation metrics, being classified as a highly specialized athlete increased the risk of overuse injury in adolescents. Therefore, highly specialized athletes have three potential confounding factors that greatly increase their risk of injury: participating more than 16 hours per week, participating more than 8 months of the year, and forsaking other sports to focus solely on volleyball. These participation metrics and specialization rates may explain why female high school volleyball players are experiencing a high rate of overuse injuries. The cohort in this study demonstrated participation trends that may increase their risk of injury, and this may be a national trend in volleyball. Further research of female high school volleyball overuse injury rates compared to their level of sport specialization and participation metrics is needed to support this hypothesis.

We observed an association between sport specialization level and the influence of obtaining a college scholarship. Highly specialized athletes were more likely to cite obtaining a college scholarship as an influential factor than low specialization athletes (Table 3). This finding is similar to previous research that observed a perceived connection between specialization and improved sport performance among youth athletes. However, several sources demonstrated that specialization may not help athletes achieve high levels of success, and the efficacy of early sport specialization continues to be debated. Our study demonstrated that 22% of the participants were highly motivated by obtaining a college scholarship, but only 2% of females in the United States obtained a partial or full college scholarship for athletics. Therefore, there is a disconnect between reality and perception for female high school volleyball players regarding the effectiveness of early sport specialization. Interestingly, no highly specialized participant cited “parents” as the most influential factor, but parents were ranked as the third most influential factor for the entire sample. Some studies cited parental drive as a major influence for early sport specialization. In our cohort, it appeared that parental influence was relatively similar between sport specialization categories.

Athlete burnout is another potential consequence of early sport specialization and high participation volume, and it can lead to drop-out. Previous research of young athletes who dropped out of sport indicated that heavy parental pressure, sibling pressure, lack of sport peers, and coaching pressure were all part of their negative sport experience. Conversely, young athletes who continued to participate cited positive coaching reinforcement, more balanced parental involvement, and
support from peers as reasons they continued to participate. In the current study, the most influential factor for all participants was that they liked playing volleyball better than any other sport (Figure 2). This is a positive finding because it demonstrates that this cohort, regardless of specialization, participates because they enjoy the sport. Theoretically, this reduces the risk of burnout and improves physical activity as they age.

Limitations
All participation metrics were recall questions on the survey and based on the past 12 months, so there is a chance for recall bias. To reduce this limitation, surveys were reviewed with each athlete by an athletic trainer and member of the study team. Another limitation is that the sample was only obtained in the midwestern United States. However, due to the number of participants, we believe the conclusions are a good representation of the region. Additional research should be done in other regions of the country where volleyball may be more or less popular. Furthermore, future studies should explore the association of sport specialization and injury rates in female high school volleyball players. Specific factors about volleyball, or the individuals who participate in it, may drive high levels of sport specialization and an increase in overuse injury, which should be identified to decrease the risk of overuse injury in high school volleyball.

IMPLICATIONS FOR CLINICAL PRACTICE
To comprehensively address issues between sport specialization and injury, sport-specific participation metrics and motivational factors must be fully understood. This study was the first to compare sport participation metrics in high school volleyball players by levels of sport specialization. This was also the first study to explore specific factors that influence female high school volleyball players to specialize. This study determined that the volleyball player cohort participated at levels that may increase the risk of injury, especially overuse injury. Furthermore, these habits may be reinforced by the idea of receiving a collegiate volleyball scholarship.

REFERENCES