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Musculoskeletal disorders and their associations with sleep quality and volleyball-specific technical characteristics among Cameroonian national-championship players: A cross-sectional study

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Abstract

Background

Volleyball places repetitive mechanical demand on the shoulder, knee, ankle, and spine, exposing players to musculoskeletal disorders (MSDs). Poor sleep quality and volleyball-specific technical characteristics have each been linked to MSDs, but their joint contribution has not previously been examined, particularly in a sub-Saharan African setting. This study aimed to describe MSD prevalence and to investigate their association with sleep quality and technical characteristics among Cameroonian national-championship volleyball players.

Methods

This cross-sectional study was conducted from February to May 2025 at the National Institute of Youth and Sports, Yaoundé, among 240 national-championship volleyball players (113 men, 127 women). Sociodemographic and technical/professional characteristics were collected by structured interview. MSDs over the last 7 days and 12 months were assessed with a validated Nordic Musculoskeletal Questionnaire, and sleep quality with the Pittsburgh Sleep Quality Index (PSQI). Associated factors were examined by binary logistic regression, crude and adjusted for sex, age, body mass index, championship seniority, and playing category.

Results

Mean age was 22.5 ± 4.7 years and mean PSQI score was 4.5 ± 2.0, with poor sleep quality reported by 27.9% of players. Over the last 7 days, 90.0-92.5% of players reported at least one musculoskeletal complaint, most frequently at the fingers (44.2%), ankles (36.7%), and knees (35.0%); prevalence rose to 92–96% over 12 months. After adjustment, playing position and blocking take-off leg were the factors most strongly associated with knee complaints, with the libero position associated with higher odds of complaints at the neck (aOR = 7.58), wrist (aOR = 3.18), and hip (aOR = 2.85), and left-leg take-off with higher odds of knee complaints (aOR = 5.68). Poor sleep quality remained associated with ankle MSDs over 12 months (aOR = 1.85) and with finger, upper back, and knee complaints over 7 days (aOR 1.89–2.15).

Conclusion

MSDs are highly prevalent among Cameroonian national-championship volleyball players and are independently associated with both poor sleep quality and volleyball-specific technical determinants, notably playing position and blocking take-off leg. These findings support combined preventive

strategies involving technical correction (blocking symmetry, foot orientation, serve-type progression) with sleep hygiene education, particularly for liberos and middle blockers.

Introduction

Volleyball is among the most dynamic, fast-paced, and popular team sports worldwide, distinguished by the unique nature of ball-contact play that underlies its markedly collective character[1, 2]. The discipline is practiced by an estimated 800 million individuals globally, spanning indoor and outdoor settings, youth and older populations, male and female participants, and able-bodied and disabled athletes alike [3]. Volleyball imposes on players a repeated sequence of jumps, overhead arm-swing strikes, and floor-level defensive actions, movements that place cumulative and repetitive mechanical demand on the shoulder, knee, ankle, and spine[2, 4–6]. This cumulative biomechanical loading underlies the musculoskeletal disorders (MSDs) documented in both training and competitive settings [6, 7]. Besides its beneficial health effects, volleyball is also associated with a risk of musculoskeletal injuries, either acute or overuse injuries, with an incidence ranging from 1.7–10.7 per 1000 playing hours [8].

The physical and mental benefits of practicing sports are important to prevent musculoskeletal pain and injuries in volleyball players, enabling them to continue to play safely with optimal performance [9]. The magnitude of this burden nonetheless varies according to competitive level and injury-recording method. Among elite men's volleyball players competing professionally and in North American university programs, weekly musculoskeletal complaints affect up to 93% of athletes over a season, predominantly at the knees, low back, and shoulders [10]. A burden has also been documented among recreational players in India with a prevalence of 77.5% [11]. The distribution of complaints is influenced by the type and frequency of technical actions, landing strategy, playing surface, training exposure, and playing position [5, 6]. Also, this convergence across competitive levels, from recreational to elite play, suggests that MSDs in volleyball are not confined to high-performance settings and may be under-recognized wherever systematic screening is absent, as is often the case in sub-Saharan African championships.

