Sailor for life, Injuries for life?
- a study about sailing related injuries among dinghy sailors in Sweden

Helena Skarp

THE SCHOOL OF SPORT, UNITEC, NEW ZEALAND
THE SWEDISH SCHOOL OF SPORT AND HEALTH SCIENCE
Negotiated studies/Examens arbete 11:2009
Bachelor in sport /Tränarprogrammet: 2006-2009
Supervisor: Dr. Graham Fordy
Examinator: Karin Söderlund
Acknowledgement

I would like to thank everyone involved in this project; I could not have done this without your help:

First of all, thank you Dr. Graham Fordy! Your supervision helped me get started and develop the project idea.

GIH supervisor Pia Lundquist Wanneberg, I greatly appreciate your offer to assist.

All sailors who participated and completed the questionnaires, you are the foundation of this research.

Interviewees, thank you for your participation and enrichment to this project.

Staff at the UNITEC library.

All federations, clubs, colleges and coaches that have been contacted regarding this study.

Last but not least, thank you everyone who has somehow supported me during this time!

Helena Skarp
Abstract

Aim
The purpose of this project has been to research injuries among elite sailors in single handed dinghies in Sweden. The intention was to find the most common injuries in relation to age groups, compare male and females and look into how common preventative training is.

Method
The chosen methods for this project were quantitative and qualitative. Questionnaires were sent out by email to 120 sailors where 42 chose to participate. Swedish elite sailors in single handed dinghies were targeted in age 13 to >28. Two interviews were performed with one experienced coach and physiotherapist. Two question templates were prepared to capture their expertise in the area following a main theme. Interviews were completed over internet (Skype).

Results
The researched showed that 76% have had one or more sailing related injuries in their sailing career. The most common injury is knee injury, followed by back injury which together calculated for over 50% of all injuries. The main type of injury for sailors is overuse injury that develop over time. There was a significant difference between male and female in injury frequency where males tend to injure themselves more often. 30% of males have injured themselves eight times or more. Both male and female showed knees as the most common injury. The majority of sailors, 75% of males and 78% of females, do regularly or sometimes perform specific training. Research showed that 80% of sailors warm up before sailing, either regularly or sometimes. The most strenuous manoeuvre identified was ‘knees while hiking’.

Conclusions
The majority of sailors, 76%, have had injuries in their sailing careers. Knees and back were the most pronounced injuries and can be categorised as overuse injuries that develop over time. There are indications of injuries starting in an early age and lack of training knowledge might be a factor. Females have greater discrepancy of injuries however males tend to injure themselves more often, although more males than females perform specific training to prevent or rehabilitate an injury. The majority of sailors, 80% of males and 60% of females believed their injuries could have been prevented by more knowledge and proper training.
Table of contents

Acknowledgement ............................................................................................................................ 2
Abstract ........................................................................................................................................... 3

1 Introduction ..................................................................................................................................... 1
  1.2 Previous research .................................................................................................................... 3
    1.2.1 Injuries in general ........................................................................................................ 3
    1.2.2 Injuries and Sailing ...................................................................................................... 4
    1.2.3 Female athletes ............................................................................................................. 6
    1.2.4 Injuries and Cycling .................................................................................................. 6
    1.2.5 Injuries and Rowing ................................................................................................. 7
    1.2.6 Core stability ............................................................................................................... 7
    1.2.7 Warm ups and warm downs .................................................................................... 8
    1.2.8 Stretching .................................................................................................................. 9
    1.2.9 Summary of previous research .............................................................................. 10
  1.3 Purpose ..................................................................................................................................... 11

2 Methods ......................................................................................................................................... 12
  2.1 Data Collection ..................................................................................................................... 12
    2.1.1 Required forms ........................................................................................................ 12
    2.1.2 Selection .................................................................................................................... 12
    2.1.3 Questionnaire design ............................................................................................. 13
    2.1.4 Interviews ................................................................................................................ 14
    2.1.5 Interview design ..................................................................................................... 14
    2.1.6 Procedure ............................................................................................................... 15
    2.1.7 Statistics ................................................................................................................ 15
    2.1.8 Validity .................................................................................................................. 16
    2.1.9 Reliability ............................................................................................................... 16
    2.1.10 Failure analysis .................................................................................................... 17

3. Results ........................................................................................................................................ 18
  3.1 Common injuries in age groups .......................................................................................... 18
    3.1.1 Knee Injury ............................................................................................................. 20
    3.1.2 Back Injury .............................................................................................................. 20
    3.1.3 Shoulder Injury ....................................................................................................... 20
    3.1.4 ‘Other’ Injuries ......................................................................................................... 20
    3.1.5 Injury frequency ...................................................................................................... 20
    3.1.6 Injury description .................................................................................................... 22
  3.2 Comparison between Male and Female .................................................................................. 24
  3.3 Preventative training ............................................................................................................. 26
    3.3.1 Identified manoeuvres ............................................................................................. 27
    3.3.2 How to design training ............................................................................................ 29
  3.3.2 Pre- and post exercises ............................................................................................ 29

4. Discussion .................................................................................................................................... 31
  4.1 The most common injuries ................................................................................................ 31
    4.1.1 Injury frequency ..................................................................................................... 33
    4.1.2 Injury description .................................................................................................... 33
  4.2 Comparison between male and female .............................................................................. 34
  4.3 Preventative training ............................................................................................................. 35
    4.3.1 Identified manoeuvres ............................................................................................. 36
    4.3.2 How to design training ............................................................................................ 37
4.3.3 Pre- and post exercise........................................................................................................ 37
4.3.4 Conclusion......................................................................................................................... 39
4.3.5 Method discussion............................................................................................................ 39
4.3.6 Future research ............................................................................................................... 40
References ............................................................................................................................... 42

Attachment 1 Questionnaire
Attachment 2 Interview questions
Attachment 3 Participant Information Form
Attachment 4 Participants Consent Form
Attachment 5 Reference search

Appendices

Figure 1. Sailor in hiking position.............................................................................................. 1
Figure 2. The Q (quadriceps) angle........................................................................................... 6
Figure 3. Core stability muscles............................................................................................... 8
Figure 4. Age spread in research. (Count) ............................................................................. 13
Figure 5. The most common injuries recorded in the questionnaires. (Percent)................. 18
Figure 6. The most common injuries in correlation to age groups. (Count)......................... 19
Figure 7. Could recorded injuries have been prevented by more knowledge and proper
training? (Percent)................................................................................................................... 19
Figure 8. Injury frequency among the sailors (Count)............................................................ 21
Figure 9. Injury frequency per years of sailing. (Count).......................................................... 21
Figure 10. Injury frequency per
hours sailing per week. (Count) ............................................................................................ 21
Figure 11. Symptoms of knee injuries. (Count)...................................................................... 23
Figure 12. Symptoms of back injuries. (Count)................................................................. 23
Figure 13. Symptoms of shoulder injuries. (Count)............................................................... 24
Figure 14. Injury frequency - male/females. (Percent) Figure 15. Injury types -
male/females. (Percent)........................................................................................................ 25
Figure 16. Hours spent on weight training. (Count) Figure 17. Hours spent on endurance
training. (Count).................................................................................................................... 26
Figure 18. Hours spent on sail training. (Count) Figure 19. Hours spent on ‘other training’.
(Count)........................................................................................................................................ 26
Figure 20. Specific training performed to prevent/rehab injury. (Percent)............................. 27
Figure 21. Recorded strenuous manoeuvres. (Count)............................................................ 28
Figure 22. Total number of strenuous manoeuvres (male and females). (Count).............. 28
K.H – Knees while hiking, B.H. – Back while hiking, H.H – Hips while hiking, K.S – Knees
sitting on heels, S.S – Shoulder sheeting, O- Other. .......................................................... 28
Figure 23. The relation of warm ups/no warm ups and back injury? (Count)..................... 29
Figure 24. The relation of sailors performing post exercise after a race day and time spent on
stretching. (Percent)............................................................................................................... 30
1 Introduction

The popularity of competitive and recreational sailing is increasing all the time.\textsuperscript{1,2} Still the majority of the Swedish population sees sailing as a fun activity for hot summer days with friends, when for others sailing is seen as a demanding sport where a lot of time and effort needs to be put in. For the second group of sailors, injuries and illness relating to sailing competitively is not unusual.\textsuperscript{3,4} Physical demands vary depending on boat class, the focus in this study will be on single-handed dinghies where hiking manoeuvres are performed.

