Wheelchair Basketball World Championships 2018 – Player Survey on Training Environment and Health Complaints

Rollstuhlbasketball Weltmeisterschaft 2018 – Befragung der Spieler zu Trainingsbedingungen und gesundheitlichen Problemen

Introduction

Wheelchair basketball follows the same rules as pedestrian basketball, but is played by athletes in wheelchairs due to inherited or acquired disabilities. In accordance with other Paralympic sports, athletes are classified according to their disability (21). An athlete’s disability is rated between 1 (severe disability) and 4.5 (minor disability), and during a game the five players on the field are not allowed to have a sum of more than 14. Thus, players with severe and minor disabilities can play together, and wheelchair basketball is considered to be an inclusive sport.

Few studies have investigated the injury epidemiology of wheelchair basketball during major tournaments (6, 12, 17, 23). The overall injury incidence rate ranged between 12 and 68 injuries per 1000 athlete hours (6, 12, 17, 23). The upper extremity and
Trainingsumgebung und gesundheitliche Beschwerden beim Rollstuhlbasketball

back were predominantly affected. More than half of the injuries were caused by overuse, and most acute injuries were incurred in contact with another player (12). Less is known about the risk factors for injuries and health complaints in wheelchair basketball, especially in consideration of underlying disabilities (7, 22). However, one preliminary study has shown that an injury prevention program focusing on strengthening and flexibility of the shoulder might potentially prevent shoulder injuries (24). Therefore, some recent advantages in the understanding and prevention of injuries in wheelchair basketball have been obtained.

However, only little is known about injuries and other health complaints outside major tournaments or about the training environment of elite athletes. Therefore, this study aimed to investigate the training environment and health complaints of national team wheelchair basketball players prior to a major tournament.

Methods

Study Design, Setting and Participants
A retrospective athlete’s survey on health complaints in the four weeks prior and training environment in the 12 months prior to the Wheelchair Basketball World Championships 2018 was conducted. The overall study cohort consisted of 28 teams from 19 different countries with a total of 336 players (female: 12 teams with 144 players; male: 16 teams with 192 players). The WBWC was held from 16th to 26th of August 2018 in Hamburg, Germany.

Data Collection
For the data collection, athletes were asked to fill in an anonymous questionnaire (15). The paper based questionnaire consisted of several parts asking for player’s demographics, match and training exposure, daily training environment, physical complaints and injury prevention in the last 12 months, as well as injuries and illnesses in the four weeks prior to the tournament. Players were asked to answer questions regarding the number of training sessions and matches, availability of support staff, physical complaints, how often they competed with complaints or a diagnosed injury, and used exercises for injury prevention as part of their regular training during the last 12 months (15). For health complaint surveillance in the previous four weeks, participants were asked to fill out four questions on the “extent of injury, illness or other health problems” (based on the Oslo Sports Trauma Research Questionnaire (OSTRC) (2, 3). The OSTRC questionnaire has already been validated and applied to several different Olympic and Paralympic sports (10, 11, 14).

The study was introduced to the teams during the International Wheelchair Basketball Federation’s team manager meeting, and a representative of each team was asked to dispense the questionnaires to all athletes. During the tournament members of the research team were present at the venue to collect the completed questionnaires in cooperation with the local organizing committee. Alternatively, team managers were offered to send the completed questionnaires via mail to the research team. The ethics committee of the University of Hamburg (protocol number AZ 2018_198) granted ethical approval for this study.

Data Analysis
All data was processed using Excel (for Mac 11, Version 14.7.1, Microsoft Cooperation, USA) and SPSS (V.23, IBM, USA). Results are described descriptively as means with standard deviation (SD) and range or percentages. Differences between groups (all players registered for the WBWC vs. participating players in the study, female vs. male players) were calculated using a chi square or t-tests. Relationship between disability classification or training load with struggle or playing with health complaints was investigated using Spearman correlation coefficients.

