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PHYSICAL ACTIVITY AND SPORT PARTICIPATION IN PEOPLE WITH EPILEPSY: BENEFITS, RISKS, AND RECOMMENDATIONS FOR SAFE PARTICIPATION – A NARRATIVE REVIEW

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Abstract

Background. Epilepsy is one of the most common serious neurological disorders, affecting more than 70 million people worldwide. People with epilepsy have historically been discouraged from sport through fear and overprotection rather than evidence, and remain less physically active than the general population.

Aim. To synthesise current evidence on physical activity and sport in people with epilepsy and to translate it into practical, risk-stratified guidance for safe participation.

Material and methods. A narrative review of MEDLINE/PubMed, Scopus, and the Cochrane Library was conducted, prioritising guidelines, systematic reviews, randomised trials, and mechanistic studies; the ILAE Task Force consensus provided the risk-stratification framework.

Results. Regular exercise rarely provokes seizures and may raise the seizure threshold; randomised and meta-analytic data show improved quality of life, fitness, mood, and cognition, with a neutral-to-favourable effect on seizure frequency. The ILAE stratifies sports into three risk categories, enabling individualised eligibility decisions. Knowledge gaps, stigma, and structural barriers still limit participation.

Conclusions. For most people with epilepsy the benefits of physical activity outweigh the risks; individualised, risk-stratified counselling rather than blanket restriction should be standard care.

Key words: epilepsy; seizures; physical activity; exercise; sport; quality of life; risk stratification

1. Introduction

Epilepsy is a chronic disorder of the brain characterised by an enduring predisposition to generate epileptic seizures, together with the neurobiological, cognitive, psychological, and social consequences of this condition. The International League Against Epilepsy (ILAE) defines epilepsy operationally as at least two unprovoked seizures more than 24 hours apart, one unprovoked seizure with a high ($\geq 60\%$) recurrence risk, or the diagnosis of an epilepsy syndrome [1]. It is among the most common serious neurological disorders: epilepsy in adults affects more than 70 million people globally [2], and the Global Burden of Disease Study 2016 confirmed that idiopathic epilepsy remains a major contributor to neurological disability, with a disproportionate share borne by low- and middle-income countries where the treatment gap is widest [3]. A systematic review and meta-analysis of international studies estimated the point prevalence of active epilepsy at 6.4 per 1,000 persons and the annual incidence at approximately 61 per 100,000 person-years, with higher figures in lower-income settings [4].

The clinical heterogeneity of epilepsy is central to any discussion of sport. The 2017 ILAE operational classification distinguishes seizures by their onset – focal, generalised, or unknown

– and, for focal seizures, by the level of awareness, replacing older terms such as “partial” and “secondarily generalised” [5,6]. The companion classification of the epilepsies adds the levels of epilepsy type and epilepsy syndrome and emphasises aetiology at every step [7]. Roughly one-third of patients continue to have seizures despite treatment; drug-resistant epilepsy is defined as failure of two appropriately chosen and tolerated anti-seizure medication schedules to achieve sustained seizure freedom [8]. Seizure type, frequency, timing, and specific precipitants together determine the practical risk that a seizure poses during a given activity, and therefore the advice a clinician should give.

Beyond seizures, epilepsy carries a heavy comorbidity and psychosocial burden. Depression and anxiety are highly prevalent and share bidirectional mechanisms with epilepsy, yet frequently go unrecognised and untreated [9]. Stigma, reduced educational and employment opportunities, and impaired health-related quality of life are documented across diverse settings, from cross-cultural European surveys [10] to high-burden low-income contexts [11]. Among adolescents in rural sub-Saharan Africa, epilepsy is associated with household poverty, school dropout, and the lowest quality-of-life scores, particularly where seizure control is poor [12]. These comorbidities are precisely the domains in which physical activity is known to help.

For much of the twentieth century, people with epilepsy were routinely advised to avoid vigorous exercise and competitive sport. This caution was driven less by evidence than by fear that exertion might trigger seizures, by protectiveness on the part of families and physicians, and by a lack of information among health professionals and sports instructors alike [13,14]. The unintended consequence has been measurable: controlled studies demonstrate that patients with epilepsy have lower physical fitness than matched controls [14], and a systematic review and meta-analysis found that adults with epilepsy are significantly less likely to meet physical activity recommendations (odds ratio 0.68) and more likely to be inactive (odds ratio 1.57) than the general population [15]. Because physical inactivity is itself a leading contributor to chronic disease and premature death [16,17], this shortfall represents an avoidable, second layer of harm.

