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Shoulder Pain Intensity in Wheelchair Basketball Players in Benin: A Prospective Observational Study

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ABSTRACT: Physical activity is crucial for the quality of life of individuals with disabilities. In many parasports, such as wheelchair basketball, the wheelchair is an essential component. However, the repetitive nature of wheelchair propulsion frequently leads to overuse injuries, with the shoulder being the most commonly affected joint. The aim of this study was to assess the intensity of shoulder pain in wheelchair basketball players in Benin at three time points: before a championship, immediately after the championship, and following a subsequent 3-month rest period, using the Wheelchair User's Shoulder Pain Index (WUSPI). This prospective observational study included 10 elite male wheelchair basketball players (mean age: 32 ± 5 years; mean experience: 13 ± 8 years). The WUSPI was administered at pre-championship (T0), post-championship (T1), and after a 3-month rest period (T2) to assess shoulder pain intensity during activities of daily living (ADLs). The Friedman test and post-hoc Wilcoxon signed-rank tests were used to compare scores between time points. The mean performance-corrected WUSPI (PC-WUSPI) score increased significantly from baseline at T0 (13.45 ± 5.77) to T1 (69.88 ± 21.91) ($p < 0.001$). Following the rest period, the score at T2 (43.92 ± 20.0) was significantly lower than at T1 ($p < 0.001$). However, the T2 score remained significantly higher than the initial baseline score at T0 ($p < 0.001$). Intensive competition induces a substantial increase in shoulder pain and functional limitation in elite wheelchair basketball players. While a 3-month rest period allows for significant pain reduction, recovery is incomplete, with pain levels remaining elevated above pre-competition baseline. These findings highlight the high physical demands of the sport and underscore the need for targeted pain management and recovery strategies.

KEYWORDS: WUSPI, Overuse Injury, Shoulder, Wheelchair Basketball, Pain Assessment, Benin, Shoulder Pain, Manual Wheelchair.

1 INTRODUCTION

Physical activity and sport play a crucial role in the quality of life for all individuals, and this is particularly true for those with disabilities [1]. Disability is understood as the complex interaction between an individual with a health condition (e.g., cerebral palsy, spinal cord injury) and the personal and environmental factors that may hinder their full participation in society [2]. The World Health Organization (WHO) defines disability as a generic term encompassing impairments, activity limitations, and participation restrictions [2].

Among parasports, wheelchair basketball has one of the most developed functional classification systems, enabling fair competition [3], [4]. Participation in wheelchair basketball offers numerous benefits, including improved self-esteem, enhanced physical conditioning, and greater self-awareness, making it an essential tool for social integration and rehabilitation [5]. However, the reliance on a manual wheelchair for both activities of daily living (ADLs) and athletic competition is a significant risk factor for the development of musculoskeletal disorders [6].

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The human shoulder, with its high degree of mobility and limited intrinsic stability, is not biomechanically optimized for the repetitive, high-load propulsion tasks required of manual wheelchair users [7]. Consequently, the glenohumeral joint is subjected to considerable strain, which is often exacerbated in athletes [8], [9]. This chronic overuse frequently leads to degenerative soft-tissue pathologies, such as subacromial impingement syndrome, rotator cuff tears, and sprains, as well as radiologically-evident degenerative changes [10], [11]. For wheelchair users, the functional integrity of the upper limbs is paramount to maintaining independence [12].

Shoulder injury is a well-documented problem in wheelchair basketball [13], [14], [15], and numerous studies have identified shoulder pain as a primary factor limiting ADLs in individuals with paraplegia [16], [17]. In a study conducted in Burkina Faso, Ouédraogo et al. [17] demonstrated that wheelchair basketball induced joint pain, with pain intensity peaking 24 hours post-training. Similarly, Curtis et al. [13] reported a 72% prevalence of shoulder pain among wheelchair basketball players.