. MSDs are associated with reduced performance, the onset of injuries, absence from training and competition, prolonged recovery periods, and, in the most severe cases, the need for physiotherapeutic or surgical intervention [6, 12]. African data on this topic remain limited, with most available studies examining multiple sport disciplines concurrently rather than volleyball in isolation [12]. A more recent multi-sport survey conducted among basketball, handball, and volleyball players competing in Cameroon's national championships in Yaoundé reported MSD prevalence as high as 71.7% at the shoulder and 65.2% at the wrist/hand among volleyball players specifically[13]. The etiology of MSDs in the sporting context is multifactorial, with poor sleep quality increasingly recognized as a determinant relevant to their prevention [14]. Shortened or fragmented sleep reduces vigilance, prolongs reaction time, slows muscular recovery, and heightens pain sensitivity mechanisms through which poor sleep quality may predispose athletes to recurrent microtrauma [15]. Physiologically, this heightened vulnerability is linked to nociceptive system sensitization and a pro-inflammatory state induced by sleep

deprivation, which helps explain the bidirectional relationship between musculoskeletal pain and sleep [15].

Technical characteristics specific to volleyball and playing position may also modulate this risk independently of sleep [16, 17]. Reception mechanics constitute a recurrent technical determinant of MSDs in this sport, although they have not previously been examined in relation to players' sleep quality. From a biomechanical standpoint, each playing position imposes a distinct loading pattern: the middle blocker performs repeated vertical jumps near the net, the libero engages in dives and low floor defense, while the outside hitter and opposite hitter combine jumping, overhead striking, and serve-reception actions, a distribution of demands that may explain why certain positions concentrate risk in specific anatomical regions [16].

These three bodies of evidence on MSD prevalence among African athletes [12], the sleep-MSDs relationship in multidisciplinary sporting cohorts [14], and the influence of volleyball-specific technical determinants on injury risk in European settings [16, 17] have so far been examined in isolation from one another. To our knowledge, few studies have jointly examined sleep quality and technical/professional characteristics in relation to MSDs among volleyball players, particularly in a sub-Saharan African national-championship setting. Accordingly, this study aimed to describe the prevalence of MSDs among volleyball players competing in the Cameroonian national championships and subsequently to investigate their association with technical and professional and sleep-quality-related factors.

Materials and Methods

Study design and setting

This was a descriptive and analytical cross-sectional study conducted over three months (February-May 2025) during the competitive season. The study was carried out at the National Institute of Youth and Sports, Yaoundé. The study was reviewed and approved by the Institutional Ethics Committee under reference number 4790CEI-UDo/01/2025/M and was conducted in accordance with the recommendations of the Declaration of Helsinki, as revised in 2013. All participants provided written informed consent.

Study population and sample size

The study included junior, cadet, and senior volleyball players from teams affiliated with the Cameroonian national championship. Participants were selected using a random-sampling procedure from teams affiliated with the Cameroonian national championship; the sampling frame and selection process were documented before data collection. Eligibility criteria included holding a valid player’s licence for the 2024–2025 season of the Cameroonian championship, having at least one year of experience in a volleyball club, and providing written informed consent to participate. Players with less than one year of volleyball experience, those with an acute musculoskeletal injury that prevented them

from participating in the study or completing the assessment, and those undergoing rehabilitation at the time of data collection were excluded. Questionnaires with substantial missing data were excluded from the statistical analysis; the number of excluded questionnaires and the handling of remaining missing values should be reported in the participant-flow description and statistical tables. The required sample size was calculated using the Schwartz formula for estimating a population proportion, $N = p(1 - p)z^2/d^2$. A prevalence of 93% was used, based on the proportion of player-seasons in which knee, low-back, and/or shoulder complaints were reported in the study by Skazalski et al.[10]. The minimum sample size was 101 participants.

Data collection

Sociodemographic and technical/professional data

A structured interview questionnaire was used to collect sociodemographic data (age, seniority) and technical/professional characteristics (playing position, seniority in the championship, laterality, take-off and landing leg, foot orientation at blocking, type of serve).

Anthropometric parameters

Standing height (m) was measured with a stadiometer graduated to the nearest centimetre, and body weight (kg) was measured using a Tanita BC-505 device (Tokyo, Japan). Body mass index (BMI) was calculated using the Quetelet formula ($BMI = weight/height^2$).