Contemporary evidence has largely reversed the historical picture. Physical activity is now understood to be safe for the majority of people with epilepsy and to confer meaningful health and psychosocial benefits [18,19]. This narrative review synthesises current evidence on physical activity and sport in epilepsy, addressing five questions: whether exercise provokes or protects against seizures; what benefits participation confers; what genuine risks exist; how

participation can be stratified by sport type; and what practical counselling, medication, and safety considerations apply. Post-traumatic epilepsy arising from sports-related head injury and sudden unexpected death in epilepsy (SUDEP) are acknowledged but treated only briefly, as each merits separate dedicated review.

2. Material and methods

This work is a narrative (non-systematic) review. The electronic databases MEDLINE/PubMed, Scopus, and the Cochrane Library were searched for English-language publications combining the terms “epilepsy” or “seizure” with “physical activity,” “exercise,” “sport,” “athlete,” “participation,” and “quality of life”. Priority was given to consensus statements and clinical guidelines, systematic reviews and meta-analyses, randomised controlled trials, and mechanistic and epidemiological primary studies. The consensus report of the ILAE Task Force on Sports and Epilepsy served as the principal framework for risk stratification [13], supplemented by ILAE position papers on the definition and classification of epilepsy [1,5,6,7,8].

Reference lists of retrieved articles were screened to identify additional relevant sources. Because this is a narrative synthesis intended to integrate evidence across heterogeneous study designs – from animal models of epileptogenesis to population surveys and randomised trials – no formal risk-of-bias appraisal or quantitative pooling was undertaken; where meta-analytic estimates are cited, they are drawn from published systematic reviews. This approach is well suited to a field that spans exercise physiology, clinical epileptology, and sports medicine, but it carries the limitations inherent to narrative reviews, including the potential for selection and interpretation bias.

3. Results and state of knowledge

3.1. Effect of exercise on seizure threshold and seizure frequency

The long-standing concern that physical exertion precipitates seizures is not supported by the weight of evidence for most patients. Physical exercise is a form of controlled physiological stress, and, paradoxically, the adaptive response to regular training appears to reduce rather than increase seizure susceptibility. Arida and colleagues characterised exercise as a stressor whose repeated, moderate application buffers the organism against subsequent stress – the most commonly self-reported seizure precipitant – through adaptation of the hypothalamic–pituitary–adrenal axis, modulation of neurotransmitter systems, and favourable neuroendocrine

and metabolic change [20]. Later syntheses extend this to neuroprotective and potentially antiepileptogenic effects, mediated partly by increased neurotrophic signalling and improved cerebral metabolic regulation [21]. Experimental work supports a causal direction: in rats subjected to brain injury, moderate treadmill training before a chemoconvulsant challenge reduced the intensity of pilocarpine-induced seizures and preserved specific interneuron populations, indicating a genuine neuronal correlate of exercise-related protection [22].

Clinically, the relevance of stress and sleep – rather than exercise – as dominant precipitants is instructive. In a structured survey of patients with juvenile myoclonic epilepsy, the most frequently reported triggers were psychological stress (83%) and sleep deprivation (77%), with exercise not featuring among the leading factors [23]. Prospective intervention data reinforce the safety of activity: in an intensive four-week training programme, only 6 of 21 adults with uncontrolled epilepsy had any seizure during exercise, aerobic capacity rose by an average of 19%, and serum anti-seizure medication levels were not clinically altered [24]. In women with pharmaco-resistant epilepsy, a 15-week programme of aerobic dancing with strength and flexibility work significantly reduced self-reported seizure frequency during the intervention [25]. Exercise-induced seizures do occur in a small, identifiable subgroup and warrant individualised assessment, but they are the exception; the general rule, endorsed by the ILAE Task Force and by narrative reviews of the field, is that active participation in sport may favourably affect seizure control rather than worsen it [13,19].

3.2. Health and psychosocial benefits of physical activity

The benefits of exercise for people with epilepsy extend well beyond seizure control. A systematic review and meta-analysis by Duñabeitia and colleagues pooled 14 studies comprising 331 people with epilepsy and found that structured exercise training produced a significant improvement in quality of life – a mean gain of 4.72 percentage points (95% CI 0.58–8.86; $p = 0.03$) – together with gains in cardiorespiratory fitness and in psycho-affective and neurocognitive outcomes; seizure frequency showed a favourable but non-significant trend toward reduction ($p = 0.08$), indicating that exercise does not worsen control and may modestly improve it [26]. Randomised trials conducted since then are consistent with this synthesis. A 12-week structured programme of aerobic and resistance training in Brazil significantly reduced seizure frequency ($p = 0.010$) and improved quality of life, stress levels, and physical fitness relative to controls [27], while a smartphone-supported aerobic-activity intervention in India

produced positive, if non-significant, changes in quality of life, seizure frequency, and stigma [28].

