

## Research

# A Survey of Musculoskeletal Injury among Ashtanga Vinyasa Yoga Practitioners

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### Abstract:

**Context:** *Ashtanga Vinyasa Yoga is a popular and physically demanding Yoga style. Although there is growing concern about the potential risk of injury from Yoga practice, there has been no research to date on the relationship between this form of Yoga and musculoskeletal injuries.*

**Objectives:** *The first objective of this survey was to determine the proportion of Ashtanga Vinyasa practitioners who are injured and the injury rate per 1,000 hours of practice. The secondary objective was to determine the location, type, and outcome of musculoskeletal injuries.*

**Design:** *Data was collected via a survey questionnaire from two Yoga centers in Helsinki, Finland and one Yoga center in Tampere, Finland in 2005. All Ashtanga Vinyasa Yoga practitioners at these centers (estimated total of 300) were invited to complete the survey, whether or not they had suffered from injuries.*

**Setting:** *Certified and authorized Ashtanga Vinyasa Yoga teachers teach at these centers, and they all follow the Ashtanga Vinyasa Yoga method as authorized by the Ashtanga Vinyasa Yoga Research Institute (Director Sri K Pattabhi Jois).*

**Participants:** *Practitioners (approximate total N = 300) from three different Finnish Ashtanga Vinyasa Yoga centers were invited to complete the questionnaires. Of these, 110 (37%) completed surveys were received.*

**Main outcome measurements:** *Primary outcome measurements were the number of injured practitioners and injury rate per 1,000 hours of practice. Secondary outcome measurements were the location, type, and outcome of injuries.*

**Results:** *Of the 110 practitioners surveyed, 68 (62%) reported having had at least one injury lasting longer than one month, and some practitioners reported more than one injury. A total of 107 musculoskeletal injuries were reported. The rate of new practice-related injuries was 1.18 injuries per 1,000 hours of practice. If recurrence of pre-existing injury and non-specific low back pain of unknown origin were included, the injury rate became 1.45 injuries per 1,000 hours of practice. Injuries related to the practice of Yoga were most common in the lower extremities, especially in the hamstrings or knees. None of the practitioners reported suffering permanent impairment from their injuries; however, this may be a consequence of the sampling procedure (see Limitations of the sample and survey, below).*

**Conclusions:** *Musculoskeletal injuries generally occur during activity, and Ashtanga Vinyasa Yoga is no exception. 62% of survey participants had suffered one or more musculoskeletal injuries that lasted in excess of one month. The three most common injury locations were hamstring, knee, and low back. Implications for Yoga teachers and practitioners are discussed.*

**Keywords:** *Yoga, musculoskeletal injury, Ashtanga Vinyasa*

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## Introduction

Recent research on Yoga has concentrated on its health benefits and therapeutic effects.<sup>1-4</sup> Although there has been an increasing amount of research on the physical and therapeutic effects of Yoga posture and breathing practices, it appears that the musculoskeletal risks of Yoga practice have not been well studied. There is an increasing awareness of Yoga-related musculoskeletal injuries in the popular press, mainly in the U.S. However, most of these reports have been based on a smaller number of teachers' personal views and individual cases.<sup>5-11</sup>

Yoga has become increasingly popular in the Western world in the past ten years,<sup>12,13</sup> with *Ashtanga Vinyasa* Yoga becoming one of the most popular Yoga styles. This style of Yoga emphasizes the importance of standardized physical posture practice with synchronized breathing.<sup>14-18</sup> In recent decades, teachers have been certified and/or authorized by the director of the *Ashtanga Vinyasa* Yoga Research Institute, Sri K Pattabhi Jois. Certified or authorized teachers in Europe can be found in 15 countries, including Finland.<sup>19</sup> The *Ashtanga Vinyasa* Yoga School of Finland is led by certified and authorized *Ashtanga Vinyasa* Yoga teachers, and the documented and traditional *Ashtanga Vinyasa* Yoga method is followed in the Yoga schools that were involved in this study.