Hiking:

Hiking is a special manoeuvre by means of which the sailor inclines the vessel, partly or completely, into a horizontal position. This is necessary because the wind action upon the sail “tilts” the boat, thus increasing its resistant and decreasing its speed.\textsuperscript{5}

From personal experience of a long competitive sailing background and now with an increased coaching approach I find that improvements can be made in many areas within the sailing sport. There has been very little research to date regarding sailing related injuries.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{sailor_hiking.png}
\caption{Sailor in hiking position\textsuperscript{6}}
\end{figure}

\begin{thebibliography}{9}
\bibitem{6} H. Skarp, 2007.
\end{thebibliography}
Hiking is maybe the most physical demanding manoeuvre in single-handed dinghies and is characterised by powerful isometric contractions of the body’s musculature, while sailing up wind.\(^7\)

Injuries may be a result from a lack of general fitness, overuse, overtraining or macro traumatic accidents.\(^8;9\) Many actions in sailing are sudden, such as wind shifts or swells which place muscles at risk when performing explosive and powerful moves. Sudden strong movements in hiking are often performed awkwardly, rotating and twisting, which may lead to back and knee problems. Inherent postural problems in many positions may be caused by muscular imbalance with changing forces on muscle groups while sailing.\(^10\)

I believe as sailing is a very complex sport with a physical demand that varies depending on the wind speed many sailors can perform well from technical and strategic advantages without the fitness required. A lot of time is spent trimming the boat and sails and the sailor either him or herself does not get enough attention. In general I believe sailors know more about their boats than they do about their own bodies, however, they need to know how their bodies work while sailing and what can go wrong as a result of the activity, to get full benefit from participation in the sport.\(^11\) As more people sail and sailors spend more hours on the water physical problems increase. By knowing the hazards many could be prevented as an injury is always easier to prevent than to cure.\(^12\)

Elite sport requires the athlete to push boundaries to perform better. Personally I have always been interested in health and sport where it is a fine line between being a winner or a loser and I believe there has been an increase in physical fitness and professionalism in the sailing sport. However, I believe that many injuries still can be prevented by accurate preparations. The nature of sailing easily puts pre- and post exercise in the background which could possibly be one factor leading to injuries.

---


In this study I will refer to an injury as a state when a sailor can not perform to the person’s optimal because of a physical pain or dysfunction. When injured, rest is often prescribed and valuable conditioning/training time will be lost. After a break from training a performance descend is often seen and the sailor has to work hard to get to where he or she was. An injury can therefore affect a person negatively both physically as well as psychologically.\textsuperscript{13}

I believe it is important to put these issues in focus and educate our sailors. To do this we first have to educate ourselves with the injuries which are the most common and how they may develop. This study will be the first step in trying to get a better grip of the related injuries in dinghy sailing.

\textbf{1.2 Previous research}

In this section I will write about injuries in general and previous researches of sailing injuries but I will also look at sports with similar loadings and demands on the body. As overuse seems to be the most common type of injury, clinical readings have also been made.\textsuperscript{14} In the research I have chosen to include warm ups and warm downs as well as stretching and will therefore look at the potential benefits of each.

\textbf{1.2.1 Injuries in general}

Physical activity is probably the most important overall determinant of a population’s health. However, activity also increases the risk of an activity related injury. The injuries can be categorised as either an acute injury or an overuse injury depending on the onset symptoms.\textsuperscript{15} With an acute injury you will always know when the injury occurs and most likely what caused it, e.g. fractures and dislocations. High speed sports with risk of falls and sport with body contact have a greater risk of acute injuries while aerobic sports with high monatomic training required have higher levels of overuse injuries. An overuse injury often develops over time and the pain and discomfort sneaks up on you.\textsuperscript{16} Repetitive motions like long distance running or rowing allows the tissue to be reinjured and weakened. As the process continues, the collagen fibres fail and elastain is lost resulting in the anatomic integrity being altered and

the healing process delayed. Studies indicate that 30-50% of all sport injuries are due to overuse.\textsuperscript{17}

### 1.2.2 Injuries and Sailing

The nature of dinghy sailing would presumably show a majority of overuse injuries. Sailors sit in their hiking position and work in monatomic movements with both upper extremities and the lower extremities. From experience acute injures rarely occur but the risk is increased in high wind speeds with sudden changes in gusts and the possibility of collisions with other boats. However, there are strict rules to follow regarding maximum racing wind speeds as well as sailing rules with who goes before whom.\textsuperscript{18}

The literature recognise the hiking manoeuvre as the most strenuous. Problems may result from overarching in the lower back because of weak abdominal muscles, or simply from overuse and abnormal spinal stress during sailing. Jim Young, director of the US Olympic Yachting Committee’s sports medicine program says the most common cause of lower back pain is compression of vertebrae. Compression occurs in normal hiking position and becomes greatly exaggerated whenever sailors lose their posture due to exhaustion. A curled position triggers a stretch reflex and puts strains on the spine. The sailor then faces the possibility of permanent damage.\textsuperscript{19}

In year 1980 a thorough study was published on the subject of sailing postures examining biomechanical aspects of the two basic body postures used in outstretching outboard. The sailor is totally dependent upon muscle force where the taxing effect of maintaining the posture has been substantiated. Head, arm and trunk placement add considerably to movement at the ankle, knee, hip and L4-L5 joints.\textsuperscript{20}

In an article from 2006 electromyography (EMG) tests had been performed on top sailors to find characteristic values in a simulation of hiking in the laser standard class. The findings were to allow for a better biomechanical understanding of the load distribution in the body

\textsuperscript{17} JB. Allen, Recreational sport injuries, \textit{Sports Medicine and Sailing} 1, vol 10, p. 48, Feb (1999).
\textsuperscript{19} J, Young, “Prevent physical problems: ways to avoid overuse and overexposure”, \textit{Sail}, 15 (1984), p. 56.\textsuperscript{19}
musculature. An EMG analysis of the quadricep muscles indicates that the respective muscle is the most loaded muscle region during sailing in dinghy classes. With EMG values ranging from 72%-109% the muscular endurance of top sailors is really astonishing. The abdominal muscles did also show great exposure but not as pronounced as that of the quadricep muscles.22

Illoipsoas is also seen as a main stressor in the hiking position with many sailors suffering from hip pain. There is not much written about the specific muscle itself but the literature uses the three muscles/muscle groups (quadriceps, iliopsoas and abdominals) when explaining the load on the spine, knee and surrounding muscles.23 The hip is the link between the lower extremities and the trunk. Large ligaments hold the joint together and many muscles cross over the hip joint or attach to it. These muscles go into the abdomen, the buttocks and down the thigh. The most common cause of hip pain is from muscle strain, which is when a muscle stretches or tears from either an acute injury or chronic overuse.24

The knees are another area of problem that commonly gets discussed in the literature. The whole weight of the body in essence is hanging upon the knees while hiking. The angle on the knees and the hull is important in regards to the level of straining. In some classes (e.g. Optimist and Finn) the knees are flexed to 90 degrees, whereas other classes (e.g. Laser) tend to be sailed with the knees almost fully extended. One practical consequence of such heavy straining is anterior knee often associated with the patello- femoral pain syndrome. Complaints are more frequent in Finn than in Laser. With fatigue, most sailors tend to isolate the vastus lateralis which leads to patellofemoral pain; turning out both feet with the legs extended increases the workload of the vastus medialis.25 Roughening on the articular surface of the patella can rarely be detected with radiography but there is a typical history of pain when rising from squatting position, walking downstairs or sitting for long periods.26

---

toe straps and plantar flexing the foot may help to straighten the knees, centralise the force of gravity and reduce the effort required by the quadriceps.27

1.2.3 Female athletes

Unbalance of muscles is more common for females.28 A female body has a wider pelvis which increases the Q (quadriceps) angle at the knee and can therefore be more vulnerable for injury compared to a male’s knee. The Q angle is measured where the femur meets the tibia.29 (See Figure 2 below) Male and female also differ when it comes to flexing their knees. When females bend their knees, their femurs give less support to their patellae which may lead to patellofemoral syndrome.30

![Figure 2. The Q (quadriceps) angle.](http://www.aafp.org/afp//AFPprinter/20030901/907_f2.jpg)  

1.2.4 Injuries and Cycling

Cycling is a complex activity requiring the synchronous motion of multiple joints, so is sailing. The two sports have similarities many people do not think about and both sports could possibly learn from each other. Both the cyclist’s weight and the sailor’s weight are carried by the bike/boat and the cyclists repetitive pedalling can be compared to a sailors hiking and leg

---

29 E. Quinn, Sport Medicine, [http://sportsmedicine.about.com/od/women/a/Q_angle.htm](http://sportsmedicine.about.com/od/women/a/Q_angle.htm), (Acc 2009-02-01).
pumping. According to ‘Clinical practice of Sport Injury prevention and care’\textsuperscript{32} a cyclist’s anterior and medial knee pain was related to the high repetitive stress placed on the knee. Entities commonly seen in cyclists with knee complaints are patellofemoral pain syndrome.\textsuperscript{33} Sometimes elite cyclists have to pull out of competitions because of back pain. As for sailors the abdominal is often a weak link and cannot support the tremendous forces the lower extremities generate. Strong abdominals is the foundation of strength for a rider; they are also the key to preserving a healthy back.\textsuperscript{34}

1.2.5 Injuries and Rowing

Rowing also has many similarities to sailing. The rower is sitting in the vessel working mainly the larger muscles in the lower extremities and trunk. The rowing stroke is divided into four phases: the catch, the drive, the finish and the recovery where the drive and the finish movement are comparable with a sailor going out into hiking position extending hips, knees and back. A common error for rowers is ‘falling in to the catch’ which occurs when the upper body hyper flexes placing the trunk into a vulnerable position for injury.\textsuperscript{35} The same error can be compared with exhausted sailors struggling to level the boat and at the same time working the mainsheet.