Results

Player Characteristics
Of 28 teams (336 players) participating in the WBWC, 19 teams (228 players) agreed to participate and distribute the questionnaires to their players. From these 228 players, 133 answered the questionnaire (response rate: 58.3%). The study population regarding sex (p=0.0271) and age (p=0.0027).
The participating 72 female (54.1%) and 61 (45.9%) male players were on average 27.4 years (SD= 6.25; range: 16-46) old. The most frequent disability classifications were 1.0 (n=24) and 4.5 (n=22), followed by 3.0 (n=20) and 4.0 (n=16). Most players reported to play in the positions forward (n=36) and guard (n=30).

This study included players competing for ten of the 19 participating countries. Eight players (6.0%) lived and trained in another country than they competed for.

Trainings Environment
Athletes trained on average 4.9 days (SD=1.1; range:1-7) with 18.1 hours (SD=9.1; range: 2-60) per week during the season, 4.7 days (SD=1.4; range:1-7) with 15.8 hours (SD=9.0; range: 2-60) per week during pre-season, and 3.5 days (SD=4.9; range=0-6) with 9.1 hours (SD=6.3; range: 0-24) per week during other times/holidays in the last 12 months. In this time frame, they competed on average in 19.2 (SD=12.3; range: 1-50) international and 22.6 (SD=11.7; range: 1-60) national matches. Coach and support staff availability is shown in Table 1.

Almost 80% of the players rated their training environment either as very good (n=51; 38.3%) or good (n=55; 41.4%). Twenty (15.0%) players rated it as sufficient, six (4.5%) as poor and one (0.8%) as very poor. Two thirds rated the support offered by their national team program very good (n=43; 32.3%) or good (n=49; 38.6%), while one third rated it as sufficient (n=28; 21.1%) poor (n=10; 7.5%) or very poor (n=3; 2.3%).

Physical Complaints and Injury Prevention
In the 12-month-period prior to the WBWC, about more than half of the players never (n=51; 38.3%) or seldom (n=55; 41.4%) struggled with physical complaints. However, a third (n=44; 33.3%) reported to have sometimes physical complaints, eleven (8.3%) often, three very often and three always (2.3%). Nineteen athletes (14.4%) stated to never play with pain or other complaints. About a third (n=47; 35.6%) played seldom and another third (n=45; 34.1%) sometimes with pain or other complaints.

Physical Complaints in the 12 months prior to the Wheelchair Basketball World Championships 2018 according to groups of disability classifications.

| DISABILITY CLASSIFICATIONS | NEVER | SELDOM | SOMETIMES | OFTEN | VERY OFTEN |
|-----------------------------|-------|--------|-----------|-------|------------|
| 1 (n=24)                    | 0     | 10 (41.7%) | 12 (50.0%) | 1 (4.2%) | 1 (4.2%)   |
| 1.5 (n=7)                   | 1 (14.3%) | 2 (28.6%) | 2 (28.6%) | 2 (28.6%) | 0          |
| 2 (n=10)                    | 2 (20.0%) | 4 (40.0%) | 4 (40.0%) | 0     | 0          |
| 2.5 (n=12)                  | 4 (30.8%) | 4 (30.8%) | 3 (23.1%) | 1 (7.7%) | 0          |
| 3 (n=20)                    | 4 (20.0%) | 10 (50.0%) | 5 (25.0%) | 0     | 1 (5.0%)   |
| 3.5 (n=7)                   | 2 (28.6%) | 2 (28.6%) | 2 (28.6%) | 0     | 0          |
| 4 (n=16)                    | 7 (43.8%) | 1 (6.3%)  | 6 (37.5%) | 2 (12.5%)| 0          |
| 4.5 (n=24)                  | 3 (12.5%) | 8 (33.3%) | 7 (29.2%) | 5 (20.8%)| 1 (4.2%)   |
| Overall (n=120)             | 23 (19.2%) | 41 (34.2%) | 41 (34.2%) | 11 (9.2%)| 3 (2.5%)   |
| Others                      | 31 (86.1%) | 1 (2.8%)  | 2 (5.6%)  | 0     | 2 (5.6%)   |

No differences between female and male players were found with regard to struggle with (p=0.662) or participation with physical health complaints (p=0.245). The number of international games (r=0.248; p=0.004) and overall games (r=0.232; p=0.009) was positively correlated with struggle with health complaints. There was no correlation between number of national games and health complaints (r=0.119; p=0.196). The weekly training load in hours was negatively correlated with struggle with health complaints (r=-0.178; p=0.043). Furthermore, no significant correlation between player’s classification and struggle with (r=-0.03; p=0.726) or participation with physical health complaints (r=-0.05; p=0.606) was found. Struggle with physical complaints and participation with pain or complaints according to the different disability classifications can be found in Tables 2 and 3.