Musculoskeletal disorders

MSDs were collected using a French-adapted version of the standardized Nordic Musculoskeletal Questionnaire[18]. This structured, validated questionnaire assesses musculoskeletal symptoms across eleven body regions. In the present study, the reference periods were adapted to the last 7 days and the last 12 months (neck, shoulders, elbows, wrists/hands, fingers, upper back, lower back, hips, knees, ankles). In the present study, MSDs were assessed over the last seven days and the last 12 months. For each region, the parameters evaluated were the presence or absence of aches, pains, or injuries during the reference period and absenteeism from training sessions during the same period for reasons related to pain in one or more body areas. For each region and period, participants indicated whether they had experienced pain, discomfort, or numbness severe enough to interfere with daily activity, training, or competition. Internal consistency of the questionnaire, assessed with Cronbach's alpha, was 0.94.

Sleep quality

The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality[19]. This instrument assesses a participant's sleep quality over the preceding month across 19 items covering seven

components: sleep onset latency, sleep duration, sleep efficiency, subjective sleep quality, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component is scored from 0 to 3, and the sum of the seven components yields a global score ranging from 0 to 21; a score above 5 (PSQI > 5) indicates poor sleep quality. Internal consistency of the PSQI, assessed with Cronbach's alpha, was 0.91.

Statistical analysis

Data were entered in Microsoft Excel and analysed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA). Normality was assessed with the non-parametric Kolmogorov-Smirnov test. Quantitative variables are presented as means ± standard deviation and were compared between men and women using Student's *t*-test; categorical variables are presented as frequencies and percentages and were compared using the chi-square test. Factors associated with the presence of MSDs were examined using binary logistic regression, first at the univariate level (crude odds ratios, cOR), then at the multivariate level after adjustment for sex, age, body mass index, seniority in the championship, and playing category (adjusted odds ratios, aOR). The statistical significance threshold was set at $p < 0.05$.

Results

General characteristics of the sample

Anthropometric characteristics, training load, and sleep quality of participants by gender presented in Table 1 show the study sample comprised 240 volleyball players, with a mean age of 22.5 ± 4.7 years, a mean body weight of 75.4 ± 10.4 kg, and a mean height of 1.84 +/- 0.10 m, yielding a mean BMI of 22.2 ±2.3 kg/m^2, within the normal weight range. Athletes trained on average 2.6 ± 0.7 hours per day, over 4.7 ± 1.3 sessions per week, with a mean seniority in the national championship of 1.4 ± 0.7 years. None of these parameters differed between men and women (*p > 0.05*), indicating a sample that was anthropometrically homogeneous. The overall PSQI score was 4.5 +/- 2.0, below the threshold of 5 commonly used to distinguish good from poor sleepers, with no difference between men and women (*p = 0.854*). Sleep latency and sleep disturbances contributed the most to this score, whereas perceived subjective sleep quality remained very good and did not differ by sex (*p > 0.05*).

Sociodemographic and technical/professional profile

In the Sociodemographic and technical/professional aspects summarized in Table 2, the study population comprised 240 players (113 men, 127 women), with female predominance (127/240 = 52.9%). Nearly all athletes (88.3%) had a normal weight status, with no significant difference by sex (*p > 0.05*). Seniors constituted the most represented playing category (42.9%), followed by cadets (32.5%) and juniors (24.6%). Poor sleep quality was reported by 27.9% of athletes, with no difference by sex (*p > 0.05*). Most athletes had 1-5 years of experience in the championship (70.0%) and were right-handed (88.8%). Technically, middle blockers (25.0%) and receiver-attackers (24.6%) were the most frequent positions, ahead of the outside hitter (19.2%), the setter (17.9%), and the libero (13.3%), with the non-

significant position-by-sex comparison reported earlier for this variable (*p = 0.231*) with no significant difference by sex (p > 0.05). Regarding blocking, players predominantly oriented their footwork toward the midline (63.9%), with take-off most often on the left leg (57.7%). For serving, however, the type of serve varied significantly by sex (*p = 0.026*); women relied somewhat more on the powerful jump serve and, especially, the standing serve, while men favored the floating jump serve.

