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Review

Injuries and other adverse events associated with yoga practice: A systematic review of epidemiological studies

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ABSTRACT

Objectives: To systematically assess the prevalence of yoga-associated injuries and other adverse events in epidemiological studies.

Design: Systematic review of observational studies.

Methods: Medline/PubMed, Scopus, the Cochrane Library, and IndMed were searched through October 2016 for epidemiological studies assessing the prevalence of adverse events of yoga practice or comparing the risk of any adverse events between yoga practitioners and non-yoga practitioners.

Results: Nine observational studies with a total 9129 yoga practitioners and 9903 non-yoga practitioners were included. Incidence proportion of adverse events during a yoga class was 22.7% (95% confidence interval [CI] = 21.1%–24.3%); 12-months prevalence was 4.6% (95%CI = 3.8%–5.4%), and lifetime prevalence ranged from 21.3% (95%CI = 19.7%–22.9%) to 61.8% (95%CI = 52.8%–70.8%) of yoga practitioners. Serious adverse events occurred in 1.9% (95%CI = 1.4%–2.4%). The most common adverse events related to the musculoskeletal system; the most common injuries were sprains and strains. Compared to non-yoga practitioners, yoga practitioners had a comparable risk of falls (odds ratio [OR] = 0.90; 95%CI = 0.76–1.08), and falls-related injuries (OR = 1.04; 95%CI = 0.83–1.29), and higher risk of meniscus injuries (OR = 1.72; 95%CI = 1.23–2.41).

Conclusions: A considerable proportion of yoga practitioners experienced injuries or other adverse events; however most were mild and transient and risks were comparable to those of non-yoga practitioners. There is no need to discourage yoga practice for healthy people. People with serious acute or chronic illnesses should seek medical advice before practicing yoga.

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1. Introduction

While yoga is rooted in Indian philosophy and has been a part of traditional Indian spiritual practice for around 3000 years,¹ it has now become a popular means to promote physical and mental well-being^{1,2}; mainly associated with physical postures (asana), breathing techniques (pranayama), and meditation (dyana) in North America and Europe.² These more physically-oriented yoga forms are gaining increased popularity as a therapeutic practice: about 11% of the American adult population reported having practiced yoga in 2016 and 28% reported having practiced it at least once in their lifetime.³ Of those who were already practicing yoga, about 80% had started practicing explicitly to improve their health

status, resulting in more than 16 million people in the US practicing yoga for health reasons.⁴

While yoga has long been promoted as beneficial and without harm, this view has been challenged in recent years. Mainly based on anecdotal evidence, the safety of yoga has been questioned in a number of lay-press articles.^{5–7} As these publications seem to have led to a general uncertainty among yoga practitioners and those interested in starting practice,⁸ it is important to systematically assess the safety of yoga. While prior systematic reviews have recently assessed yoga-associated adverse events based on case reports⁹ and randomized controlled trials,¹⁰ absolute population-based prevalence rates of adverse events associated with yoga are best estimated from large epidemiological surveys.

Therefore, this review aimed to systematically assess the prevalence of yoga-associated injuries and other adverse events in epidemiological observational studies.

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2. Methods

This review was planned and conducted in accordance with the Meta-Analysis Of Observational Studies in Epidemiology (MOOSE) statement.¹¹

2.1. Eligibility criteria

Eligible articles were required to meet the following criteria:

Type of studies: Epidemiological observational studies reporting original data and published in peer-reviewed journals were eligible. Experimental studies (e.g. clinical trials) were excluded. Abstracts and unpublished studies were included if they provided sufficient information.

Type of participants: Studies on yoga practice under naturalistic conditions were eligible. Studies prescribing yoga to participants (e.g. clinical trials) were excluded. Studies reporting on a subsample of yoga practitioners (e.g. those practicing a specific yoga style; specific patients groups) were included but analysed separately.

Type of outcome measures: Studies assessing prevalence of injuries and/or other adverse events or side effects of yoga practice were eligible. Studies assessing injuries or other adverse events that were not clearly related to yoga practice were also included when rates of those events in yoga practitioners were compared to those in a control group of non-yoga practitioners.

