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John JM[1,2,], Bursik J[1,2,*], Burgstahler C[2,3], Büsch D[4,5], Luig P[5], Kühnle F[6], Mayer J[7], Reussner A[1,2], Thiel A[1,2]*

1. UNIVERSITY OF TÜBINGEN, *Institute of Sports Science, Tübingen, Germany;*
2. UNIVERSITY OF TÜBINGEN, *Interfaculty Research Institute for Sport and Physical Activity, Tübingen Germany*
3. UNIVERSITY OF TÜBINGEN, *Department of Sports Medicine, Internal Medicine V, Tübingen, Germany*
4. UNIVERSITY OF OLDENBURG, *Institute of Sport Science, Oldenburg, Germany*
5. GERMAN HANDBALL FEDERATION E.V., *Dortmund, Germany*
6. INSTITUTE OF SPORT SCIENCE, *Technical University of Darmstadt, Darmstadt, Germany*
7. UNIVERSITY OF EDUCATION SCHWÄBISCH GMÜND, *Institute of Health Sciences, Schwäbisch Gmünd, Germany*

** equal first authors*

Prevalence of Sport-Related Analgesic Use in German Elite Handball Players

Prävalenz des sportbezogenen Schmerzmittelkonsums bei deutschen Spitzen-Handballern

Summary

- **With its high physical demands** on players' bodies and high rates of injury, elite-level handball constitutes an ideal environment for studying analgesic use. We aimed to investigate the career and season prevalence of sport-related analgesics use among elite youth and elite senior handball players. We explored the frequency of analgesic use on practice and competition days within one season.
- **The sample** consisted of 459 elite handball players (233 female, 226 male). Sport-related analgesic use was assessed with two replicable measures of prevalence complemented by two frequency measures. χ^2 analyses were performed to determine group differences in prevalences for gender, age group, contract situation, and role within the team. We conducted hierarchical binomial linear regression analyses for the analgesic prevalences to evaluate the prediction of the prevalences from the independent variables.
- **The sport-related career prevalence** of analgesic use was 70.7% (95% CI[66.6, 74.9]). Throughout one season, 55.6% (95% CI[51.0-60.1]) of handball players used analgesics. Gender, age, contract status, and role within the team seemed to impact the use of analgesics. Further, analgesics were used significantly more often on competition than on practice days.
- **Our findings indicate** that the sport-related use of analgesics is relatively common among elite handball players, with female players, senior players, players with a contract, and perceived rotation players reporting significantly higher career and season prevalences. Therewith, our findings offer a starting point for targeted prevention strategies.

KEY WORDS:
Elite Athlete, Pain, Sport, Medication

Zusammenfassung

- **Handball auf hohem Leistungsniveau ist** angesichts der hohen körperlichen Anforderungen und Verletzungsraten ein geradezu idealtypisches Exempel für eine Studie über Schmerzmittelgebrauch. Ziel dieser Studie war es, die Karriere- und Saisonprävalenz des sportbezogenen Schmerzmittelgebrauchs bei jugendlichen und erwachsenen Spitzenhandballspielern zu untersuchen. Dabei wurde auch die Häufigkeit des Schmerzmittelgebrauchs an Trainings- und Wettkampftagen innerhalb einer Saison untersucht.
- **Die Stichprobe** umfasste 459 Spitzenhandballspieler (233 weiblich, 226 männlich). Der sportbezogene Schmerzmittelgebrauch wurde mit zwei replizierbaren Prävalenzmaßen und zwei Häufigkeitsmaßen erfasst. Chi-Quadrat-Analysen (χ^2) wurden durchgeführt, um Gruppenunterschiede in der Prävalenz nach Geschlecht, Altersgruppe, Vertragsstatus und Rolle im Team zu identifizieren. Zusätzlich wurden hierarchische binomiale lineare Regressionsanalysen durchgeführt, um die Vorhersage der Prävalenzen aus den unabhängigen Variablen zu bewerten.
- **Die sportbezogene Karriereprävalenz** des Schmerzmittelgebrauchs betrug 70,7% (95% CI[66,6, 74,9]). Im Verlauf einer Saison verwendeten 55,6% (95% CI[51,0-60,1]) der Handballspieler Schmerzmittel. Geschlecht, Alter, Vertragsstatus und Rolle im Team schienen den Schmerzmittelgebrauch zu beeinflussen. Darüber hinaus wurden Schmerzmittel signifikant häufiger an Wettkampftagen als an Trainingstagen eingesetzt.
- **Unsere Ergebnisse zeigen,** dass der sportbezogene Gebrauch von Schmerzmitteln bei Spitzenhandballspielern relativ verbreitet ist, wobei weibliche Spieler, ältere Spieler, Spieler mit Vertrag und Spieler, die nicht Stammspieler sind, signifikant höhere Karriere- und Saisonprävalenzen berichten. Damit bieten unsere Ergebnisse einen Ausgangspunkt für gezielte Präventionsstrategien.