Prevalence of MSDs by sex and sleep quality

With regard to the prevalence of MSDs (Table 3), it has been observed that over the last 7 days, the majority of athletes (90.0%) reported at least one musculoskeletal complaint in the absence of poor sleep, versus 92.5% among poor sleepers; this difference was not statistically significant, nor was it significant between men and women. Based on the body regions, fingers (44.2%), ankles (36.7%), and the knees (35.0%) were most affected by MSDs. Over 12 months, overall prevalence rose to 92-96%, and two regions stood out for their association with sex: the shoulder (*p = 0.03*) and especially the upper back (*p = 0.001*) and the ankle (*p = 0.01*), which were more frequently reported among women than among men without sleep disturbance.

For the prevalence of MSDs by technical and professional characteristics presented in Table 4, we notice that MSDs prevalence did not vary according to playing category, seniority, and laterality, whether over 7 days or 12 months. Regarding the take-off leg during serving, players taking off on the left leg were proportionally more likely to report MSDs, both over 7 days (*p = 0.039*) and over 12 months (*p = 0.045*). Among participants without poor sleep quality, players who used a powerful smash serve had a significantly higher prevalence of musculoskeletal disorders (MSDs) compared with those using other types of serve (*p = 0.009*). Playing position and foot orientation at blocking were also associated with MSD occurrence over the last 12 months (*p < 0.0001*).

Factors associated with MSDs: bivariate analysis

In the 12-month bivariate analysis, age was significantly associated with MSDs of the neck (cOR = 1.11, 95% CI: 1.03-1.19, *p = 0.004*), and seniority in the championship was associated with MSDs of the elbows (cOR = 1.89, 95% CI: 1.16-3.08, *p = 0.011*). Playing position emerged as the most contrasting factor. Middle blockers were associated with fewer MSDs of the upper back (cOR = 0.09, 95% CI: 0.01-0.80, *p = 0.030*) and hips (cOR = 0.21, 95% CI: 0.08-0.55, *p = 0.002*), but more of the knee (cOR = 2.56, 95% CI: 1.16-5.64, *p = 0.020*), whereas being a libero multiplied the risk of MSDs of the neck (cOR = 3.49, 95% CI: 1.13-10.77, *p = 0.030*) and wrists (cOR = 4.78, 95% CI: 1.16-19.72, *p = 0.031*) by 3.5 to 4.8, while reducing that of the knee (cOR = 0.24, 95% CI: 0.07-0.81, *p = 0.022*). Technically, left-leg take-off at blocking was associated with a 5.5-fold increase in the risk of knee MSDs (cOR = 5.52, 95% CI: 2.42-12.61, *p < 0.001*). Poor sleep quality also emerged as a factor associated with ankle complaints (cOR = 1.84, 95% CI: 1.04-3.25, *p = 0.036*). Over the last 7 days, poor sleepers reported more complaints of the fingers (cOR = 2.20, 95% CI: 1.24-3.91, *p = 0.007*), upper back (cOR = 2.31, 95% CI: 1.27-4.18, *p = 0.006*), and knee (cOR = 1.82, 95% CI: 1.02-3.25, *p = 0.043*). Receiving the serve on the right leg was associated with an increased risk

of MSDs of the neck (cOR = 4.53, 95% CI: 1.47-13.98, *p = 0.009*), elbows (cOR = 3.91, 95% CI: 1.25-12.23, *p = 0.019*), and especially the upper back (OR = 5.12, 95% CI: 2.50-10.48, *p < 0.0001*). (Table 5)