1.2.6 Core stability

From personal experience recent years has developed a better understanding and concept of core stability and changed the way sailors train and condition. Particular attention has been paid to the core because it serves as a muscular corset that works as a unit to stabilise the body and spine with and without limb movement. (See core muscles, Figure 3 below) The literature recognises weak abdominal muscles being a leading factor to injury.\textsuperscript{36} The core has

been referred to as the ‘powerhouse’, the foundation or the engine of all limb movement.\textsuperscript{37}

There is very little literature about sailing in correlation to specific advantages of core stability training to date but from fact of what core stability can provide and the issues sailors’ today face, I believe this could make a great change. While there is no single measure of core stability, many simple tests and exercises can be used right from an early age.\textsuperscript{38}

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{core_stability_muscles.png}
\caption{Core stability muscles\textsuperscript{39}}
\end{figure}

\subsection*{1.2.7 Warm ups and warm downs}

Warm ups prepare the body for exercise; to allow absorption of the extra exertions and shocks of athletics muscles and joints.\textsuperscript{40} The type of exercise to be performed determines the type of warm up. The most effective warm up consists of both general and specific exercises. General exercise may include jogging, general stretching and resistance exercises. Specific exercises include stretches and movements that are appropriate for the particular activity about to be undertaken.\textsuperscript{41,42} There is no data on which to prescribe intensity and duration of warm ups but the intensity should gradually be increased and the larger muscle groups should get the initial attention. One guideline is to produce some mild sweating without fatigue. The effects of a warm up last approximately 30 minutes so it is important not to warm up too early.\textsuperscript{43}

The possible benefits of warming up prior to physical training include increased blood flow to muscles, increased speed of nerve impulses, increased relaxation and concentration, decreased stiffness of connecting tissue and number of injuries due to an increased range of motion.\textsuperscript{44} A

recent high quality randomised trial has shown that structured warm up programmes designed to prevent injuries can reduce injury risk by 50% or more. \(^{45}\) However, it is not known whether it is the physiological effects of the programmes described above which confer the effect of injury risk, or whether the reduced risk results from training effects on strength, neuromuscular control, technique or other factors. \(^{46}\)

Another important part of physical training is warm downs. The purpose is to return the body to its normal state. It helps to effectively break down the build up of waste products from activity such as lactic acid. It is not necessarily a cure for muscle soreness but it may mean the muscles are less stiff. The warm down should not make anyone tired, it should be seen as a gentle session e.g. jogging and stretching between an active and non active state. \(^{47}\)

1.2.8 Stretching

The ability to move a joint smoothly throughout a full range of movement is considered an important component of good health. Although increased flexibility attained through stretching was widely believed to decrease musculotendinous injuries and minimise and alleviate muscle soreness and perhaps even improve performance, researches struggle to prove the relationship. It is not known whether a specific stretching programme to prevent a particular injury type such as stretching the hamstrings to prevent hamstring strains, is effective. \(^{48}\) However good flexibility and range of movement decreases the possibility of injury as a muscle in normal length automatically gives a better function in outer positions. This helps decrease the risk of overload and injury; it also gives better coordination and sometimes even pain relief. \(^{49}\)

In a recent study the effects of active warm up alone, static stretching alone and active warm up combined with static stretching were determined. The results indicate that active warm up


\(^{48}\) P. Brukner, K. Khan, Clinical sports Medicine, 3rd edition, (North Ryde, McGraw-Hill, 2007) p. 81

\(^{49}\) F. Johansson, Fysisk träning för ungdom, (Malmö, SISU Idrottsböcker, 2003) p. 96
alone is not effective in increasing range of motion but that it may have an additive effect if it is performed prior to static stretching.\textsuperscript{50}

1.2.9 Summary of previous research

The injuries can be categorised as either an acute injury or an overuse injury, depending on the onset symptoms.\textsuperscript{51} Overuse injuries seem to be the most common injury among sailors where monatomic movements are performed.\textsuperscript{52} The literatures recognise the hiking manoeuvre as the most strenuous. Lower back pain can develop in the hiking position by compressions of vertebrae.\textsuperscript{53} An EMG analysis showed astonishing values on muscular endurance of top sailors. The quadriceps muscles were the most pronounced but the abdominals also showed great exposure.\textsuperscript{54} Iliopsoas is seen as one of the main stressors in the hiking position. It works as the link between the lower extremities and the trunk, where many muscles cross over the hip joint or attach to it.\textsuperscript{55} Knees are another problem area that commonly gets discussed in the literature. The sailor’s whole body weight is hanging upon the knees while hiking, where the angle on the knees and the hull seem to play an important part in the level of strain.\textsuperscript{56}

Many parallels can be drawn between sailing and other sports with similar body loadings. Common injuries in cycling are knees and back where the repetitive pedalling can be compared with the hiking movements.\textsuperscript{57} Sailors, cyclist and rowers all have their weight carried by their vessels. A common rowing stroke error is to “fall into the catch”, when the upper body hyper flexes, which can be compared with when an exhausted sailors struggle to level the boat and at the same time working the main sheet.\textsuperscript{58}

The core serves as a muscular corset that works as a unit to stabilise the body and spine with or without limb movement. Warm ups prepare the body for exercise; to allow absorptions of the extra exertions and shocks of athletics muscles and joints. The possible benefits of warming up prior to physical training include increased blood flow to muscles, increased speed of nerve impulses, decreased stiffness of connecting tissue, increased relaxation and concentration and decreased number of injuries due to increased range of motion. Warm downs are also important with the purpose of returning the body to its normal state and break down built up waste. Researches struggle to find relations to prove that stretching is effective. However, good flexibility and range of movements decreases the possibility of injury, gives better coordination and sometimes even pain relief.

I have established this topic is lacking in researches and from my point of view existing studies have not reached down to the sailors’ level properly either. Especially young sailors need better directions on the above mentioned and to be aware of possibilities and issues before it is too late. This study will hopefully be the first step for a better understanding among sailors.

1.3 Purpose

The purpose of this project is to research injuries among elite sailors sailing single handed dinghies in Sweden.

- In relation to age groups what are the most common injuries?
- Are there differences between male and female?
- How common is preventative training?

---

2 Methods

2.1 Data Collection

My purpose with this project is to research injuries among elite sailors sailing single handed dinghies in Sweden. A quantitative method was chosen as the best way to establish the most common injuries. A questionnaire was created as I targeted sailors from different single handed dinghies and required a large amount of information. The questionnaire was distributed by email which was both cost and time effective. It also allowed me to target sailors geographically distant in Sweden while I was present in New Zealand during my exchange year at UNITEC together with GIH.

To widen my perspective I also interviewed an experienced sailing coach/trainer and a physiotherapist. Contacts were made by email and dates were set up for an interview over Skype (internet), a qualitative method was chosen. A qualitative method is suited when less people are involved and a more in depth answer is required.

2.1.1 Required forms

The Ethics form required for this research was prepared in consultation with Supervisor Dr. Graham Fordy and later accepted by UNITEC Research Ethics Committee.

A Participant Information form and a Participant Consent form were designed and sent out to the participating parties.

2.1.2 Selection

The questionnaires were sent out to 120 (52% males, 47% females) Swedish sailors geographically spread out focusing on single handed dinghies from the main yacht clubs; Göteborgs Kungliga Segsällskap (GKSS) and Kungliga Kappseglings sällskapet (KSSS), The Swedish Laser federation including Laser Radial, Laser Standard and Laser Master sailors, The Swedish Zoom federation as well as sailors from the National sailing colleges Lerums Seglargvnsmnasium and Motala Seglargvnsmnasium. I chose to exclude the Swedish Europe federation as I considered mentioned boat class covered in my personal data bank and through my contacts with the colleges. The age varies from 13 to >28 with both juniors and
seniors. Figure 4 below shows a slightly higher number of teenage males (14) in relation to teenage females (10) participating in the research. However, a more even spread is seen in the age groups above and results in an overall validity between the genders.