Health Complaints in the Four Weeks Prior to the WBWC
When asked for difficulties participating in normal training and competition due to health complaints in the four weeks prior to the WBWC, 81 (61.5%) players had no health complaints. Every fourth to fifth player (n=31; 23.7%) participated fully, but with a health complaint. Seventeen players (13.0%) reduced participation with a health complaint and two (1.5%) could not participate due to a health complaint. Four out of five players with health complaints (n=39; 78.0%) did modify the volume, content or intensity of their training volume due to the injury, illness or other health problems. About a quarter (n=21; 42.0%) did modify it to a minor extent, 14 (28.0%) to a moderate and 2 (4.0%) to a major extent. Two (4.0%) athletes could not participate at all. Ten percent of the players with health complaints (n=5)
reported no effect of an injury, illness or other health problems on their performance in the four weeks prior to the current championships. Two thirds of the players (n=32; 64.0%) reported minor, 12 (24.0%) moderate and one (2.0%) major effects of health problems on their performance. About a quarter of these players (n=11; 22.4%) had experienced no symptoms/health problems. Twenty-seven athletes (55.1%) reported minor, eight (16.3%) moderate and three (6.1%) severe symptoms/health problems. Asked what had bothered them the most in the four weeks before the WBWC, one third of athletes ticked that they were overloaded by the combination of work/school and training/competition (n=48; 36.4%), followed by injury/physical complaints (n=39; 29.5%), and personal problems in their relationship/family (n=35; 26.5%). Low performance (n=21; 15.9%), mental health problems (n=19; 14.4%), press, media, public pressure (n=18; 13.4%) affected more athletes than illness (n=15; 11.4%), too little support by the coach/contacts with the coach (n=13; 9.8), conflicts within the team (n=9; 6.8%) or financial problems (n=9; 6.8%).

Discussion

This is the first survey of elite wheelchair basketball players on training load and health complaints prior to a major tournament. The training environment and national team support was predominantly rated as good or very good. However, almost half of the players that qualified for the tournament struggled with health complaints and about a third played or trained with pain or health complaints. In accordance, for the 2016 Rio Olympic Games also a high pre-competition injury rates have been reported (6). Furthermore, about the same number (39%) of elite pedestrian basketball players stated to play with health complaints (18). In their survey, Schneider et al. (2019) (18) elite player stated that they would compete with joint pain (42% agreed), cold with fever (66% agreed) and when their physician tells them too (79% agreed). From our data, it cannot be derived whether the decision to play with a health complaint was upon consultation with the medical team. However, Schneider et al. (2019) (18) highlight that physicians (family and team physicians) play a central roll in the decision whether or not to play with injuries or illnesses. From our study, the availability of specialized medical staff was very different for players (Table 1).

A positive finding of this survey was that injury prevention was always or often part of the training routine in about more than half of the athletes. Shoulder injury prevention focusing on flexibility and strength has already been shown to successfully reduce the risk of injuries in a pilot study (24). However, this study’s questionnaire did not enable conclusions about the characteristics of the used injury prevention programs and misperceptions of effective prevention strategies are known in other sports (26). To date, only few studies have documented the injury epidemiology in wheelchair basketball players and the etiology is still relatively vague (6, 9, 12, 17, 23). Therefore, more efforts are needed to understand the underlying mechanism of injuries in conjunction with the different disabilities in wheelchair basketball players to develop adequate and evidence-based prevention strategies (1).