It is important to highlight the specific context of wheelchair basketball in West Africa, particularly in Benin, where the sport is often practiced using non-specialized wheelchairs, many of which are obtained through community donations. To date, research on wheelchair sports and the etiology of pain during practice in Benin remains scarce. The few existing studies have focused on pain management or on determining pain prevalence among players solely in Cotonou. This leaves a significant knowledge gap, as handisport associations are also active in northern Benin.

While several instruments exist to measure pain or functional impairment, such as the Brief Pain Inventory (BPI) and the Visual Analogue Scale (VAS), the Wheelchair User's Shoulder Pain Index (WUSPI) is the most specific and validated tool for this population. The WUSPI was developed to measure the intensity of shoulder pain and its impact on the performance of ADLs specifically in manual wheelchair users [18], [19].

Therefore, the aim of this study was to use the WUSPI to assess the intensity of shoulder pain in Beninese wheelchair basketball players before and after a national championship, and following a subsequent 3-month rest period.

2 METHODS

2.1 STUDY DESIGN

This study employed a prospective, longitudinal observational design to assess shoulder pain in elite male wheelchair basketball players at three distinct time points: baseline (T0), taken two days before a national championship; post-competition (T1), taken 72 hours after the final match; and a 3-month follow-up (T2), after a prescribed period of rest from the sport. The protocol was conducted in accordance with the principles of the Declaration of Helsinki, and all participants provided written informed consent prior to inclusion. A convenience sample of 14 players from two clubs competing under the Benin Handisport Federation was initially recruited. Inclusion criteria required participants to be registered players in Benin, attend training regularly, and possess a functional wheelchair. Exclusion criteria included the use of a damaged wheelchair, inability to follow the protocol, or participation in other sports during the rest period. Of the 12 players who consented, two were later excluded for violating the rest protocol, resulting in a final cohort of 10 participants for analysis. Data were collected at each time point using the Wheelchair User's Shoulder Pain Index (WUSPI), a validated 15-item questionnaire assessing pain during activities of daily living on a 10-cm Visual Analogue Scale (VAS) [18]. To account for unperformed tasks, a performance-corrected score (PC-WUSPI) was calculated by summing the VAS scores for performed items, dividing by the number of activities performed, and multiplying by 15 [13].

2.2 STATISTICAL ANALYSIS

All statistical analyses were performed using IBM SPSS Statistics (Version 27). The distribution of quantitative data was assessed for normality using the Shapiro-Wilk test. Descriptive statistics were used to summarize participant and wheelchair characteristics. Quantitative variables were expressed as mean ± standard deviation (SD), while qualitative variables were presented as frequencies and percentages. As the WUSPI score data were not normally distributed, non-parametric tests were employed for inferential analysis. The Friedman test was used to compare the PC-WUSPI scores across the three time points (T0, T1, and T2). When the Friedman test indicated a significant overall difference, post-hoc analysis was conducted using the Wilcoxon signed-rank test with a Bonferroni correction to identify which specific pairs of time points differed significantly. The alpha level for statistical significance was set at $p < 0.05$ for all tests.

2.3 ETHICAL CONSIDERATIONS

This research was conducted in accordance with the ethical principles of the Declaration of Helsinki. It respected the rights, dignity, and well-being of participants, without compromising their physical or moral integrity. All study participants were informed about the research protocol, its objectives, and potential benefits. They were assured that, upon completion of the study, the results would be communicated to them confidentially and as soon as possible. Participants were also guaranteed that the collected data would be anonymised and used solely for the purposes of this research.