Figure 4. Age spread in research. (Count)

The reason I chose this target group is because I wanted to research elite sailors, including future and former elite sailors. To ensure adequate recourses I deliberately sent out additional questionnaires to the major yacht clubs to quantify the research and data. The male and female ratio was held equal with approximately 52% males in relation to 47% females. I received 42 completed questionnaires where 24 males and 18 females responded, which is 57% males in relation to 43% females. Regarding significance that is a rather low number to implement statistics analysis and all data will not be significant.

2.1.3 Questionnaire design

53 questions were included in the questionnaire. The design was mainly quantitatively questions but some also gave room for detailed information. The high number of questions allowed a lot of information to come through which increased satisfying analysis and the quality of the research.

The questionnaire was designed with the three sections; general, main and injury specific. Initially the sailors were asked to answer a set of general questions regarding gender, age, boat class and years of experience. Thereafter, they were asked about their training habits
followed by the main questions regarding injuries, preventative training and post- and pre exercise. On the last few pages in the injury specific section, more in-depth questioning about certain injuries was requested.

My supervisor and I inspected the questionnaire numerous times before carrying out the final copy. I also organised a questionnaire trial where I had two sailors completing the draft and useful feedback was received. (See attachment 1)

2.1.4 Interviews

I choose to interview a trainer and coach with a solid background and expertise. He has had a wide range of impressive work titles over the years and worked with both juniors and seniors on different capacity levels. He started his career by studying at the Swedish school of sport and health science (GIH) and Bosön’s Folk High School. After graduating he started one of the leading National Sailing colleges in Sweden and worked there as teacher and trainer for 10 years. Over the years he has also been the National coach for several boat classes, Youth captain for the Swedish sailing federation, the Olympic coach, the Olympic Club coach and the Captain for the Swedish sailing federation. Today, he has taken one step back and works at the Sailing College he once started.

I choose to interview a physiotherapist with 19 years of experience in sport and fitness injuries. Over the years she has worked with several sailing related cases mainly with sailors from the sailing colleges but also elite sailors from the west coast area. She started her career by studying the Physiotherapy program and thereafter taking additional papers to enhance her qualifications. She is also a keen sailor herself and can therefore easily relate to the sailing manoeuvres required and performed.

2.1.5 Interview design

The interview questions were designed to capture the expertise in their area. Both interviews started off with a set of general questions regarding education, experience and their relation to sailing. Thereafter, questions were more specific to get more in-depth answers but still followed the main theme. The question templates were prepared with 8 main questions for the coach and 10 main questions for the physiotherapist. A series of 1-6 possible follow up questions were also prepared to continue on from each main question. (See attachment 2)
2.1.6 Procedure

I personally developed the research idea as I am very interested in the sport of sailing and physiotherapy. In consultation with the Swedish sailing federation, The Swedish School of Sport and Health Science (GIH) and the School of Sport at Unitec, New Zealand, I designed the project. As I was at the time currently residing in New Zealand and my research targeted Swedish sailors, I sent out questionnaires by email. I had numerous email addresses in my personal data bank but I also received help from sailing federations, coaches and colleges. The sailors received participating information needed along with response details. They had two weeks to complete the questionnaire and email it back. I sent out a reminder two days before the return date which resulted in 42 completed questionnaires.

To widen my perspective and to increase the quality of the research I also interviewed an experienced coach and physiotherapist. To make their expertise relevant to the targeted group I chose to interview a Swedish coach and physiotherapist. The first contact was made by email to prepare for the interview over the internet (Skype).

The interview with the coach was completed in approximately 50 minutes and several questions were prepared. This qualitative method was chosen to be able to follow up answers and get a more in depth result. While interviewing I recorded the answers manually in Swedish and thereafter typed up a transcript in English.

The interview with the physiotherapist was more difficult to complete as I struggled to receive information from several parties. The prepared questions were sent out by email to simplify the procedure as the physiotherapist was lacking communication availability. However, I still followed the prepared document while interviewing and recorded the answers manually in Swedish to later type up a transcript in English.

2.1.7 Statistics

To analyse the received data I used the SPSS analyse program. Questions from the questionnaire were number coded and entered into the program. Thereafter questions were combined and I created graphs and tables, e.g. gender and age differences (chi-square tests) and injury type frequencies were studied. Although, all data did not give a significant
difference I believe useful patterns were created. The significance needed to exclude the possibility of data occurring at random is $p<0.05$.

### 2.1.8 Validity

The questionnaire which was the main source of information was well structured and covered many associated questions the results presented match the purpose of the research. However slight displacement needs to be considered as we are dealing with data from the past and important information can have easily been forgotten.

Possible consequences of the low number of responses could have been a displacement in the age groups and gender however Figure 4 shows a reasonable even spread in both age and between male and females within the target group.

The interviews were also well structured and prepared and I believe they enrich the results of the questionnaires. As there was a slight modification of the purpose during the process a number of questions later become less relevant. The interview with the physiotherapist did not contribute as much as intended as I was not fully familiar with her experience with sailors and perhaps it could have been greater.

### 2.1.9 Reliability

For a research to have a good reliability they need to be reproducible. I believe both the questionnaires and the interviews can be reproduced as they both have well prepared templates. A quantitative method is always easier reproducing as the possible answers are limited. With a qualitative method you are always dependent on personal experiences and interpretations.

However, there are complex of problems when a questionnaire has to be short and concise but still gather a lot of information. The questionnaire was designed with three sections; general, main and injury specific questions. Analysing the data might have revealed a slight confusion for some regarding recording an injury both in the main section as well as in the injury specific. In this case only a small decline rate was recorded.
The majority of the interviews implemented were relevant and useful. They were well structured and a comfortable atmosphere was created. The two interviews did not have exactly the same questions but followed the same main theme. This does slightly affect the reliability as how the answers are put together is a matter of interpretation.

My chosen physiotherapist did have lesser experience of sailors and sailing related injuries than I had been lead to believe. With the more experienced coach that might cause a somewhat skewed picture.

2.1.10 Failure analysis

I received 42 questionnaires from the 120 sent out, that calculates to 35 % return statistics. There can be several reasons for the decline of responses. The questionnaires were emailed out to potential participants but some addresses might have been old and not in use. I received a few email errors and then sometimes struggled to find the correct email address. This then shortened their time to complete the questionnaire. One reminder was sent out to everyone two days before the return date, maybe a second reminder would have improved the statistics. Also the time to complete the questionnaire for the research might have been a factor, many sailors are away competing in August/September and they might not have read the email in time. Considering the target group and the fact that mainly top elite sailors participate in larger regattas abroad the consequences might be a displacement of the research result.

With the low number of responses the results of the target group represented may be somewhat skewered, however the overview of age groups and the relation between male and female (Figure 4) show reasonably even divided data. The received questionnaires were represented by 57% males and 43% females in correlation to the sent out ratio of 52% males and 47% females in the initial targeted group of 120 sailors.

A couple of sailors failed to attach the completed questionnaire. I sent out a clarification and asked them to resend but no responses were received. This may have caused inconveniency for them and perhaps they had not saved the questionnaire. A higher number of questionnaire responses would have affected the significance of the research. The questionnaire design allowed the sailors to record more than one answer which affected the statistics presentation.
The design with the three sections; general, main and injury specific, where some information should have been recorded twice might have put some sailors off. Perhaps a higher response rate could have contributed in a better understanding of why and when injuries occur. There where several randomised questions which sailors failed to record, however, the randomness should not have affected the bigger picture of the research.

3. Results

3.1 Common injuries in age groups

According to the research performed the majority of sailors, 76%, have had one or more sailing related injuries in their sailing careers. 8% of the sailors have had injuries in more than one area. The most common injury is knee injury, followed by back injury. Together they calculated for over 50% of all injuries and can be seen as the major injuries in sailing. Shoulder, ankles and ‘other’ injuries were less frequent. 24% of sailors in the research never had any specific areas of injury. The main type of injury for sailors is overuse injury that develops over time.

8 % of the sailors responded with more than one injury and this is presented with separate bars in Figure 5. Two sailors have had both back and knee injuries, one sailor has had knee, shoulder and ‘other’ injuries and one sailor has had injuries in all mentioned problem areas.