### Table 3

| DISABILITY CLASSIFICATIONS | NEVER | SELDOM | SOMETIMES | OFTEN | VERY OFTEN |
|----------------------------|-------|--------|----------|-------|-----------|
| 1 (n=24)                   | 2 (8.3%) | 6 (25.0%) | 13 (54.2%) | 2 (8.3%) | 1 (4.2%) |
| 1.5 (n=7)                  | 0 | 3 (42.9%) | 0 | 3 (42.9%) | 0 |
| 2 (n=10)                   | 4 (40.0%) | 4 (40.0%) | 1 (10.0%) | 1 (10.0%) | 0 |
| 2.5 (n=12)                 | 3 (23.1%) | 3 (23.1%) | 5 (38.5%) | 0 | 1 (7.7%) |
| 3 (n=20)                   | 3 (15.0%) | 8 (40.0%) | 7 (35.0%) | 2 (10.0%) | 0 |
| 3.5 (n=7)                  | 3 (42.9%) | 1 (14.3%) | 2 (28.6%) | 1 (14.3%) | 0 |
| 4 (n=16)                   | 2 (12.5%) | 7 (43.8%) | 6 (37.5%) | 0 | 1 (6.3%) |
| 4.5 (n=24)                 | 2 (8.3%) | 10 (41.7%) | 6 (25.0%) | 6 (25.0%) | 0 |
| Overall (n=120)            | 19 (15.8%) | 42 (35%) | 40 (33.3%) | 15 (12.5%) | 3 (2.5%) |
| Others                     | 31 (86.1%) | 1 (2.8%) | 2 (5.6%) | 0 | 2 (5.6%) |

Participation with pain or health complaints at training or games in the 12 months prior to the Wheelchair Basketball World Championships 2018 according to groups of disability classifications.

basketball is difficult. Likewise, the comparison to other Paralympic sports is difficult due to differences in pre-existing disabilities (7, 8).

One of the main findings of this survey was that more than one third of athletes reported health complaints in the four weeks prior to the study and one forth played or trained with pain or health complaints. In accordance, for the 2016 Rio Olympic Games also a high pre-competition injury rates have been reported (6). Furthermore, about the same number (39%) of elite pedestrian basketball players stated to play with health complaints (18). In their survey, Schneider et al. (2019) (18) elite player stated that they would compete with joint pain (42% agreed), cold with fever (66% agreed) and when their physician tells them too (79% agreed). From our data, it cannot be derived whether the decision to play with a health complaint was upon consultation with the medical team. However, Schneider et al. (2019) (18) highlight that physicians (family and team physicians) play a central role in the decision whether or not to play with injuries or illnesses. From our study, the availability of specialized medical staff was very different for players (Table 1).
A relatively high grade of professionalism of wheelchair basketball can be derived from this study. Several specialized professions (coaches, specialized trainers, massage therapists and physiotherapists) were available for most of the players most of the time. Sport scientists, sport psychologist and nutritionists were available on demand. Only 14-16% of players had no access to medical professionals. The players trained on average about 18h per week, but the range (2-60h) was very large. While an increasing number of weekly training hours was correlated with less health complaints, more international and overall games were associated with more health complaints. Taking the high number of health complaints and training extent together, a future area for wheelchair basketball (and Paralympic sports) research could be the load management which has been in the focus of Olympic sports (19).

Some points limit the generalizability of our findings. Due to the cross-sectional and retrospective character of this study, no causal relationships can be derived. Even though the study cohort consisted of a high-level cohort of national team players, one cannot extrapolate them to all wheelchair basketball players. In addition, having a response rate of 58.3% (41.3% of the overall population) and differences in general variables (sex and age) does suggest that the participating players might not be representative for the whole population. Only investigating players that qualified and participated at the WBWC, might underestimate the overall prevalence of health complaints. Moreover, it is not clear whether some of the health complaints are results of an injury or related to the disability. Further research is needed to prospectively monitor injuries and illnesses in wheelchair basketball and understand the probably multifactorial etiology as already established in other (primarily able-bodied) sports (1, 13, 14, 16, 25). In addition, more data is needed to look at injury and illness differences in subgroups according to disability classification and playing position.

**Conclusion**

This study was the first to survey training environment and health complaints of elite wheelchair basketball players prior to a major tournament. While most players rated their training environment and team support as good or very good and already implemented an injury prevention program, pre-competition health complaints were reported by almost 38.5% of the players. Most players indicated to continue to play with pain and health complaints.