After adjustment for sex, age, BMI, championship seniority, and playing category resumed in Table 6 shows that playing position and take-off leg at blocking remained the most robust determinants of knee complaints over 12 months. Being a middle blocker (aOR = 2.83, 95% CI: 1.24-6.45*, p = 0.013*), and taking off on the left leg (aOR = 5.68, 95% CI: 2.38-13.53, *p < 0.0001*) or on both legs (aOR = 3.02, 95% CI: 1.14-8.00, *p = 0.026*), each increased this risk, whereas receiving the serve on the right leg was associated with a reduced risk of wrist (aOR = 0.44, 95% CI: 0.22-0.86, *p = 0.017*) and knee MSDs (aOR = 0.50, 95% CI: 0.28-0.90, *p = 0.020*), and orienting the footwork toward the sideline was associated with a reduced risk of overall MSDs (aOR = 0.07, 95% CI: 0.02-0.35*, p = 0.001*), lower back MSDs (aOR = 0.50, 95% CI: 0.27-0.94*, p = 0.030*), and knee MSDs (aOR = 0.48, 95% CI: 0.26-0.88, *p = 0.018*). The libero position showed the heaviest overall profile, with an increased adjusted risk at the neck (aOR = 7.58, 95% CI: 1.97-29.14, *p = 0.003*), wrist (aOR = 3.18, 95% CI: 1.01-9.95, *p = 0.047*), and hip (aOR = 2.85, 95% CI: 1.02-7.96, *p = 0.045*), counterbalanced by a protective effect at the knee (aOR = 0.24, 95% CI: 0.07-0.84, *p = 0.025*). Poor sleep quality remained associated, after adjustment, with ankle MSDs over 12 months (aOR = 1.85, 95% CI: 1.02-3.37, *p = 0.044*), and with finger (aOR = 2.10, 95% CI: 1.15-3.85, *p = 0.016*), upper back (aOR = 2.15, 95% CI: 1.16-3.99, *p = 0.015*), and knee MSDs (aOR = 1.89, 95% CI: 1.03-3.49, *p = 0.041*) over the last 7 days. Over 12 months, the floating jump serve was associated with fewer complaints of the shoulder (aOR = 0.34, 95% CI: 0.17-0.68, *p = 0.002*) and lower back (aOR = 0.26, 95% CI: 0.10-0.73, *p = 0.010),* but more of the knee (aOR = 2.74, 95% CI: 1.37-5.49, *p = 0.004*); over 7 days, it was associated with fewer complaints of the fingers (aOR = 0.49, 95% CI: 0.25-0.97, *p = 0.039*), but more of the hip (aOR = 3.45, 95% CI: 1.06-11.21, *p = 0.040*) and knee (aOR = 2.63, 95% CI: 1.24-5.57, *p = 0.011*). Right-leg service reception also retained a strong, adjusted association with upper back MSDs over 7 days (aOR = 4.99, 95% CI: 2.38-10.46*, p < 0.0001*).

Discussion

This cross-sectional study, conducted among volleyball players from the Cameroonian national championship, aimed to describe the prevalence of MSDs and examine their associations with sleep quality and players' technical characteristics. The prevalence observed according to good and poor sleep quality was very high, with the fingers, ankles, and knees being the most affected regions. Poor sleep quality and certain volleyball-specific technical determinants were associated with MSDs, often independently of one another after adjustment.

The prevalence of MSDs in the present study is higher than that reported in Senegal by Malam et al.[12], namely 67.8%, in a sample practicing football, basketball, rugby, tennis, athletics, and wrestling. This gap reflects a more heterogeneous population compared with volleyball players exposed to the specific jump-land-hit cycle. In Brazil, the men's national team reported a complaint load lower than ours despite a 10.2% incidence, a low rate of time-loss injuries [20], echoing the observation of Kiliç et al.[6] that few studies report prevalence rather than incidence alone, limiting comparisons. Our prevalence is similar to

that reported by Skazalski et al.[10] using the Oslo Sports Trauma Research Centre Overuse Injury questionnaire (OSTRC) and found a prevalence of 93% MSDs. The MSD prevalence reported by this study is among the highest, contrasting with the relatively low rates from major international surveillance systems such as that of the International Volleyball Federation, where [2] report a low injury risk among world-class players. This discrepancy is likely due to a difference in instruments: federal registries only record injuries “with time loss from play,” whereas the Nordic questionnaire captures any pain, including subclinical pain.