The rigid adherence of *Ashtanga Vinyasa* Yoga practitioners to a standardized and documented posture series makes it a strong candidate for scientific study. However, research into *Ashtanga Vinyasa* Yoga appears to be limited to two recent studies. One study concluded that practitioners benefited from statistically significant improvements in muscular strength in the upper body and core, endurance, flexibility, and health perception, as well as decreased diastolic blood pressure and perceived stress, in a six-week period of regular practice.<sup>3</sup> A second study reported that heart rate during *Ashtanga Vinyasa* practice can be compared to heart rate during moderate exercise, and therefore possibly leading to improved cardiac and respiratory fitness.<sup>4</sup>

## The Present Study

The primary objective of this study was to survey the injury rate among current *Ashtanga Vinyasa* Yoga practitioners in Finland, and, further, to determine the rate of injuries per 1,000 hours of practice. We chose to limit the survey to musculoskeletal injuries with at least a one-month duration, to place more emphasis on longer duration injuries. Short-lived "injuries" from Yoga practice or other activi-

ties can change presentation and come and go without an obvious reason. We also wanted to exclude from the study short-term overuse pain such as delayed onset muscle soreness (DOMS), which is a regular occurrence in any exercise program.<sup>20</sup> The secondary objective of this study was to determine the location, type, and outcome of musculoskeletal injuries in this population. We conducted a survey of participants' history of musculoskeletal injuries during the previous three years, irrespective of cause. The survey specified that all injuries listed should be musculoskeletal injuries of more than one month duration and have occurred during the participant's period of *Ashtanga Vinyasa* Yoga practice. The survey questionnaire adhered to the guidelines stated in the Epidemiology of Sport Injuries categorization system.<sup>21</sup> The study was ethically reviewed and approved by the research project module team at the Welsh Institute of Chiropractic (WIOC), University of Glamorgan.

## Methods

### *Participant Recruitment*

Retrospective reports of injuries were collected from students at the Yoga schools of Helsinki and Tampere during the period of January 6, 2006 to May 20, 2006. We also posted advertisements about the survey in the areas around the Helsinki and Tampere Yoga schools. The poster included contact details, stipulated the voluntary and confidential nature of study, and stated the aim (prevalence of musculoskeletal injuries incurred by *Ashtanga Vinyasa* Yoga practice) and target participants of the survey. The posters and information section attached to the questionnaire explicitly requested that all practitioners complete the survey "whether you have or have not suffered any injuries." The questionnaires were anonymous, and the Yoga teachers at the centers were not aware of who had completed a questionnaire and who had not. There was no time limit or pressure placed on participants, as the completed questionnaires could be placed into a collection box in the communal areas at any time during the collection period (16 weeks).

### *Participant Selection*

Practitioners were required to meet the following inclusion criteria:

1. Because previous reports have cited incompetent teachers and/or unregulated Yoga teaching qualifications as the most common causes of Yoga injury,<sup>7,8</sup> we limited the study to participants who were practicing under the guidance of a certified or authorized teacher in the *Ashtanga Vinyasa* Yoga method of Sri. K. Pattabhi Jois.

2. The practitioners needed to have practiced for at least one hour, twice a week, for more than six months. These criteria were used to ensure that practitioners were primarily following the *Ashtanga Vinyasa* Yoga method, and not cross-training with other Yoga styles or different physical exercises. The criteria also excluded practitioners who had limited experience of regular *Ashtanga Vinyasa* Yoga practice.

Based on conversations with teachers of *Ashtanga Vinyasa* Yoga in Finland, the number of practitioners meeting the inclusion criteria was approximately 300 at the time of the survey. 112 questionnaires were returned. Two questionnaires were excluded due to incomplete or missing data, leaving a sample size of 110 practitioners.