SCHLÜSSELWÖRTER:
Spitzenathlet, Schmerz, Sport, Medikamente

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CORRESPONDING ADDRESS:
Jan Bursik
University of Tübingen
Institute of Sports Science
Wilhelmstraße 124
72074 Tübingen, Germany
: Jan.Bursik@uni-tuebingen.de

Introduction

Within competitive sports, pain and injuries constitute inevitable health risks for elite athletes who must continually push their bodies to the limit to increase performance capability (6, 23). In contact sports like handball or football, pain is often linked to sport-typical physical contact with opponents (8, 14). Both youth and senior athletes report a high willingness to participate in competitions despite health complaints such as injuries, pain, or illness (18); in fact, research indicates that the concealment of pain by athletes to allow ongoing participation in training and competition (12, 16, 17, 28) is almost the norm within elite sports (18, 22).

One way to suppress pain to tolerable levels is the use of analgesics. A high prevalence of sport-related analgesic use has been reported across a range of

Table 1

Career-time prevalence of sport-related analgesic use with Chi-Square Analyses.

VARIABLE	N	%	CHI²	P	CRAMER'S V
Gender			9.98	.002	0.15
Male	226	63.7			
Female	232	77.6			
Age group			69.91	<.001	0.40
Senior	205	90.7			
Youth	253	54.5			
Contract			39.33	<.001	0.26
Yes	131	89.3			
No	327	63.3			
Perceived Role			9.60	0.002	0.15
Starting	227	63.9			
Rotation	231	77.5			

sports, with non-steroidal anti-inflammatory drugs (NSAIDs) being the most common (4, 38). The reported prevalence of NSAID use among athletes varies depending on the survey method and sample, ranging from 12% to 93% (10, 33, 36, 39). Based on these findings, pain medication use appears more common among competitive athletes than the general population (3, 10).

Consumption of pain medication has been linked to several negative health consequences ranging from kidney and liver damage to lesions in the gastrointestinal tract or gastric bleeding. With continuous use, damage to the central nervous system has also been reported (3, 4, 37, 39). Further, the use of NSAIDs was found to be associated with positive attitudes toward risk behaviors in terms of health and doping (20).

Several factors appear to be associated with a higher risk of analgesic use in sports. Higher pain medication use is reported in female compared to male athletes (30, 38). Concerning age, few studies have directly compared youth and senior athletes. A recent meta-analysis, however, suggests that the prevalence of analgesic use is not significantly associated with age (24). Previous research involving elite football players instead indicates that those players with precarious employment conditions (i.e., short-term contracts or no contracts) face high pressure to make the most of every opportunity (2, 26, 27). Such conditions might increase the likelihood of playing hurt and, consequently, of using analgesics. Similar pressures have also been reported for players who are not considered starters but have to fight for a spot on the roster (27).

With its high physical demands on players' bodies and high rates of injury, elite-level handball constitutes an ideal environment for studying pain medication use (1, 21). Previous qualitative studies exploring the health and injury management of elite senior handball players have indicated the complexity of pain causes and the difficulty of prevention in handball (17); however, research on the actual extent of pain medication use within elite-level handball is lacking. Thus, with the current study, we first aimed to examine the career and season prevalence of sport-related analgesics use among elite youth and elite senior handball players. Secondly, we explored the relative frequency of analgesic use on practice and competition days within one season. Thirdly, we tested for sociodemographic differences in prevalence and frequency of analgesic use, taking age, gender, contract situation, and role within the team (starters vs. non-starters) into account.

Methods

The data was collected between October 2021 and April 2022 through an online survey on Unipark (www.unipark.com). The survey was distributed directly to the athletes and clubs via channels of the German Handball Federation. The study has been approved by the Faculty of Economic and Social Sciences ethics committee at the University of Tübingen (AZ.: A2.5.4-176_ns). All participants completed an online informed consent, a demographic questionnaire, and an extensive questionnaire on painkiller use and their understanding of pain and injuries. Further, item batteries regarding psychosocial characteristics and the handling of pain and injuries were also assessed but are not included in this analysis. In total, the questionnaire took approximately 30 minutes to complete. Participants of the study were not involved in the design, conduct, reporting, or dissemination plans of our research.