**Acknowledgement**

The authors would like to thank the International World Basketball Federation, namely Charlie Betel, Norbert Kucera and Maureen Orchard, as well as the local organizing committee of the Wheelchair Basketball World Championships (Anthony Kahlfeldt and Dr. Jürgen Völpe) and Franziska Glöer for their help during the planning and conduct of this study.

**Ethical Approval Information**

Ethical approval has been obtained from the local ethics committee of the University of Hamburg (protocol number AZ 2018_198).

**Conflict of Interest**

The authors have no conflict of interest.
References

(1) BITTENCOURT NFN, MEEUWISSE WH, MENDONCA LD, NETTEL-AGUIRRE A, OCARINO JM, FONSECA ST. Complex systems approach for sports injuries: moving from risk factor identification to injury pattern recognition-narrative review and new concept. Br J Sports Med. 2016; 50: 1309-1314. doi:10.1136/bjsports-2015-095850

(2) CLARSEN B, MYKLEBUST G, BAHN R. Development and validation of a new method for the registration of overall injuries in sports injury epidemiology: the Oslo Sports Trauma Research Centre (OSTRC) overall injury questionnaire. Br J Sports Med. 2013; 47: 495-502. doi:10.1136/bjsports-2012-091524

(3) CLARSEN B, RONSEN O, MYKLEBUST G, FLORENO TW, BAHN R. The Oslo Sports Trauma Research Center questionnaire on health problems: a new approach to prospective monitoring of illness and injury in elite athletes. Br J Sports Med. 2014; 48: 754-760. doi:10.1136/bjsports-2012-092067

(4) CURTIS KA, DILLON DA. Survey of wheelchair athletic injuries: common patterns and prevention. Paraplegia. 1985; 23: 170-175.

(5) DEGHANSAI N, LEMEZ S, WATTIE N, BAKER J. Surveillance Systems im paralympischen Leistungssport – Implementation eines Injury and Illness Monitoring Systems. Br J Sports Med. 2018; 52: 24-31. doi:10.1136/bjsports-2017-098039

(6) CLARSEN B, MYKLEBUST G, BAHN R. The epidemiology of injuries at the London 2012 Paralympic Games. Br J Sports Med. 2017; 51: 260-263. doi:10.1136/bjsports-2016-096669

(11) KLUGE S, GLOER F, RIEPENHOF H, ZECH A, JUNGE A. Injury and illness in aquatic sport: how high is the risk? A comparison of results from three FINA World Championships. Br J Sports Med. 2017; 51: 277-282. doi:10.1136/bjsports-2016-096075

(17) REYNOLDS J, STIRKA, THOMAS A, GARRY P. Paralympics - Barcelona 1992. Br J Sports Med. 1994; 28: 14-17. doi:10.1136/bjsm.28.1.14

(18) SCHNEIDER S, SAUER J, BERSCHKE G, LÖBEL C, SCHMITT H. “Playing hurt” – competitive sport despite being injured or in pain. Dtsch Z Sportmed. 2019; 2019: 43-52. doi:10.5960/dzsm.2019.365

(19) ZECH A, WELLMANN K. Wheelchair basketball from the orthopedic viewpoint. Sportverletz Sportschaden. 1997; 11: 109-115. doi:10.1055/s-2007-993376

(20) VILROY J, HIBBERD E. Evaluation of a Shoulder Injury Prevention Program in Wheelchair Basketball. J Sport Rehabil. 2018; 27: 554-559. doi:10.1123/jss.2017-0011

(21) ZECH A, GLOBIG H, BRAUMAN KM. Sprunggelenkverletzungen und Präventionsstrategien im deutschen Nachwuchsbasketball. Dtsch Z Sportmed. 2014; 65: 61-65. doi:10.5960/dzsm.2014.115

(22) ZECH A, WELLMANN K. Perceptions of football players regarding injury risk factors and prevention strategies. PLoS One. 2017; 12: e0176829. doi:10.1371/journal.pone.0176829