### Measures and Survey Design

The survey questionnaire was first prepared in English and then translated into Finnish. The translation was made by a Finnish and English language specialist. Face validity and translation accuracy were assessed by two *Ashtanga Vinyasa* Yoga practitioners, who fulfilled the inclusion criteria of the study and were fluent in Finnish as well English.

The questionnaire had four sections: Section A was designed to gather general demographic data about the participants, such as age and sex. Section B asked about aspects of the participants' Yoga history, including the *Ashtanga Vinyasa* Yoga school where the student practiced, and the number of years and frequency of regular practice. Section C was concerned with musculoskeletal injuries that had persisted for more than one month. Space was made available for the description of up to seven different injuries. Participants were asked to specify the location of injury by choosing among the following categories: 1) Head and trunk, sub-divided into head, neck, upper back, middle back, low back, chest, and ribs; 2) Upper extremity, sub-divided into shoulders, elbows, wrists, hands, and fingers; and 3) Lower extremity, sub-divided into hips, upper thighs, hamstrings, knees, ankles, feet, and toes. The side of the injury was also specified; that is, left, right, or both sides of the body. The type of injury was divided into sprain, strain, dislocation (including intervertebral disc injuries), bone fracture, abrasion, concussion, and other injury types. If "other injury type" was specified, more details were requested. If the injury had occurred before starting *Ashtanga Vinyasa* Yoga practice, it was categorized as a recurrent, old injury. There was an additional section concerned with injury outcome (divided into full/partial recovery or permanent impairment). Section D was for further, open-ended comments relating to any injury in section C and for injuries that were not included within the scope of this report.

### Data analysis

Research into the epidemiology of sports injuries commonly cites both injury rate per practitioner (point prevalence) and injury rate per 1,000 hours of practice. We conducted both types of analysis. To determine injury rate per 1,000 hours, the total number of hours practiced was calculated from the participants' self-report of practice time by multiplying the average number of weeks of regular practice by the frequency of practice per week. The average practice time was taken as 1 hour. The data was statistically analyzed using SPSS version 14.0 for Windows.

### Results

112 questionnaires were returned. Two questionnaires were excluded due to incomplete or missing data, leaving a sample size of 110 practitioners. As the number of practitioners meeting the criteria for inclusion in this survey was estimated at 300 in 2005, the estimated response rate was 37%. Of these respondents, 31 were male and 79 female. The age distribution is shown in Table 1. The mean age for this group was 35.9 ( $\pm$  10.8) years.

Age in years	16-30	31-40	41-50	51-65
Number of respondents	46	34	18	12

Table 1. Age distribution of the respondents.

The mean years of *Ashtanga Vinyasa* Yoga practice was 2.54 ( $\pm$  1.1) years, with a range from 6 months to 8 years. The mean frequency (times per week) of *Ashtanga Vinyasa* Yoga practice was 3.59 ( $\pm$  1.2) times per week, with a range from 2 to 6 times per week. The level of *Ashtanga Vinyasa* Yoga practice ranged from first (primary) series through advanced series, with the majority of participants practicing primary series.

Sixty-eight of the 110 participants (62%) reported having had at least one injury, with the total number of injuries among participants being 107. Eleven of these injuries were re-occurrences of old injuries (pre-*Ashtanga Vinyasa* Yoga). The distribution of injuries per respondent was as follows: 42 reported no injury, 40 reported only 1 injury occurrence, 22 reported 2 injuries, 5 reported 3 injuries, and only 2 respondents reported 4 injuries. None of the respondents reported suffering more than 4 injuries. Table 2 shows the distribution of injuries according to the level/series of practice, ranging from level 1 (partial primary series) through level 4 (advanced series). The most common site of injury

was in the lower extremities (69 injuries), followed by the head and trunk (27 injuries), and upper extremities (11 injuries). A more detailed distribution of injuries can be found in Table 3.