Participants

The sample includes 459 handball players (233 females, 226 males) from the first division 9.6% (n=44), the second division 6.5% (n=30), the third division 28.5% (n=131), and the German Youth Handball Bundesliga 55.3% (n=254). According to Unipark, the link to the online survey reached 1404 participants; hence, the survey was distributed to 1404 out of approximately 4000 handball players competing within the respective German leagues. The mean age of participants was 22.8 years (SD=4.8 years). As one of the most popular sports in Europe (28), Handball has comparable revenues and spectators per game to ice hockey and basketball (11), tying for the second most popular sport behind football. Thus, the sample of this study can be considered as (nationally) elite (see 34). On average, the athletes physically participated in their sport for 13.51h per week (SD=5.57h).

Outcome Measures

Two specific prevalences of sport-related analgesic use and two frequencies of sport-related analgesic use function as the primary outcomes in this study. The career prevalence of sport-related analgesic use was assessed with the question: "Have you ever taken painkillers in connection with sports (before/during/after practice/game)?". For the assessment of the season prevalence, we used a similar wording ("Did you take any painkillers in connection with sports (before/during/ ›

after practice/game) last season?"). Last season referred to the 2020/21 season. The frequencies of painkiller use were assessed for practice sessions and competitions. In order to obtain comparable data, participants reported their use of painkillers per 100 hypothetical practice days per season ("Suppose you had 100 practice days last season: On how many of these 100 practice days did you consume painkillers?") and per 30 hypothetical competitions per season ("Suppose you had 30 game days last season: On how many of these 30 game days did you use painkillers?"). Data resulted in binary form for the two prevalences and as percentage values (per 100 practice days; per 30 competitions) for the two frequencies. Further, athletes were asked to indicate (multiple selections) which types of analgesics they had taken throughout their careers and during the last season.

Data Analysis

R Software (25) was used to perform the statistical analyses. χ^2 analyses were performed to determine group differences in prevalences for gender, age group, contract situation, and role within the team. The role within the team variable was assessed through the extent to which the athletes subjectively perceived themselves as starting players (0-100%). We binary-coded this variable into "starters" and "rotation players" through a median split. Further, we conducted hierarchical binomial linear regression analyses for the analgesic prevalences to evaluate the prediction of the prevalences from the independent variables. Group differences in frequencies of sport-related analgesic use were analyzed using t-tests. The level of significance was set at α=0.05. Cramer's V was calculated as an effect size statistic for the χ^2 analyses and Cohen's d as the effect size statistic for the t-test analyses. Due to a lack of reported effect sizes for similar assessments or samples (32, 35), the traditional benchmarks for effect sizes (7) were used as first orientation (Cramer's V: small=.10, medium=.30, large=.50; Cohen's d: small<0.50, medium=0.50 - 0.80, large>0.80).

Results

Sport-Related Career Prevalence

Overall, 70.7% (95% CI[66.6, 74.9]) of the athletes (n=324) reported having used analgesics in temporal or causal relation to their sport participation at some point in their career. Among these athletes, Ibuprofen was the most frequently reported type of analgesic used (96.0%), followed by Diclofenac (57.1%). Fewer athletes had used paracetamol (38.3%) and acetylsalicylic Acid (23.8%). Just 4.6% of the athletes reported to have used other pain medications (e.g. Etoricoxib, Metamizole). The career prevalence of sport-related analgesics use was significantly higher among female vs. male athletes, senior vs. youth athletes, athletes with a contract vs. no contract, and perceived rotation players vs. starting players (table 1). The block hierarchical binomial regression analysis revealed the model including the predictor variable of age to be statistically significant. A main effect of age (z=-7.72, p<.001) was identified. Senior athletes had a higher chance (OR=8.16, 95% CI[4.89, 14.27]) of having used analgesics in their careers than youth athletes.