![Chart of most common injuries](image)

Figure 5. The most common injuries recorded in the questionnaires. (Percent)
To research the awareness of injury prevention the sailors were asked if they believe their injury could have been prevented by more knowledge and proper training. The majority believed that this was the case although males responded more positively than females. More than 80% of males believe their injuries could have been reduced compared with just over 60% of females.
3.1.1 Knee Injury

One section of the questionnaire was injury specific to focus on each possible problem area. The majority of the sailors with knee injuries responded that the problems started at 12-15 years of age. 75% of those sailors also said they still suffered from problems with their knees today. 50% of the sailors looked for help from a physiotherapist but only a few had to avoid sailing altogether during injury.

3.1.2 Back Injury

Study showed a tendency of back injuries starting at an early age, <15 years old, but there was no significant difference whether they still had problems with their back today or not. 60% of those sailors looked for help from a physiotherapist. 50% of sailors with back injuries were forced to stay away from sailing for one week or more as a result.

3.1.3 Shoulder Injury

Study showed a slight tendency for shoulder injuries to occur between the ages of 19-21, but with no significant difference. Nor did it show any difference between sailors still having problems with their shoulders today or not. However, 80% of the injured sailors looked for help from a physiotherapist at the time and the majority was forced to stay away from sailing for one week or more as a result.

3.1.4 ‘Other’ Injuries

A small number of sailors recorded ‘other’ unspecified injuries which showed a tendency of later occurrence, age <22. Although there is no significant difference, numbers may guide us to possible complicated injuries as 60% of the sailors looked for help from a physiotherapist and were forced to stay away from sailing more than a month.

3.1.5 Injury frequency

To follow up the question regarding specific injuries, sailors were asked how many times they had been injured. Many failed to record their answer which resulted in non significant statistics but still showed a pattern with 19% of sailors injured 1 time, 19% 2-3 times, 2% 4-7 times and 14% more than 8 times. However the answers do not show if it is repeatedly the
same injury or if it is in separate areas. Below is the presented data; Injury frequency overall (Figure 8), spread of injury in relation to years competing (figure 10) and spread of injury in relation to amount of hours sailing/week (Figure 9)

![Figure 8. Injury frequency among the sailors (Count)](image)

![Figure 9. Injury frequency per years of sailing. (Count)](image)

![Figure 10. Injury frequency per hours sailing per week. (Count)](image)

What we can see in Figure 9 is how many times the sailors have been injured in relation to how many years they have been sailing competitively (years on the right). Sailors that have competed 1-5 years have a lower rate of naturally caused injury. There is a wide range of injury frequencies for sailors competing 10-15 years but with a tendency of males getting injured more often than females. Sailors who have competed for 15 years or more have a higher frequency rate but there is no significant difference.
Figure 10 shows how many times the sailors have been injured in relation to how many hours they train sailing per week. By comparing Figure 9 and 10 research shows that males with high injury frequency sail 11-20 or 5-10 hours per week, while females with high injury frequency sail 21-30 hours. The mentioned female group has 15 years or more of competitive experience while the males are divided into a range between 6-10, 10-15 and >15 years of experience.

64% of the sailors recorded that the majority of injuries occur over the Summer/regatta season. Then when usually less physical training is performed but more sailing, compared with during winter when focus is on physical training.

The interviewed coach believes most injuries occur during the winter ‘build up’ period, when focus is on physical training and less sailing. The situation changes slightly when sailors become elite and sail as professionals. The Physiotherapist believes the majority of injuries occur over the Summer/regatta season.

3.1.6 Injury description

One question in the questionnaire was to identify injuries the sailors had experienced. The question was written qualitatively and sailors were asked to describe injury in as much detail as possible. That resulted in a lot of extra useful information but sometimes also somewhat diffused injury descriptions.

Regarding knee injuries the most common issue was ache, followed by unbalanced muscles. Many sailors also have had problems with their knee caps. Many sailors described issues from/while running e.g. ‘runners knee’ or ache from a combination of running and other tough training. Shin splints are also a major problem for sailors where sailors identified issues both while sailing and while performing supplementary training.
The results from specific back injuries were persistent with three main factors. Again, it is a matter of interpretation as back problems are often described diffusely. However lower back pains are the most consistent injury mentioned, followed by ‘overuse’ and ‘disc problems’.

Specific shoulder injuries resulted in four main factors where muscle strain showed to be the most common issue. Dislocation, which is an acute injury, is also a problem among sailors. ‘overuse’ and ‘other’ injuries were less frequent in the research.
Both interviewed, the coach and the physiotherapist only recorded minor injuries last year (2008). The coach dealt with approximately five injuries at the college. Shin splints are most common among first year students as they are often too unfit for the exercise they are pursuing. According to the coach the most common injuries within Swedish sailing sport are backs (from poor hiking technique and weak abdominals), sore knees (from hiking) and shin splints (from running). Many girls in single handed dinghies who are not very physically aware, often put unnecessary strain on their bodies when they try to match the weight demands in their boat class in other ways than fitness.65

The physiotherapist dealt with approximately six injuries at the clinic involving hand, knee, lower back and chest back. She had no recurring injuries. It is important to find the source of injury and she always completes an examination to find any possible weakness or stiffness. Perhaps the training program is designed poorly. The physiotherapist has not noted any differences between males and females regarding injury type or frequency.

3.2 Comparison between Male and Female

The results showed a significant difference between male and female in injury frequency where males tend to injure themselves more often. A high number of males, 30%, have

65 Interview coach
injured themselves 8 times or more while instead a high number of females, 60%, have never or once been injured (Figure 14).

Figure 9 show the distribution of injuries between male and female. Females have a greater discrepancy of injuries than males but both show knees as the most common problem area. 10 sailors have never been injured, where 7 of those are males. Females show a greater tendency than males of facing more than one injury. Males main problem areas are back and knees, females have similarly but not as pronounced.

Below are separate diagrams showing the amount of hours, males and females, spend per week on weight training, endurance training, sailing and on ‘other’ training.

Males and female show an even pattern with hours spent on weight training and sailing (Figures 16 and 18). However, females have a slight right displacement. In Figure 17, males show a tendency to accomplish more hours on endurance training than females, although analysis show no significant difference.

Figure 19, showing hours spent on ‘Other’ training, has a slight altered pattern between males and females. The majority of both males and females perform ‘other’ training less than 5 hours per week. One female group performs ‘other’, unspecified training between 5-10 hours per week while one group of males performs the equivalent between 11-20 hours per week.
3.3 Preventative training

Below is recorded data of; how many sailors that perform specific training to prevent or rehabilitate an injury (Figure 20). A majority or sailors do regularly or sometimes perform specific training which includes mainly core exercises. Type of exercises recorded in the questionnaires were e.g. Core and back exercises with a Swiss ball, stabilising exercises, balance exercises, back exercises and stretching.
The interviewed coach believes education is one important key to prevent injuries. As mentioned earlier, first year students often lack knowledge and many learn the hard way. The physiotherapist states similar when promoting versatility training. She believes children performing many different sports better keep the physique all year around and have better balanced muscles.

Both the coach and the physiotherapist mention two main factors to consider regarding injury prevention. The first one is; core stability. It has received more attention the last few years but it is important and cannot be neglected. The second one is; rest. Many younger sailors are ambitious and train hard and motivated but they easily forget the importance of rest. You always have to look at the bigger picture, the body needs balance.

### 3.3.1 Identified manoeuvres

Sailors were asked to identify specific manoeuvres that they experienced as the most strenuous on the body. Hiking was clearly shown as the most demanding exercise with; ‘Knees while hiking’ and ‘Back while hiking’ evenly divided on approximately 40% of total manoeuvres mentioned.

---

66 Interviewed coach  
67 Interviewed coach
Many sailors also struggle with their knees while ‘sitting on heels’ sailing down wind. Research showed 75% of them being males. Together, with males and females, ‘sitting on heels’ is as demanding as ‘knees while hiking’.

To clarify the diagram above, and to sum up the specific manoeuvres (questionnaire responses with more than one manoeuvre were presented with its own bar) Figure 22 below present the total number of male and females responses to a specific manoeuvre. ‘knees while hiking’ is the most strenuous followed by ‘back while hiking’ and ‘knees sitting on heels’.

Figure 22. Total number of strenuous manoeuvres (male and females). (Count)
3.3.2 How to design training

The interviewed physiotherapist states physical training and sail training should be separated and a specialist should be appointed for each area. She also says a suitable long term plan needs to be assigned, followed by a one year plan as well as weekly training plans. Then you can control the amount of training with ‘blocks’ and prepare for important competitions. The coach agrees with the importance of plan and structure, however, the sailors at the college are in the process of learning how to plan, train and reach goals. The coach is always there to support but planning and time management need practise. The college follows the Swedish seasons and provides sail training 3-4 times/week from August until November, thereafter they focus more on weight training, endurance training and general theory. Sailing starts again as soon as the weather allows it. The college’s plan for training increases their intensity and duration throughout the year.