Level of practice in series	1	2	3	4
Number of respondents	56	22	21	11
Number of respondents reporting injury	31	12	18	7
Number of injuries reported	38	26	34	9

**Table 2.** *Distribution of injuries by level of practice.* Levels 1 and 2 refer to primary series, and levels 3 and 4 refer to intermediate or advanced series. Number of injuries reported refers only to injuries of greater than 1 month duration.

Lower extremity injuries	Hips	Upper thighs	Hamstrings	Knees	Ankles	Feet	Toes
Total = 69	7	0	28	25	5	2	2
Head and trunk injuries	Head	Neck and upper back	Mid-back	Low-back	Chest and ribs		
Total = 27	0	4	1	20	2		
Upper extremity injuries	Shoulders	Elbows	Wrists	Hands	Fingers		
Total = 11	6	0	5	0	0		

**Table 3.** *Distribution of injury by body region.*

Sprains ( $n = 29$ ) and strains ( $n = 34$ ) were the most common form of injury, with a small number of dislocations ( $n = 2$ ) and abrasions ( $n = 1$ ), but no bone fractures or concussions. The most common injury was hamstring sprain or strain ( $n = 28$ ). The majority of hamstring-injured practitioners (70%) were practicing at the primary series level only. Forty-one injuries were reported in the “other injury” category. Nineteen (20%) low-back injuries were placed in this category, and further described as unspecific pain of unknown origin.

Fifty-four respondents reported a full recovery of all injuries, and 53 respondents reported a partial recovery (i.e., healing in progress). There were no reports of any permanent impairment.

## Discussion

### *Injury Rates*

Although this study has a number of limitations, it is the first to estimate the injury rate in those people actively participating in this physically demanding style of Yoga under appropriate training. At first glance, the rate of injury found here appeared to be high. A large proportion of the practitioners (62%) reported having a Yoga-related injury of more than one months duration, and the risk of new injury or re-injury was 1.45 per 1,000 hours of practice.

When putting this data into perspective, it must be remembered that both non-specific low-back pain and injuries that were incurred before starting *Ashtanga Vinyasa* practice may be seen as general problems in the population, and not specifically related to Yoga practice. Indeed, on this basis it might be justifiable to remove them from the estimate of injury rates.

When these types of injury were excluded, the risk of injury was 1.18 per 1,000 hours of practice, which is probably more reflective of the actual injury rate related to *Ashtanga Vinyasa* Yoga practice.

The relative importance of these figures can only be appreciated when seen in light of comparison with data on injury rates from other activities. For example, the Study of Active Living Risks in Finland<sup>22</sup> looked at activity-related injuries in a randomly selected cohort of

3,363 participants (ages from 15-74 years). Participants were followed over a one-year period, and a wide range of activities were tracked, including walking, cycling, gardening, home repair, hunting, fishing, golf, dancing, swimming, and rowing. For everyday activities (such as walking, cycling, and gardening), the risk of injury ranged from 0.19 to 1.5 per 1,000 hours of activity. For athletic activities, the risk of injury was much higher, ranging from 6.6 to 18.3.

The main methodological difference between the Study of Active Living Risks in Finland<sup>22</sup> and our survey is that participants were interviewed by phone on three occasions at four-monthly intervals. Consequently, the results of that study were presumably less affected by participants’ recall bias. The retrospective nature of our study could

have affected our estimate of injury rate for practitioners.<sup>23</sup> Musculoskeletal injuries of more than one month's duration were chosen because we assumed that these would have been more memorable than shorter-term transient events. However, this important difference in study methodology makes direct comparison of the injury rates for Yoga and other activities impossible.

### *Types of Injury*

It is interesting to note that the most common injury reported was hamstring strain or sprain. Most participants reporting hamstring injuries were practicing the primary series, which emphasizes forward-bending postures which in most Yoga systems would be considered advanced. The reported hamstring sprains and strains could be related to overuse and overstretching of the hamstrings caused by the repetitive forward-bending.