3 RESULTS

3.1 PARTICIPANT CHARACTERISTICS

The 10 male wheelchair basketball players included in the final analysis had a mean age of 32 ± 5 years (range: 24-41) and a mean Body Mass Index (BMI) of 23 ± 4 kg/m ^{2}. The mean duration of disability was 29 ± 8 years, and the participants had a mean of 13 ± 8 years of experience in wheelchair basketball. The etiologies of disability were poliomyelitis (60%), amputation (30%), and paraplegia (10%). Regarding playing chair comfort, 60% of players reported experiencing "no comfort," 20% reported being "comfortable," and 20% reported being "very comfortable" **(Table 1).**

Table 1. Player characteristics, type of disability and feeling in the wheelchair: N = 10

	m ± s	**Min - Max**	**N (%)**
Anthropological characteristics			
Age (years)	32.0 ± 5.0	24 – 41	NA
Body mass (kg)	60.0 ± 9.0	45 – 80	NA
Body mass index (kg.m-^{2})	23.0 ± 4.0	16 – 29	NA
Game features			
Anteriority of disability (years)	29.0 ± 8.0	19 - 46	NA
Lengh of pratice (years)	13.0 ± 8.0	2 - 27	NA
Type of disability			
Poliomyelitis	NA	NA	6 (60).
Amputee	NA	NA	3 (30).
Paralyzed	NA	NA	1 (10)
Feeling in the chair			
Not comfortable	NA	NA	6 (60).
At ease	NA	NA	2 (20).
Very confortable	NA	NA	2 (20).

***BM**: Body weight **BMI:** Body mass index **m:** average **s:** standard variation **Min:** Minimum **Max:** Maximum*

3.2 WHEELCHAIR CHARACTERISTICS

The wheelchairs used by the players had a mean weight of 13 ± 2 kg (range: 10-17 kg). All chairs had four wheels (two large, two small). The mean large wheel diameter was 55 ± 10 cm, and the mean small wheel diameter was 7 ± 2.05 cm. The mean seat height from the ground was 52 ± 13 cm, and the mean backrest height was 28 ± 5 cm **(Table 2).**

Table 2. Characteristics of the play wheelchairs in the study

	m ± s	Min - Max
Number of wheels	4,0 ± 0,0	4 – 4
Large wheel diameter (cm)	55,0 ± 10	44 – 67
Small wheel height (cm)	7,0 ± 2,05	5 – 10
Footrests (cm)	15,0 ± 4,0	6– 21
Seat height (cm)	52,0 ± 13,0	36 – 67
Cushion thickness (cm)	5,0 ± 1,0	4 – 7
Backrest height (cm)	28,0 ± 5,0	21 – 33
Chair weight (kg)	13,0 ± 2,0	10 – 17

m: *average* ***s:*** *Standard variation* ***Min:*** *Minimum* ***Max:*** *Maximum*

3.3 CHANGES IN WUSPI SCORES OVER TIME

The primary analysis focused on the change in the performance-corrected Wheelchair User's Shoulder Pain Index (PC-WUSPI) score across the three time points. The Friedman test revealed a statistically significant difference in PC-WUSPI scores over time (χ^2 (2) = 17.2, p < 0.001). Post-hoc analysis using the Wilcoxon signed-rank test with a Bonferroni correction was performed to identify where these differences occurred: PC-WUSPI scores increased significantly from pre-championship (T0: 13.45 ± 5.77) to post-championship (T1: 69.88 ± 21.91) (p = 0.005). Scores decreased significantly from post-championship (T1) to the 3-month follow-up (T2: 43.92 ± 20.0) (p = 0.005). Despite this decrease, scores at the 3-month follow-up (T2) remained significantly higher than the pre-championship baseline at T0 (p = 0.005) **(Table 3).**

Table 3. Variation in WUSPI scores for each player (before, after and three months)

	Anteriority of disability (years)	Length of pratice (years)	Body mass index (kg.m-^{2})	*Items validated*			*Score PC-WUSPI*		
				BF	AF	3 Months AF	BF	AF	3 Months AF
P1	20	15	16.52	14	13	13	13.05	50.4	16.05
P2	46	27	27.05	12	13	14	21.75	73.95	35,25
P3	30	25	24.44	14	14	14	19.05	44,55	15
P4	23	15	27.35	13	13	13	22.05	45.75	36.9
P5	30	19	24.46	12	12	12	14.25	56.12	75
P6	37	5	20.7	12	12	12	7.35	89.12	69
P7	34	2	29.33	13	13	13	10.2	94.84	60
P8	19	3	18.07	13	13	13	11.7	87.34	45
P9	28	15	25.39	12	12	12	9.23	101.5	43.33
P10	24	6	25.15	12	12	12	6	55.25	46.67