3.3.2 Pre- and post exercises

Research shows that approximately 80% of the sailors warm-up before sailing, either regularly or sometimes. However, it does not tell us if the warm-up is on shore or out on the water. Analysed statistics show that it has no effect on numbers of sailors warming up whether the trainer or coach put out time for pre exercises before training or not. The majority of sailors warm up for 5-10mins.

Figure 23. The relation of warm ups/no warm ups and back injury? (Count)

68 Interviewed Physiotherapist
69 Interviewed Coach
Above, Figure 23 is showing no significance difference whether sailors who warm up have less back injuries or not. However, both the coach and the physiotherapist agree with the importance of warming up. Both also agree with that it is yet no proper nor structured way sailors practise the exercise. Sailors at the sailing college have warm ups on their own responsibility before the session starts. ‘There is no point of going running and get sweaty as they will cool down before they hit the water.’ The coach believes the warm ups should be done in the boat, by sailing with frequent tacks and gybes. The physiotherapist acknowledges that warm ups is something that needs to be more looked into. She is picturing suitable exercises where the larger muscle groups are included, preferably performed in the boat on the way out to the sailing area. A warm up should last approximately 10 minutes.

The relation between sailors who perform post exercise after a race day and time spent on stretching showed a significant difference. Sailors do not regularly warm-down (run-down) after a race day, but 51% recorded that they ‘sometimes’ do. A warm-down is here defined as; ‘an exercise to help blood flow back into muscles after a race day’. Below is a diagram showing numbers of sailors warming-down (Y-axle) compared with how long the sailors perform stretching after a race day (X-axle). The diagram can be interpreted as; sailors who perform warm-down also generally perform longer stretching.

Figure 24. The relation of sailors performing post exercise after a race day and time spent on stretching. (Percent)

---

70 Interview with coach
71 Interviewed Physiotherapist
The interviewed coach believes that stretching is neglected. The nature and tradition of sailing are not helping. The sailors have to take their own responsibility but the coach admits that should be performed better. Top elite sailors take better responsibility and often run down followed by stretching. The physiotherapist is unwilling to promote stretching; she believes it depends on the each sailor and how stiff they are. Every individual experience the hiking position differently but as it is a lot of static contractions, stretching could be recommended. Hips, thighs and back would be the most important parts.

The physiotherapist promotes an exercise for sailors who easily lose their posture while hiking, as that can lead to increased pressure on their discs. Back on shore they should lie down on their stomach and lift/bend the back upwards.

4. Discussion

The purpose of this project was to research injuries among elite sailors in single handed dinghies. The research showed that 76% of the sailors have had one or more sailing related injury in their career. I believe that is a rather low figure considering I targeted elite sailors. One explanation can be that sailors mainly deal with overuse injuries which are not as easy to diagnose as what acute injuries are and it may be a high number of unrecorded cases.

4.1 The most common injuries

The most common injury is knee injury, followed by back injury. The result gets support in an article from 2006 where EMG analyses were performed to allow for a better biomechanical understanding of the load distribution in the body musculature. The findings were to indicate that the abdominal muscles showed great exposure but not as pronounced as that of the quadriceps muscle.

---

72 Interviewed Coach
73 Interviewed Physiotherapist
74 Interviewed Physiotherapist
The angle on the knees and the hull is important in regards to the level of straining but with fatigue, most sailors tend to lose their posture and increase the workload of the knees. The literature mention hiking as the most strenuous manoeuvre and therefore it is no surprise that knees and back calculated for more than 50% of all injuries in this research. However, the result showed a low number of hip injuries which could have been expected to be greater as the hip works as the link between the lower extremities and the trunk. The literature often talks about the muscles/muscle groups (quadriceps, iliopsoas and the abdominal) when explaining the load on the spine, knees and surrounding muscles, and iliopsoas is seen as one of the main stressor in the hiking position.

It is concerning that 80% of males and 60% of females believed that recorded injuries could have been prevented by more knowledge and proper training. The question is why this has not come into focus earlier. These figures clearly show that injury prevention needs to be taken more seriously. The majority of knee injuries recorded seem to have started in an early age of 12-15, an age when teenagers mainly physically grow. Is the muscle strain while hiking causing permanent damage? That is a question worth analysing as the majority of participating sailors were over 15 years of age and 75% of them still have problems with their knees.

Problems with back injuries also seemed to start an age around 15. However, the problems seem to be mild to start with but escalating with time. Jim Young, director of the US Olympic Yachting Committee’s Sports Medicine program says the most common cause of lower back pain is compression of vertebrae. Compression occurs in normal hiking position and become greatly exaggerated whenever sailors lose their posture due to exhaustion. A curled position triggers a stretch reflex and put strains on the spine. The sailors then face possibility of permanent damage. That proves how important it is to keep a correct hiking posture throughout the day. A strong core would stabilise the body and spine and the sailor could better control movements. It would both enhance the performance skills as well as prevent injuries.

---

4.1.1 Injury frequency

There is no obvious explanation found why some sailors have high injury frequency. Due to lack in responses and the no significant difference in the research, can I only assume that many years of competing and hard training have great affect on the body. The literature supports the assumption by stating; overuse injuries, which develop over time, are the most common injury within dinghy sailing. The most experienced sailors in the research, sailors with 15 or more years competing, all have had injuries. By studying Figure 9 (see page 23), the majority of sailors train 11-20 hours per week and therefore is the specific row in the graph showing a high frequency of injury. By comparing Figure 9 with Figure 10 where sailors train 21-30 hours per week, a higher injury frequency is unveiled as all those sailors have been injured once or more.

According to the interviewed coach injuries more often occur off season when focus is on physical training (mainly weight training). That is interesting, as sailors themselves have an opposite view, 64% believed the majority of injuries occur over the summer/regatta season when less physical fitness is performed but more sailing. The physiotherapist also believed in the summer season but with her lesser experience I grade her response lower in this matter. One reason for the different views might be the age of the targeted group. The majority of participating sailors in the research is over 19 years of age while sailors at the college, which the coach targeted, are between 16 and 19. According to the coach many injuries at the college occur in the first year, when they still learn about their own limits and sometimes push themselves too far. The participating sailors in the research may already have a built up a basic physique and focus is more on sailing.

4.1.2 Injury description

The type of injuries mentioned in the research are all overuse injuries, except two shoulder dislocation, which are acute injuries. I received a lot of useful information from most participating sailors but some could only vaguely describe injuries. Descriptions like; ache in knees and pain in lower back, are somewhat diffuse and can not be correlated to any specific injury. Unfortunately, that may also show the lack of knowledge there is among sailors. I

82 Interview with coach
believe many sailors today deal with pain and dysfunctions or work around it, instead of researching what is causing it.

Regarding knee injuries, injuries described were ache, unbalanced muscles and knee cap problems. It is understandable that the sailors do not exactly know how their complications occurred as with overuse injuries they sneak up on you and develop over time. Sailors in hiking positions have their whole body weight hanging upon their knees and as JB. Allen states; sudden strong movements in hiking are often performed awkwardly, rotating and twisting. That may lead to knee problems, especially if they suffer from fatigue as they then tend to rotate out their feet which increase the work load even more.

The angle on the knees and the hull is important in regards to the level of straining. In the comparison between Finn (where knees are flexed to 90 degrees), and Laser (where knees are almost fully extended), complaints are more frequent among Finn sailors. The research showed that most knee injuries started in an age of 12-15, an age when most sailors sail the Optimist dinghy in Sweden. Hiking angles in Finn and Optimists are comparable, which may result in a too heavy strain on young growing sailors. Many teenagers experience knee problems without physical strain, can the extra load be causing permanent damage? It is difficult to say exactly what the source of this could be but the research shows an alarming high number (75%) of sailors still having problems with their knees today. It is definitely worth looking into, perhaps could a preventative program improve the statistics.

4.2 Comparison between male and female

The research showed (with a significant difference) that males injure themselves more often than females. When looking at injury types, females have a great discrepancy of injuries while males are more persistent with knees and backs. Knees are evidently the main problem for both males and females, where females show a slightly higher percentage. The results get support from previous research; as according to E. Quinn; the female knee is more vulnerable

85 Ibid, p587
86 Ibid, p. 591
87 Ibid, p.591
to injury compared to a male’s knee. 88 It is interesting though that more males than females
perform specific training to prevent or rehabilitate an injury (see Figure 16). Unbalanced
muscles are also more common among females. 89 That might be one factor for the higher
number of various types of injuries.