Forward-bending is commonly considered a class of poses that may put the lower back at risk, so it is worth considering the rate of low-back injuries in our study. Low-back injuries were reported by 20% of the respondents, and 19% were classified as non-specific low-back injuries of unknown origin. A 20% rate of low-back pain compares favorably to statistics from the general population, where in one year up to 50% of the population would be expected to have suffered from an episode of low-back pain.<sup>24</sup> It must be noted that the percentage of back-pain sufferers in our sample was based on total injury over slightly more than three years, rather than one year. Although this could lead to an overestimate of the size of this problem in *Ashtanga Vinyasa* Yoga practitioners, it is interesting to note that the proportion still compares favorably with expectations based on population statistics; in fact, this result might suggest that a slightly *lower* incidence of back pain is present in this group compared to the general population.

### *Limitations of the sample and survey*

The response rate (approximately 37%) for our survey might not represent the total population of *Ashtanga Vinyasa* practitioners in Finland. There was a bias in the sample toward female respondents (79, in comparison with 31 males). Whether this was representative of the sex distribution within the *Ashtanga Vinyasa* discipline is unknown, as no data on this is available at present. There was a relatively short average length of practice (approximately three years), which could have affected the distribution of expertise within the group of respondents: 71% had practiced part or full primary series only, and only 29% had progressed to intermediate or advanced series.

The injury rate reported by practitioners might have been affected by a number of other factors. It is possible that those who had experienced a Yoga-related injury might have seen this survey as an opportunity to "speak out." Additionally, those without injury might not have thought they could add anything to the survey.<sup>25</sup> In an attempt to address this, the advertising/recruitment posters and invitations emphasized the importance of participation by all practitioners, irrespective of injury status. However, it is impossible to know whether there was a biased response rate without directly sampling those who did not initially reply.

The validity of self-recall is another methodological issue to consider. Past reports of self-recall validity have shown that the longer the time-frame and higher the level of detail requested, the more the accuracy of recall declined.<sup>23</sup> However, although recall of past injuries is not completely accurate, in another report 61% of participants showed completely accurate recall over a one-year period.<sup>23</sup>

One issue that cannot be stressed enough is the potential of this study to under-represent the number of serious injuries occurring in practitioners of *Ashtanga Vinyasa* Yoga. Although no evidence is available to support this, it is likely that seriously injured practitioners would no longer be attending the Yoga schools. Thus they would not have been aware of the survey or included and this therefore leading to an under-representation of this level of injury.

## Conclusions

Musculoskeletal injuries often occur during exercise, and *Ashtanga Vinyasa* Yoga appears to be no exception. The three most common injury locations were hamstrings (n=28), knees (n=25), and the lower back (n=20). None of the respondents in the current study reported permanent impairment from their injuries, but this may have been due to a sampling anomaly. Although the results of this survey cannot easily be compared to other studies, it is possible to conclude that the injury rate and number of injuries per 1,000 hours of practice fall closer to those found for everyday activities like gardening and cycling than to common sporting activities such as squash and basketball.

Although the current study does not answer the question of risk-to-benefit ratio for *Ashtanga Vinyasa* Yoga practice, it did show that the risk of injury is not inordinately high. Further research is needed to determine the physiological and psychological benefits practitioners of *Ashtanga Vinyasa* Yoga experience. Additionally, more appropriate design for future studies should consider a prospective study of randomly selected practitioners to increase both accuracy

of the information and determine the risk with respect to all severities of injury.

The results from this survey appear to support the conclusion that *Ashtanga Vinyasa* Yoga practice under appropriate supervision does not dramatically increase the risk of injury to its practitioners. The most commonly reported injuries (hamstring strains and sprains) may be related to the posture sequence of the primary series, and appropriate instruction and practice may reduce this risk. As *Ashtanga Vinyasa* Yoga includes standardized series of postures, a greater emphasis on individual needs and the importance of relaxed non-goal-oriented practice could prevent some injuries. In the *Ashtanga Vinyasa* Yoga schools in Finland, the trend has been towards emphasising the importance of the internal experience and mind-body cooperation during practice.

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