P: *Players* ***BF:*** *Before* ***AF:*** *After*

3.4 ANALYSIS OF INDIVIDUAL WUSPI ITEMS

A detailed analysis of the 15 individual WUSPI items was conducted to identify the most painful activities at each time point. A consistent pattern was observed across most activities of daily living (ADLs): Reported pain intensity for individual items peaked at the post-championship time point (T1). At the 3-month follow-up (T2), pain scores for these items decreased but did not return to the pre-championship baseline levels (T0). The statistical analysis confirmed that the changes in pain intensity over time were significant for the majority of the individual items (p < 0.05). It was also noted that several ADLs, particularly those related to vehicle transfers ("transferring from wheelchair to car," "placing wheelchair in car") and "driving," were not performed by all participants at each time point (**Table 4**).

Table 4. Comparison of mean shoulder pain intensities by item in handibasket players

	m ± s			p Value (Friedman)
	BEFORE	AFTER	3 MONTHS	
Transfers				
1 Armchair bed	1.1 ± 1.4	5.4 ± 2.8 *	3.1 ± 1.4 ‡ †	0.007
2 Armchair to the car	NOT REALISED			
3 Armchair to the shower	0.9 ± 1.0	4.5 ± 3.2 *	3.1 ± 1.4 ‡	0.004
4 Armchair in car	NOT REALISED			
Wheelchair mobility				
5 Push chair 10min	1.3 ± 1.8	5.8 ± 2.9 *	5.3 ± 2.5 ‡	0.002
6 Mounting ramps	1.0 ± 0.8	5.0 ± 2.5 *	3.9 ± 2.6 ‡	0.014
Personal care				
7 Shelf object	1.0 ± 0.6	4.7 ± 2.9 *	4.3 ± 2.3 ‡	0.008
8 Put on pants	0.6 ± 0.4	2.4 ± 1.7 *	0.6 ± 1.6 †	0.001
9 Put on a t-shirt	1.2 ± 1.9	5.4 ± 2.7 *	1.2 ± 2.1 †	0.000
10 Put on a shirt	0.7 ± 0.9	2.3 ± 1.9 *	0.2 ± 0.6 ‡ †	0.000
11 Washing your back	0.7 ± 0.4	6.3 ± 2.5 *	3.0 ± 1.7‡ †	0.000
General activities				
12 Daily activities	0.6 ± 0.3	4.0 ± 2.6 *	1.3 ± 1.6 †	0.002
13 Driving	NOT REALISED			
14 Cleaning	0.6 ± 0.3	4.2 ± 3.2 *	1.2 ± 1.4 †	0.002
15 Sleep	0.6 ± 0.2	5.2 ± 2.5 *	1.7 ± 1.9 †	0.001
PC Score -WUSPI	13.45 ± 5.77	69.88 ± 21.91 *	43.92 ± 20.0 ‡ †	0.000

**: Significant difference p<0.05 between before and after †: Significant difference p<0.05 between after and 3 months after ‡: Significant difference p < 0.05 between before and 3 months after*

4 DISCUSSION

The primary aim of this study was to prospectively assess the intensity of shoulder pain in elite wheelchair basketball players in Benin at three key time points: before a championship, immediately after, and following a three-month rest period. The principal finding of our study is that an intensive competition period leads to a more than fivefold increase in shoulder pain and functional impairment, as measured by the PC-WUSPI. Furthermore, while a subsequent three-month rest period allowed for a significant reduction in pain, recovery was incomplete, as pain scores remained significantly elevated above the pre-competition baseline.