Cross-sectional evidence points in the same direction: higher physical activity levels are positively associated with quality of life and negatively associated with depression, anxiety, and reported medication side effects in people with epilepsy [29]. These associations matter because depression, anxiety, and cognitive difficulties are frequent, under-treated comorbidities that strongly shape quality of life [9]. Exercise is an evidence-based adjunctive treatment for mood and cognitive symptoms across a broad range of mental disorders in the general population [30], and the epilepsy-specific data suggest patients share in these gains. Physical activity also mitigates the elevated cardiovascular and metabolic risk that accompanies a sedentary lifestyle and some anti-seizure medications [16,17], and it fosters the social inclusion that counters stigma [10,12]. Not every modality has strong evidence: a Cochrane review of yoga for epilepsy found only low-quality data and could draw no reliable conclusion about seizure control, illustrating that enthusiasm should be matched to the strength of evidence for each intervention [31].

3.3. Risks and adverse events

Acknowledging genuine risk is essential to credible counselling. The principal hazard is not that exercise provokes seizures but that a seizure, should one occur, may have serious consequences in particular environments. Water immersion carries a risk of drowning; heights carry a risk of falls; and activities conducted alone or at speed reduce the opportunity for timely assistance. On this basis, narrative reviews conclude that people with well-controlled epilepsy face few restrictions apart from scuba diving, skydiving, and sports performed at height [19]. The distinction between perceived and actual risk is large: surveys of both patients and clinicians reveal persistent over-estimation of danger that translates into unnecessary restriction [32], and prospective data show that seizures during supervised exercise are infrequent even among patients with poor baseline control [24].

Two rarer but serious concerns lie largely outside the scope of this review. Sports-related head trauma can, in a minority of cases, contribute to the later development of post-traumatic epilepsy; the management of sport-related concussion is addressed by dedicated international consensus [33]. Sudden unexpected death in epilepsy is uncommon – approximately 1 in 4,500 children and 1 in 1,000 adults with epilepsy per year – and its major modifiable risk factor is the occurrence of generalised tonic-clonic seizures, so that optimising seizure control is central

to reducing risk [34]. Neither concern justifies avoidance of activity; both reinforce the importance of seizure control, appropriate supervision, protective equipment, and environment-specific precautions.

3.4. Risk stratification and the ILAE sport classification

The ILAE Task Force on Sports and Epilepsy provided a pragmatic framework that remains the reference standard for eligibility decisions. Sports are divided into three groups according to the potential consequences of a seizure occurring during the activity [13], summarised in Table 1.

Table 1. ILAE classification of sports according to the potential risk should a seizure occur (adapted from reference [13]).

Group	Definition	Representative examples
Group 1	No significant additional risk to the person with epilepsy or to bystanders	Athletics (most track and field), football/soccer, basketball, volleyball, tennis, field hockey, baseball, golf, bowling, cross-country skiing, dancing
Group 2	Moderate risk to the person with epilepsy, but no risk to bystanders	Swimming, cycling, gymnastics, horseback riding, contact/combat sports (boxing, martial arts, wrestling), weightlifting, alpine skiing, skating, archery, biathlon
Group 3	Major risk, where a seizure may be fatal to the athlete and/or bystanders	Aviation, scuba diving, rock/free climbing, motor sports, parachuting/skydiving, hang-gliding, solo sailing, downhill high-speed events

Source: adapted from the ILAE Task Force on Sports and Epilepsy [13]. Examples are illustrative; the original consensus provides more detailed lists.

Assignment to a category is only the starting point. The Task Force emphasised that individual eligibility should weigh the type of sport, the probability that a seizure will occur, the type and severity of the seizures, known precipitating factors, the usual timing of seizures (for example, seizures confined to sleep carry different implications), and the person's own attitude toward accepting a degree of residual risk [13]. A person who has been seizure-free for a prolonged period on stable medication occupies a very different risk position from one with frequent, poorly controlled convulsive seizures – a distinction that maps onto the formal definition of drug-resistant epilepsy [8] – even for the same sport. This framework also informs the issuance

of medical fitness certificates, which should be individualised rather than granted or withheld categorically, and aligns with the consensus that restrictions for people with controlled epilepsy should be narrow and specific [19].

3.5. Special considerations: children, elite athletes, and medication

In children and adolescents, participation in physical education and sport supports motor development, peer relationships, and self-esteem, and exclusion can be more harmful than the small risks it seeks to avoid; the general encouragement to participate applies with particular force in this group [13,18]. Photosensitive and other reflex epilepsies warrant attention to specific environmental triggers, such as flickering light, but affect only a minority of patients and rarely contraindicate mainstream sport. For elite and competitive athletes, anti-seizure medication management intersects with performance and with anti-doping regulation: some medications cause sedation, weight change, or cognitive slowing that can affect training, and athletes should verify the status of their medications against current anti-doping standards.