Sport-Related Season Prevalence

The use of analgesics in temporal or causal relation to sport participation during the last season was reported by 55.6% (95% CI[51.0, 60.1]) of the athletes (n=254). Ibuprofen was also the type of analgesic (98.8%) that most athletes used over the last season. The use of Diclofenac (48.6%), Paracetamol (31.6%), and Acetylsalicylic acid (15.4%) was reported by fewer athletes. Other types of pain medications (e.g., Etoricoxib, Metamizole) were used by 5.9% of the athletes. Analogous to the career prevalence, the season prevalence of sport-related analgesics use was significantly higher among female vs. male athletes, senior vs. youth athletes, athletes with a contract vs. no contract, and perceived rotation players vs. starting players (table 2). The block hierarchical binomial regression analysis revealed a model which includes the predictor variables of gender and age to be statistically significant. A main effect of gender (z=2.97, p<.003) and age (z=-6.01, p<.001) was identified. Female athletes had a higher chance (OR: 1.87, 95% CI[1.23, 2.81]) of having used analgesics last season than male athletes. Similarly, senior athletes had a higher chance (OR: 3.63, 95% CI[2.40, 5.57]) than youth athletes.

Sports Event-Related Frequencies

For the frequencies of analgesic use on practice days and competitions over the previous season, we only considered those athletes that had used analgesics at least once in temporal or causal relation to their sport participation. Athletes reported using analgesics relatively more frequently on competition days (M=19.4%) compared to practice days (M=10.8%, t(381.08)=5.12, p<.001, d=0.46, 95% CI[5.28, 11.89].

Frequencies of Analgesic Use in Practice

Most athletes (81.9%) reported using analgesics on less than 20 practice days during a hypothetical season with 100 practice days (see table 3). However, 19% of athletes used analgesics on more than every fifth practice day. Regarding group differences, there was no significant difference between the frequencies of analgesic use on practice days for gender, age group, contract situation, or role within the team.

Frequencies of Analgesic Use in Competition

Most athletes (69.6%) reported using painkillers on less than six competition days (during a hypothetical season with 30 games). In contrast to the practice days, some athletes used analgesics rather regularly on competition days (see table 3). Regarding group differences, there was no significant difference between the frequencies of analgesic use on competition days for gender, age group, contract situation, or role within the team.

Discussion

This study is the first to specifically assess four key measures that characterize sport-related analgesic use in a sample of elite German handball players, with equally distributed gender and age groups. Whereas previous studies have assessed the consumption of painkillers through a wide variety of prevalence estimates (10, 33, 36, 39), we employed specific and replicable prevalence and frequency measures of sport-related analgesic use. Two measures of prevalence (career, season) were complemented by two frequency measures in which we assessed the number of days players practiced or competed with analgesics in the previous season (per 100 practice days, per 30 competition days).

Concerning the types of analgesics handball players used, our results are consistent with studies in the German general population and German professional football reporting that Ibuprofen was the most widely used analgesic (29, 36). Whereas our study shows that Diclofenac is the second most widely used analgesic among elite German handball players, in the general population Acetylsalicylic acid and paracetamol are used more frequently (29).

Table 2

Season prevalence of sport-related analgesic use with Chi-Square Analyses.

VARIABLE	N	%	CHI²	P	CRAMER'S V
Gender			26.06	<.001	0.24
Male	226	43.4			
Female	231	67.5			
Age group			53.28	<.001	0.35
Senior	205	74.6			
Youth	252	40.0			
Contract			20.39	<.001	0.22
Yes	131	72.3			
No	326	48.8			
Perceived Role			5.69	.017	0.12
Starting	227	49.8			
Rotation	230	61.3			

Table 3

Frequency of analgesic use on practice and competition days among athletes who ever used analgesics in connection with their sport participation. Table shows the percentage and total number of athletes who reported using pain medication on 30 hypothetical competition days and 100 practice days in a season. The number of competition and practice days were divided into quintiles for clarity and comparability.

	PERCENTAGE OF COMPETITION/PRACTICE DAYS WITH ANALGESIC USE				
	< 20%	20%-40%	40%-60%	60%-80%	80%-100%
Athletes in % (n) – on practice days	81.9% (204)	13.3% (33)	3.2% (8)	1.6% (4)	-
Athletes in % (n) – on competition days	69.6% (158)	16.3% (37)	4.4% (10)	4.9% (11)	4.0% (9)

The assessed career prevalence for sport-related analgesic use of 70.7% and the season prevalence of 55.6% align with findings from other sports, samples, and prevalence measures (24). According to our results, athletes used pain medication on average every 10th practice and every 5th competition day, with small high-risk groups of athletes reporting an alarming number of days with analgesic use, especially on competition days. Overall, our findings indicate that the sport-related use of analgesics is relatively common among elite handball players to allow ongoing participation in training and competition. These findings are in line with previous research in elite sports (12, 16, 17, 18, 28).