The substantial increase in pain observed immediately post-championship (T1) aligns with existing literature highlighting the high physical demands of elite wheelchair basketball [13], [14]. The sport requires repetitive, high-intensity, and often explosive upper-limb movements, including propulsion, shooting, and physical contact with other players. This places enormous stress on the shoulder joint, which is biomechanically ill-suited for chronic weight-bearing and high-load activities [7], [20]. The high repetition and joint compression forces are known to trigger or aggravate underlying degenerative processes such as tendinopathies and osteoarthritis [11], [21], which likely explains the dramatic surge in pain reported by the athletes in our cohort after the championship.

A critical finding of our study is the incomplete recovery observed at the three-month follow-up (T2). This suggests that the pain experienced by these athletes is not merely acute, transient muscle soreness but may reflect a more persistent, underlying inflammatory or sub-clinical degenerative condition. This condition appears to be exacerbated by intense competition and is not fully resolved by a prolonged period of rest alone. This observation is further supported by the analysis of individual WUSPI items, which showed that pain remained elevated at T2 for demanding activities like "pushing the wheelchair for 10 minutes or more" and "lifting objects overhead." These tasks directly stress the rotator cuff and subacromial structures, indicating a persistent pathological state. This underscores the potential for cumulative damage and the development of chronic, debilitating shoulder conditions over successive competitive seasons if not managed proactively.

When comparing our PC-WUSPI scores to those in the literature, our baseline scores at T0 (13.45 ± 5.77) are comparable to those reported by Curtis et al. (15.6 ± 20.5) in a similar population of wheelchair basketball players [18]. However, our post-

championship scores (69.88 ± 21.91) are considerably higher. This notable discrepancy may be attributed to several factors specific to the context of this study. A crucial factor is likely the equipment used. As noted in the introduction, athletes in Benin often rely on non-specialized wheelchairs obtained through donations. Ill-fitting chairs can force athletes into suboptimal biomechanical positions during propulsion, significantly increasing joint stress and leading to higher pain levels compared to athletes using custom-fitted, high-performance sports wheelchairs [17].

Furthermore, the potential lack of access to specialized strength and conditioning programs, advanced coaching techniques, and comprehensive medical support in this low-resource setting could also contribute to greater post-competition pain and poorer long-term recovery.

In our analysis of individual player characteristics, we did not find a clear pattern linking factors such as age, BMI, or duration of disability to the intensity of shoulder pain. This aligns with findings from Mercer et al. [22], who also argued that age is not a primary predictor of shoulder pain in this population. While some literature suggests that playing experience might be a factor [23], [24], [25], our small sample size prevented a robust statistical exploration of these correlations [25].

This study has several limitations that must be acknowledged. The primary limitation is the small sample size (n=10), which restricts the generalizability of our findings and the statistical power to conduct more complex correlational analyses. The use of a convenience sample may also have introduced selection bias. Additionally, the etiology of disability and other demographic data were self-reported and not clinically verified. Finally, while the WUSPI is a validated tool, it remains a subjective measure of pain. Future research would benefit from incorporating objective measures, such as dynamometry for strength testing or ultrasound imaging to assess soft-tissue pathology.

Despite these limitations, this study provides the first longitudinal data on the impact of competition and rest on shoulder pain in wheelchair basketball players in Benin. The findings clearly demonstrate that elite competition induces severe shoulder pain and that rest alone may be insufficient for complete recovery. This highlights an urgent need for targeted interventions to protect the shoulder health and prolong the careers of these athletes. Such interventions should include not only improved access to appropriate, well-fitted equipment but also the implementation of evidence-based injury prevention programs, structured conditioning, and effective recovery strategies.

5 CONCLUSION

This study demonstrates that elite wheelchair basketball players in Benin experience a severe increase in shoulder pain and functional impairment immediately following a competitive championship. While a subsequent three-month rest period leads to a significant reduction in pain, recovery is incomplete, with pain levels remaining elevated above pre-competition baseline. These findings highlight the substantial physical toll of the sport and underscore the urgent need for proactive strategies—including access to appropriate equipment, structured conditioning, and evidence-based pain management—to protect the long-term shoulder health of these athletes.

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