Research showed that the majority of sailors believed their injuries could have been prevented
by more knowledge and proper training. Males showed a more positive approach with 80%,
compared to females 60%. I interpret this result with that sailors are well aware of their lack
of knowledge.

64% of the sailors believe that the majority of injuries occur over the summer/regatta season
and therefore have male and female sailing habits been studied. Figure 9 and 10 show that
males with high injury frequency (>8) sail 11-20 or 5-10 hours per week while females with
high injury frequency (>8) sail 21-30 hours per week. There are noticeably a higher number
of males injured but it is no clear pattern of when the injuries occur. However, the female
group has 15 years or more of experience which might indicate that injuries have been
stretched over several years. As overuse injuries develop over time, the risk of getting injured
increases with the years sailing competitively. The male group consists of several sailors with
15 year or more of experience but also less experienced sailors which might explain the
greater spread. However, the experienced male sailors do not sail equivalent hours as the
experienced females. It is interesting that the males still have such a high injury frequency, do
they push themselves harder?

The physiotherapist had not noticed any significant difference between males and females
regarding injury type of frequency. The interview coach however stated that first year male
students often went over hand and trained too hard, especially with weight training.

4.3 Preventative training

Research showed that the majority of sailors perform regularly or sometimes specific training
to prevent or rehabilitate an injury. Exercises recorded were e.g. core and back exercises,
stabilising exercises and stretching. That is interesting as the majority of sailors also believed

88 E. Quinn, Sport Medicine, http://sportsmedicine.about.com/od/women/a/Q_angle.htm, (Acc 2009-02-01)
89 R. Winter, G. Beim, How to prevent and treat Sports Injuries in Women and Girls, The Female Athlete’s body
that their injuries could have been prevented by more knowledge and proper training. The correlation between these two responses are somewhat vague, but it is alarming if sailors train specific training but in an unaccommodating way. I believe sailors might start too late. Core training can be performed in young age as the own body weight is used as weight. The coach and physiotherapist both state that core stability is one of the main factors in injury prevention. It is satisfying to see that sailors today have taken a more conditioning approach and is giving core and balance exercises better attention but it still needs to be taken further. The literature refers the core as; the “powerhouse” and the foundation of all limb movements.  

I believe previous sentence which sums up the importance of core stability well.

The interviewed coach also discussed education as an important key to prevent injuries. Many first year students lack knowledge about training and many train after ‘the more, the better’. Rest is another main factor in injury prevention as well as training development. If sailors at the college arrived with a better basic understanding and versatile training background many sailors could get much further faster. Also, with better knowledge regarding rest and recovery sailors could get better effect out of their training.

4.3.1 Identified manoeuvres

To successfully design a preventative training program it is important to know what manoeuvres that causes the most strain on the sailors. The research showed clearly hiking as the most strenuous manoeuvre where knees and back take huge loadings. A program should therefore ideally be designed to strengthen and support those areas but also to maintain the versatility. As sailing is a very complex sport, poor hiking technique, often a result of fatigue can further increase the loadings. J. Young support previous statement by stating that compressions of vertebras occur in normal hiking position and become exaggerated whenever sailors lose their posture due to exhaustion. J. Young also states that sailors then face possible permanent damage. With a more curled position sailors tend to also flex their knees. A contraction of iliopsoas affects the quadricep femoris muscle as it goes cross both knee and hip joints. Therefore is it physiologically harder to keep the knee extended when the posture is lost. Previous research refers the core as a muscular corset that stabilise the

---

91 Interviewed coach and physiotherapist
93 Ibid. P.56.
Concerning the above stated I believe a strong core could enhance the sailors’ performance and decrease the risk of getting injured.

### 4.3.2 How to design training

It is important to train with a structured plan towards a goal. Many sailors lack knowledge and it is a matter of education. The interviewed coach states that sailors need to receive education regarding training earlier than what is practised today as he often deals with many unnecessary injuries at the college. The question is how to implement these important elements. Sailors, who compete on higher level in the Optimist class, range from 12 to 15 years of age; require high-quality guidance in training. That is when young sailors first develop sailing styles, techniques and build up a basic physique. Perhaps could the Swedish Optimist federation take better responsibility? Even though injuries will not show during the time in the Optimist it would at least be in the Swedish sailing federation’s interest to implement good routines for future sailors.

The interviewed physiotherapist states that physical training and sail training should be separated and a specialist should be appointed for each area. That is today possible for the top elite sailors, with support from the Swedish sailing federation or the major yacht clubs. Many minor clubs around the country can not supply that sort of professionalism and therefore is physical training often put on the sailor’s own responsibility. I believe the lack of qualified leaders is in correlation with the lack of knowledge among sailors. However, it is a matter of ‘supply and demand’ and minor clubs struggle to compete with major clubs. By looking at what could be the best for the sailing sport; merges of clubs may help. However, the minor clubs attract first timers as they are seen as more laid back and not too competitively focused. I believe the lack of qualified leaders with training expertise definitely is one major issue but there is no obvious way of how to resolve it.

### 4.3.3 Pre- and post exercise

Research showed that approximately 80% of sailors warm-up before sailing, either regularly or sometimes. Perhaps warm ups could have been better defined in the questionnaire as I personally doubt presented value. It is somewhat unclear what is included in the warm up and

---

96 Interviewed coach and physiotherapist
if it is performed on shore or in the boat. From personal experience warm ups are often neglected, especially prior to training. The interview coach explains that sailors at the college have warm ups on their own responsibility, when the coach blows his whistle on the water, the training session starts. If sailors are late out onto the water they join in training exercises straight away. Both the coach and the physiotherapist are aware of the problem and that a better structured way of warm ups needs to be assigned. According to previous research; a warm up prepare the body for exercise to allow absorption of the exertions and shocks of athletics muscles and joints. I believe warm ups are not being properly prioritised. If comparing sailing with other sports, most athletics start their training with a joint warm up. Sailors have better discipline at competitions when the warm up is included in the sailing course preparations. Following the principle for specific training; you should execute training equally as competition as ‘you get good at what you practise’. Warm ups during training should be a matter of course. There is no data on which to prescribe intensity and duration of warm ups but the intensity should gradually be increased and the larger muscle groups should get the initial attention. The physiotherapist recommended sailors to spend approximately 10 minutes on warm ups and research showed that the majority of sailors warm up for approximately 5-10 minutes.

Researchers today still struggle to prove the effects of stretching. However, good flexibility and range of movements decreases the possibility of injury, gives better coordination and sometimes even pain relief. The research showed, with a significant difference, that those sailors who perform stretching for 5-10 minutes or longer more likely also perform warm downs. I believe warm downs are important for sailors as the hiking involve static contraction and the build up of waste products needs to be broken down. I personally believe most sailors today perform stretching to try returning the body to its normal state and cure muscle soreness and stiffness.

The interviewed coach leaves the responsibility for stretching with the sailors. However, he admits it could be performed better but no extra time is put aside for it. It is just not being properly prioritised today. I believe trainers and sailors easily stress about the time on the

97 Interviewed coach  
water and perhaps could the last ten minutes complete the session with a joint warm down and stretching. Generally young sailors today seem to struggle with pre- and post exercise as sailing with rigging and de-rigging is time consuming as it is. It is interesting however that the physiotherapist was unwilling to choose side regarding stretching. She stated that each individual is different and it depends on how stiff they are. I interpret that as different sports have different demands on flexibility and no general recommendation can be made.

4.3.4 Conclusion

The majority of sailors (76%) have had injuries in their sailing careers. Knees and back were the most pronounced injuries and can be categorised as overuse injuries that develop over time. Together they calculated for more than 50% of all injuries and shoulder, ankle and other injuries were less frequent. There are indications of injuries starting in an early age and lack of training knowledge might be a factor.

Females have greater discrepancy of injuries however males tend to injure themselves more often, even though more males than females perform specific training to prevent or rehabilitate an injury. Both male and female showed knees as the most common injury. The majority of sailors believed their injuries could have been prevented by more knowledge and proper training. Early education might be the key factor in the matter.

The majority of sailors do regularly or sometimes perform specific training which includes core exercises. Types of preventative exercise recorded by the sailors were core and back exercises with a Swiss ball, stabilising and balance exercises and stretching. Research showed that 80% of sailors warm up before sailing, either regularly or sometimes. The most strenuous manoeuvre identified was ‘knees while hiking’ followed by ‘back while hiking’.

4.3.5 Method discussion

I believe the chosen method for this research was successful with good reliability. However, if it was to be reproduced there are several small changes that could be made. It was my first time executing a large project like this and many procedures were new to me.
The relatively low number of responses may have affected the outcome of the research. However I am pleased with the chosen target group as it covered a variety of experience and age groups and I believe the relatively even spread made the study relevant. I feel the preparations with the email addresses could have been organised differently. Some organisations and clubs had strict regulations with their data bases and could not give me any details without the members’ permissions. Instead did the people responsible send out my questionnaire on my behalf but I wish I had better control of who was contacted. I also experienced several federations not having an updated contact register. Today I would have taken better help from the Swedish sailing federation and pushed for their support in the hunt as it is always easier when you represent someone.