Beyond measurement issues, structural differences may amplify this prevalence; unlike European leagues [6, 16], the Cameroonian championship does not have genuine permanent medical support, let alone regular access to preventive physiotherapy, which Kiliç et al.[6] show that it reduces the incidence of ankle injuries. Its absence may favor the accumulation of untreated microtrauma. It is nonetheless notable that the anatomical distribution (fingers, ankles, knees) largely overlaps with that reported in Europe and South America, where the ankle, knee, and shoulder also predominate[3, 6, 21], arguing for a biomechanical determinant common to volleyball rather than one strictly tied to the practice context [7]. Skazalski et al. [10] found that elite men's players developed knee, low back, or shoulder complaints over a season, with the knee (31%) the single most prevalent region, a pattern our adjusted models partly reproduce through the elevated knee risk associated with playing position and take-off leg. Using the same Nordic Musculoskeletal Questionnaire employed in the present study, however, Indave et al.[11] reported that recreational players' complaints were dominated by the wrist and shoulder, a distribution closer to the finger-and-ankle-led pattern observed in the present cohort. Within Cameroon itself, a multi-sport study conducted in Yaoundé among amateur athletes practicing basketball, handball, and volleyball player Mbang Bian et al.[13] had reported a markedly different anatomical pattern for volleyball, with the shoulder and wrist/hand as the two most affected regions over twelve months, contrasting with the finger-, ankle-, and knee-led pattern observed in the present cohort. Taken together, these comparisons suggest that the fingers and wrist, systematically excluded from the OSTRC overuse injury questionnaire, constitute an underestimated component of the true injury burden in volleyball, and that instrument choice, at least as much as competitive level, explains part of the divergence between African and European/North American prevalence estimates.

The prevalence of poor sleepers (27.9%) is remarkably similar to that reported by Mekoulou Ndongo et al.[14] among elite Senegalese athletes (27.8%), suggesting a homogeneous sleep profile among sub-Saharan African athletes. After adjustment, poor sleep quality remained associated with twelve-month ankle MSDs (aOR: 1.85), as well as with seven-day finger (aOR: 2.10), upper-back (aOR: 2.15), and knee (aOR: 1.89) MSDs. These results are consistent with those of Mekoulou Ndongo et al.[14] and with the bidirectional sleep-pain relationship described by Charest & Grandner[15]. The physiological basis rests on two converging mechanisms, namely that poor sleep quality disrupts the anabolism-catabolism balance (hypercortisolemia, decreased testosterone and growth hormone), slowing musculotendinous repair [20]; in addition, sleep deprivation promotes a pro-inflammatory state and nociceptive sensitization that lowers the pain perception threshold[15]. These two pathways explain why the ankle and knee, which absorb most of the landing forces after each jump, are the joints where the effect of

poor sleep is most pronounced. Sleep deprivation would not create a new vulnerability, but would rather reduce the recovery capacity of the structures already most heavily stressed.

Playing position is the most discriminating technical factor. Middle blockers, subjected to repeated vertical jumps near the net, showed an increased risk of knee MSDs (cOR: 2.56; aOR: 2.83) but a reduced risk at the upper back and hip. Conversely, the libero position carried the heaviest risk at the neck (aOR: 7.58), wrist (aOR: 3.18), and hip (aOR: 2.85), with a clear protective effect at the knee (aOR: 0.24), illustrating the position-specific biomechanics described by Kilic et al.[6], where in the libero the load shifts from the lower limb to the cervical spine and upper limbs. The takeoff leg used for blocking was a second major determinant; a left-leg or two-legged takeoff was associated with higher adjusted odds of knee MSDs more than fivefold (aOR: 5.68 for the left-leg takeoff; aOR: 3.02 for the two-legged takeoff), reflecting a loading asymmetry at jump landing, consistent with the causality model of Bahr & Krosshaug[21], and with the review by Sassi et al.[23] identifying the landing after an attack hit as the most frequent non-contact mechanism of anterior cruciate ligament ruptures in volleyball.