Medication choice carries particular weight for athletes of childbearing potential. The 2024 practice guideline of the American Academy of Neurology, American Epilepsy Society, and Society for Maternal-Fetal Medicine recommends avoiding valproic acid where clinically feasible because of teratogenic and neurodevelopmental risks, favouring lamotrigine, levetiracetam, or oxcarbazepine, and advising folic acid supplementation [35]. Although framed around pregnancy, these principles reinforce a broader message relevant to every active patient: optimising the regimen for both seizure control and side-effect profile is integral to enabling sustained, safe participation in sport, and is consistent with the observation that better seizure control lowers the risk of the most serious outcomes [8,34]. Recent reviews in the regional physical-culture literature reinforce these points: physical activity has been shown to improve cognition, mental health, and quality of life in children and adolescents with epilepsy [36], while non-pharmacological options such as the ketogenic diet [37] and cannabidiol [38] are increasingly explored for drug-resistant epilepsy.

4. Discussion

The evidence assembled here supports a clear reorientation from restriction toward enablement. Exercise is safe for most people with epilepsy, rarely provokes seizures, and delivers measurable improvements in quality of life, fitness, mood, and cognition, with a neutral-to-favourable effect on seizure frequency [21,26,27]. Mechanistic and experimental work provides a plausible biological basis for these clinical observations, including stress-axis adaptation and neuroprotection [20,22]. The ILAE framework offers a defensible, individualised route to eligibility decisions that neither exposes patients to unreasonable danger nor denies them the benefits of participation [13,19].

Yet a gap persists between this evidence and everyday practice. A multinational survey of neurologists found that although the great majority encouraged exercise, about one-third lacked information on its effects and roughly 60% were unaware of the ILAE recommendations, while more than half would still restrict patients with uncontrolled seizures [32]. Insufficient knowledge among clinicians, physical-education teachers, and sports instructors was identified as a barrier decades ago and persists today [14]. Because clinicians strongly influence patient confidence and behaviour, these knowledge gaps directly constrain participation and help explain why people with epilepsy remain less active than their peers [15].

Barriers extend beyond the clinic. Stigma, family anxiety, insurance and liability concerns, and – particularly in low-resource settings – poverty and limited access to safe facilities intersect with epilepsy to depress quality of life, especially where seizure control is poor [10,11,12]. Addressing these determinants is therefore part of any serious strategy to increase participation, not a peripheral concern. For clinicians, the practical implication is to replace categorical prohibition with structured, individualised counselling: classify the sport, characterise the patient's seizures and their control, identify precipitants such as sleep deprivation and stress [23], agree on environment-specific precautions (for example, supervision in water or the use of protective equipment), and document a shared decision. For coaches, physical-education teachers, and sports organisations, the priority is basic seizure-awareness training and preparedness rather than exclusion. For health systems, disseminating the ILAE framework and integrating physical-activity counselling into routine epilepsy care are low-cost, high-value interventions with benefits that extend to the cardiovascular and mental-health comorbidities of epilepsy [9,16,17]. These conclusions are echoed in the physical-culture literature, which highlights both the psychological dimensions of sport participation [39] and the promotion of physical activity as a core healthy behaviour from childhood [40].

This review has limitations. It is narrative rather than systematic, and the underlying epilepsy-specific evidence base – though consistent in direction – remains modest in size, with small samples, heterogeneous interventions, and relatively few large randomised trials; some modalities, such as yoga, are supported only by low-quality data [31]. The meta-analytic signal for seizure reduction did not reach statistical significance [26], and long-term and sport-specific safety data are limited. These gaps define a clear research agenda: adequately powered randomised trials of exercise interventions, prospective registries of athletes with epilepsy, standardised reporting, and updated consensus guidance incorporating new evidence, as the Task Force itself anticipated when it described its recommendations as a work in progress [13].

5. Conclusions

For the majority of people with epilepsy, the benefits of physical activity and sport outweigh the risks. Regular exercise is safe, rarely provokes seizures, and improves quality of life, fitness, mood, and cognition, while its effect on seizure frequency is neutral to favourable. Decisions about participation should be individualised and risk-stratified using the ILAE framework, taking account of seizure type, control, precipitants, and the specific demands and environment of each sport, rather than relying on blanket restriction.

Realising these benefits requires closing the gap between evidence and practice. Educating clinicians about the ILAE recommendations, equipping coaches and teachers with seizure-awareness skills, optimising medication for both control and tolerability, and addressing stigma and structural barriers would together allow far more people with epilepsy to participate safely in sport. Future research should strengthen the evidence base with larger trials and prospective data and should keep consensus guidance current, so that physical activity takes its place as a routine, prescribed component of comprehensive epilepsy care.

Disclosure

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