2.2. Search methods

Four electronic databases were searched by a researcher with longstanding experience in systematic literature search methodology from their inception through October 04, 2016: Medline/PubMed, Scopus, the Cochrane Library, and IndMED. The literature search was constructed around search terms for “yoga” and for “adverse events”, and adapted for each database as necessary. The complete search strategy for each database is shown in Supplementary Table 1.

Additionally, reference lists of identified original articles or reviews, and the tables of contents of the *International Journal of Yoga Therapy*, the *Journal of Yoga & Physical Therapy* and the *International Scientific Yoga Journal SENSE* were manually searched.

Two reviewers independently screened abstracts identified during the literature search and read potentially eligible articles in full to determine whether they met the eligibility criteria. Disagreements were discussed with a third review author until consensus was reached.

2.3. Data extraction and management

Data on setting (country of origin, study sample), period of data collection, study design (longitudinal, cross-sectional, retrospective), sample size, assessment of injuries or adverse events (type of interview, questionnaire), and main findings (prevalence for any type of injury or adverse events reported) were extracted independently by two reviewers. If this information was not reported in the original publication, 95% confidence intervals (CI) for prevalence rates and/or odds ratios (OR) between yoga practitioners and non-yoga practitioners were calculated. Additional information on adverse events such as type or severity of adverse events, participant characteristics associated with risk of adverse events, or practice characteristics (e.g. yoga type, supervised vs. unsupervised practice, type of yoga practice) associated with risk of adverse events were additionally extracted.

2.4. Assessment of risk of bias

A scoring system previously used for systematic reviews of observational trials^{12,13} was used to critically appraise the located epidemiological studies:

1. Sample representative for the underlying population with unbiased sampling strategy,
2. Adequate sample size (at least 1000),
3. Adequate response rate (at least 70%),
4. Comparison between respondents/non-respondents (those who refused to participate),
5. Reliable and valid assessment of adverse events (standardized instruments used, clear definition of injury/adverse event).

For each criterion, risk of bias was rated as

1. Low risk of bias, if the respective criterion was adequately met
2. Unclear risk of bias, if insufficient information were provided to judge risk of bias
3. High risk of bias, if the respective criterion was not or inadequately met.

Risk of bias was assessed by two reviewers independently; disagreements were discussed with a third review author until consensus was reached.

3. Results

3.1. Literature search

The literature search revealed a total of 759 non-duplicate records of which 748 were excluded because they did not report on yoga practices, were no surveys or did not report adverse events. Out of 11 full-texts assessed for eligibility,^{14–24} one article was excluded because it was not an observational study,¹⁴ and one article was excluded because it did not adequately assess adverse events.¹⁵ Finally, nine observational studies including a total of 9129 yoga practitioners and 9903 non-yoga practitioners were included in the qualitative synthesis (Fig. 1).^{16–24} All articles were published in English.

3.2. Study characteristics

The nine included studies all were cross-sectional in nature and were conducted between 2005 and 2013. Four studies did not report the time point of assessment, however one of those had received approval from the institutional review board in 2014 and was thus most likely conducted in 2014 or later (Table 1).¹⁸ The studies were based on US,^{17,18,21,23} European,²⁰ Asian,^{19,24} and Australian^{16,22} samples. The targeted underlying population included all self-identified current and/or prior yoga practitioners^{16,17,21,22,24}; practitioners that had just attended a yoga class¹⁹; those that were practicing a specific yoga style, Ash-tanga Vinyasa yoga,²⁰ or hot yoga¹⁸; or yoga practitioners who were diagnosed with bipolar disorder.²³ Where reported, the mean age of included participants ranged from 33.0 to 58.5 years (median: 43.1 years); between 71.8 and 100.0% (median: 91.1%) of participants were female. The outcome measures varied widely between studies and included any adverse events,^{18,19,21,23} any adverse events resulting in discontinued yoga use,¹⁷ meaningful,²² or persistent injuries,²⁰ meniscus injuries,²⁴ or falls and falls-related injuries¹⁶ (Table 1). All studies assessed the type/location of injuries/adverse events; and three studies further differentiated the severity of adverse events.^{17,19,20} Six studies assessed lifetime prevalence of

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