Serve type illustrated a shift rather than a reduction in risk. Thus, the jump floater serve was associated with fewer twelve-month shoulder and lower-back MSDs (aORs: 0.34 and 0.26, respectively), consistent with less explosive shoulder rotation compared with the spike, which Seminati & Minetti[7] describe as the main cause of shoulder and spine overuse. However, it was associated with more knee and hip MSDs, suggesting a transfer of load to the lower limb. Landing on the right leg increased the risk at the neck, elbow, and especially the upper back (aOR: 4.99), whereas a foot orientation toward the sideline was protective, consistent with Domaradzki et al.[16], on foot mobility. Age was associated with neck MSDs (cOR: 1.11) and years of practice with elbow MSDs (cOR: 1.89), probably related to the accumulation of stresses from serving and attacking in extension. This dual association might be explained by the age-related accumulation of repeated mechanical stress on the cervical spine and upper back during overhead movements (serving, spiking, blocking), a problem specifically documented in elite volleyball players[23], and by overuse in elbow extension/valgus related to the large forces and torques generated in the upper limb during serving and attacking, the magnitude of which increases with the number of repetitions accumulated over a career [24].

The differential vulnerability by sex (shoulder, upper back, ankle), more pronounced in female players without sleep disturbance, is consistent with the findings of Sassi et al.[22] on a higher incidence of anterior cruciate ligament injuries in female athletes, particularly outside hitters, possibly related to differences in ligament laxity. Finally, sleep and technical determinants did not systematically act on the same joints, suggesting two largely independent pathways: one regenerative/hormonal, the other biomechanical, converging on the knee and, to a lesser extent, the neck, identifying these two joints as priority targets for combined prevention. These associations are consistent with the multifactorial nature of MSDs, consistent with the model of Bahr & Krosshaug[21], which distinguishes intrinsic factors (age, sex, years of practice, position) from extrinsic factors (training load, sleep).

Strengths and limitations

This study relies on validated tools (Nordic questionnaire and PSQI) with satisfactory internal consistency (α: 0.94 and 0.91) and represents, to our knowledge, one of the few sub-Saharan studies to jointly examine sleep and technical characteristics in relation to MSDs among volleyball players, filling a gap identified by Malam et al.[12] and Mekoulou Ndongo et al. [14], whose work focused on multidisciplinary cohorts. It nonetheless carries the limitations inherent to its cross-sectional design (no causal link can be established) and to its reliance on self-reported data (recall or social desirability bias). The cross-sectional design also precludes establishing temporality, and the observational associations should not be interpreted as causal effects. Generalization to other African championships or levels of play should remain cautious. Its use of the same Nordic questionnaire as recreational-level studies [11] also facilitates comparison across competitive levels, unlike OSTRC-based elite surveillance [10], which omits the fingers and wrist.

Conclusion

This study confirms that MSDs were highly prevalent among volleyball players in the Cameroonian national championship, with the fingers, ankles, and knees being the most affected. Their occurrence was associated with a combination of biomechanical and technical factors (playing position, takeoff leg, serve type, landing leg) that modulate risk depending on the joint, and with poor sleep quality, which was independently associated with complaints, particularly at the ankle and knee, possibly through impaired recovery and nociceptive sensitization. These findings support combined preventive strategies rather than approaches centred on a single factor: on the technical side, attention to the symmetry of the blocking takeoff, foot orientation, and the progressive learning of serve types; on the physiological side, integrating sleep hygiene education into team follow-up, an accessible lever where access to preventive physiotherapy remains limited. Priority attention to the libero and middle-blocker positions, as well as to the knee and cervical spine, appears warranted.

Declarations

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Ethics approval and consent to participate

The study was approved by the Institutional Ethics Committee of the University of Douala under reference number 4790CEI-UDo/01/2025/M. The study was conducted in accordance with the Declaration of Helsinki, as revised in 2013. Written informed consent was obtained from all participants before data collection.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available because they contain potentially identifiable participant information but are available from the corresponding author on reasonable request.

Authors' contributions

JMN and WMB conceived the study, performed the data analysis, interpreted the results, and drafted the manuscript. WNT, ASMR, EGNN, ECM, and FHF collected the data, drafted the manuscript, and contributed to its revision. LPKF, JMN, and MME performed the data analysis, proofread the English language, and revised the manuscript for important intellectual content. PBAN, HMMA and EEM critically revised the manuscript for important intellectual content. WRG and SHM supervised the study at all stages. All authors read and approved the final version of the manuscript.

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Tables

Table 1 to 6 are available in the Supplementary Files section.

Supplementary Files

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