The results of our study suggest an underlying constellation of variables for a higher risk of analgesic use. Group differences were found in the sport-related career and season prevalence for gender, age group, contract situation, and perceived role. Previous research has also reported higher analgesic use among female athletes (30, 38). Menstrual symptoms, which are reported to be one of the leading causes of analgesic use in women (13), might account for these gender differences. With regard to the contract situation and perceived role, our results underline that pressures related to employment conditions and uncertainty could result in a higher chance of using analgesics (2, 26, 27). More specifically, athletes with contracts had a significantly higher chance of taking analgesics throughout a season and their careers. Future research could investigate whether further employment-related details such as the duration of the contract (e.g., number of seasons) or the degree of financial dependence on handball further impacts the risk of analgesic use (cf. 28). The significant difference between age groups in our study does not align with the findings of a recent meta-analysis that did not find an influence of age on analgesic use (24). However, whereas the meta-analysis only considered athletes aged 15-24, the present study also included older athletes.

Further, within our study, the variable age group (youth vs. senior athletes) appeared to have the most predictive value for the career and season prevalence of sport-related analgesic use. Older athletes might have accumulated more injuries during their careers that might cause ongoing pain (31). Further, senior athletes might be more socialized into the sport-specific culture of risk (22) in which athletes are expected to play despite pain or injuries (18, 28). Both aspects might explain why senior athletes had a higher chance of having used analgesics within their careers and over the previous season. However, given that recent studies suggest that a significant amount of analgesics medication among youth athletes is not supervised by a medical professional (6), the lower prevalences of analgesic use among youth handball players should not be neglected.

Interestingly, neither the career nor the season prevalence showed significant interactions between the predictor variables. Further, when accounting for all variables in the regression models, only age group for the career prevalence and gender and age group for the season prevalence remained significant. Additionally, our analyses did not reveal any group differences for the frequency measures. However, situational aspects seem to impact the frequency of analgesic use; athletes reported using analgesics relatively more frequently on competition days compared to practice days. This finding is consistent with qualitative and quantitative studies highlighting a higher willingness of athletes to participate in important competitions despite injury or illness compared to practice sessions (9, 23). ›

Limitations of the Study

Two important limitations of the study warrant discussion. First, our study uses novel prevalence and frequency measures. Despite offering replicable measures, their comparability with earlier studies has been proven difficult. Second, a recurrent limitation of studies investigating analgesic use in athletes is the unknown response bias due to the topic's sensitivity. However, there is no possibility of assessing a potential non-response bias in the sample. We tried to address this issue a priori by actively emphasizing the anonymity of participants within the informed consent forms.

Avenues for Future Research

We identified several critical areas for future research. Methodologically, future research should precisely analyze how analgesic use is measured. Similar measures of analgesic use should be adopted across studies to improve the comparability of results. Within our paper, we have proposed four easily replicable measures of analgesic use, targeting both the prevalence and frequency of analgesic use among elite athletes.

Further, our results indicate that, particularly for the frequency of analgesic use on competition and practice days, other variables (than the ones we assessed in our study) should be given additional consideration. Based on research within the area of playing hurt and presenteeism in elite sport (19), we suggest that future research focuses on psychosocial (such as perfectionism and athletic identity) and sociocultural variables (such as handling of pain and injuries and values related to the culture of risk) to identify athletes with an elevated risk of analgesic use. Situational aspects (i.e., time in the season, underlying reasons for analgesic use) should also be considered. In addition, our analyses highlighted that a higher number of senior handball players compared to youth athletes had consumed analgesics at least once during the last season. To better understand the development of analgesic consumption over an athlete's career, qualitative research designs might also be promising (5).

Perspectives

Our study demonstrated widespread use of analgesics among elite handball players, particularly on competition days. Regarding career and season prevalence, especially female handball players and senior players seem more vulnerable to using analgesics and thus might be the target point for specific prevention and education campaigns. In this regard, coaches, medical staff, or science support staff in elite sports settings should aim to sensitize athletes to the appropriate and inappropriate uses of analgesics, highlighting the potential, negative effects on training adaptations (15) and negative side effects (such as kidney and liver damage, and bleeding in the stomach and gastrointestinal tract). Overall, it is imperative that athletes, coaches, medical staff, and other support staff critically assess the risks and benefits before using analgesics in connection with elite sports participation.

Conflict of Interest

The authors have no conflict of interest.

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