Perhaps could the questionnaire have been narrowed down and focused more specifically on the purpose as the length of the questionnaire might have affected the response frequency. However, the purpose was slightly modified during the process and the broad questioning made that possible. If I was to design a new the questionnaire today I would merge the injury specific into the general questions to reduce the number of questions and pages. I believe the time given to respond was accurate however; further reminders might have affected the response rate positively.

I believe the interviews had good validity even though they could have been focused more specifically on the purpose. The templates were written in an early stage and included questions regarding physical training which initially was covered within the purpose. The interviews included several questions within the mentioned area but then not brought forward into the project.

4.3.6 Future research

This study might be one small step in the right direction. There are many possibilities within Swedish sailing sport but I believe it is a long road ahead. If I was to execute a similar research it would be interesting to follow sailors over a longer period of time. The time limit for this study did not give depth into the problems, more an overview. It would therefore be very interesting to see future research targeting each problem area separate. As I believe sailors would have an advantage of training knowledge in a younger age I also wish to see studies covering that.
Like I previously mentioned, this might be one small step in the right direction and to continue the development I would execute a research targeting young Optimist sailors and try measure the load on their knees and to see possible damage that might cause. Thereafter I would with the new experience complete a case study including core stability and possible affects of the load on knees and backs.

Once a sailor, always a sailor! Hopefully can our future sailors enjoy a life without injury.
References


Cockerill. S, No pain: how to develop a hiking style that avoids the knee problems which put many out of the sport, Australian Sailing, Sep, 40-2, (1999).


**Unpublished references**

Interview with coach 23-10-2008.

Interview with physiotherapist 05-02-2009

**Electronic references**

BBC Sport, *Sport academy*,


E. Quinn, Sport Medicine, http://sportsmedicine.about.com/od/women/a/Q_angle.htm, (Acc 2009-02-01)
The type and incidence of sailing related injuries among dinghy sailors

With this voluntary questionnaire I am researching the extent of sailing related injuries among dinghy sailors. The outcome of this research will be a summary of the most common injuries with timeframes of injury, information about what causes the injuries to develop and how they can be prevented.

This will only take a few minutes and I would really appreciate if you would take some of your time to fill this out. Please answer the questionnaire as detailed as you can by colour or underline your answer and by typing on the dotted line. (As it is a word document the format will change slightly). In respect to confidentiality all returns of this completed survey will remain anonymous in the presentation of the findings. Only the researcher and the primary supervisor will have access to the data. By completing this questionnaire you give informed consent.

Return the completed survey by email to helenaskarp@yahoo.se before the 19th September and if you wish to receive a copy of the presented data please say so in your returning email.

If you have any question at all about this survey please feel free to contact me on helenaskarp@yahoo.se. Thank you in advance for your time.

Please colour or underline your answer

<table>
<thead>
<tr>
<th>1. Gender</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>2. Age group</th>
<th>13-16</th>
<th>17-20</th>
<th>21-24</th>
<th>25-27</th>
<th>&gt;28</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>3. Boat class (what you have sailed or sailing at present)</th>
<th>Europe</th>
<th>Zoom</th>
<th>Laser</th>
<th>Laser radial</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>4. How many years have you been sailing competently? (in total)</th>
<th>1-5</th>
<th>6-10</th>
<th>10-15</th>
<th>&gt;15</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>5. Are you active sailor at present?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>6. How many hours a week do/did you sail?</th>
<th>&gt;5</th>
<th>5-10</th>
<th>11-20</th>
<th>21-30</th>
<th>&gt;30</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>7. How many hours a week do/did you do endurance training?</th>
<th>&gt;5</th>
<th>5-10</th>
<th>11-20</th>
<th>21-30</th>
<th>&gt;30</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>8. How many hours a week do/did you weight training?</th>
<th>&gt;5</th>
<th>5-10</th>
<th>11-20</th>
<th>21-30</th>
<th>&gt;30</th>
</tr>
</thead>
</table>
9. How many hours a week do/did you do other training?
>5 5-10 11-20 21-30 >30
Please give details

10. Are you currently, or have you previously suffered from any of following sailing related injuries? Tick more than one if require. If No injury- go to question 15.
Back Knees Shoulder Ankles Other No Injury
Please give details:

11. If Yes – How old were you when it started?
<12 13-15 16-19 20-23 >24

12. If Yes – Do you think your injury could have been prevented with more knowledge and proper training?
Yes No

13. If Yes - How many times have you been injured? When an injury has affected your sailing capacity
Never 1 2-3 4-7 >8

14. Are you affected by an injury at present?
Yes, all the time Yes, feeling it sometimes No, not at all

15. What time of the year (season wise) do you think the most injuries occur?
During winter with focus on physical training
During summer/regatta season with lesser physical training but more sailing

16. Identify specific manoeuvres while sailing you would say put the most pressure on your body? Please specify as followed: e.g Knees while hiking or Back, pumping at start

17. Do you do any specific training to prevent or rehabilitate an injury?
Yes No Sometimes
Please give details:

18. Does your trainer put out time for pre exercise before training and post exercise as stretching after training?
19. Do you pre exercise - “warm up” before you go sailing (competing)?
   Yes  No  Sometimes

20. If Yes – For how long?
   <5mins  5-10mins  10-20mins  >20mins

21. Do you post exercise - “run down” after a racing day?
   Yes  No  Sometimes

22. How much time do you normally spend on stretching after a racing day?
   None  <5mins  5-10mins  >10mins

23. Do you think you would perform better if you spent more time on pre- and post exercises?
   Yes  No  Maybe

24. Does your sail trainer help you with your physical training?
   Yes  No  Someone else

Injury Specific:

25. Have you had a knee injury? If No- go to question 31
   Yes  No

26. What sort of injury was it?
   Please describe the injury in detail:

   ........................................................................................................................................
   ........................................................................................................................................

27. How old were you when you got injured?
   <12  12-15  16-20  21-24  >25

28. Do you still have problems with you knee/s?
   Yes  No

29. Did you see a physiotherapist or similar?
   Yes  No

30. How long did you have to stay away from sailing to rehabilitate?
   Not at all  <1 week  1-4weeks  >1 months

31. Have you had repeated knee injuries?
   No  1-2 times  2-4times  >4 times

32. Have you had a back injury? If No- go to question 38
   Yes  No
33. What sort of injury was it?
Please describe the injury in detail:

........................................................................................................................................
........................................................................................................................................

34. How old were you when you got injured?
<15   16-18   19-21   22-24   >25

35. Do you still have problems with your back?
Yes    No

36. Did you see a physiotherapist or similar?
Yes    No

37. How long did you have to stay away from sailing to rehabilitate?
Not at all   <1 week   1-4 weeks   >1 months

38. Have you had repeated back injuries?
No   1-2 times   2-4 times   >4 times

39. Have you had a shoulder injury? If No- go to question 45
Yes    No

40. What sort of injury was it?
Please describe the injury in detail:

........................................................................................................................................
........................................................................................................................................

41. How old were you when you got injured?
<15   16-18   19-21   22-24   >25

42. Do you still have problems with you shoulder/s?
Yes    No

43. Did you see a physiotherapist or similar?
Yes    No

44. How long did you have to stay away from sailing to rehabilitate?
Not at all   <1 week   1-4 weeks   >1 months

45. Have you had repeated shoulder injuries?
No   1-2 times   2-4 times   >4 times

46. Have you had any other injuries? If No- go to question 52
Yes    No
47. What sort of injury was it?
Please describe the injury in detail:

........................................................................................................................................................................
........................................................................................................................................................................

48. How old were you when you got injured?
<15  16-18  19-21  22-24  >25

49. Do you still have problems with the injury?
   Yes   No

50. Did you see a physiotherapist or similar?
   Yes   No

51. How long did you have to stay away from sailing to rehabilitate?
   Not at all  <1 week  1-4 weeks  >1 months

52. Have you had repeated injuries?
   No  1-2 times  2-4 times  >4 times

53. Do you wish to receive a copy of the presented data from this survey?
   Yes   No

Thank you again for completing this survey!
Return this to helenaskarp@yahoo.se before the 19th of September 2008
Attachment 2

Interview questions – Trainer/Coach (for single handed sailors)

1. Facts about you…
   • Education
   • Experience
   • Background as –sailor –trainer –coach
   • Levels of coaching – what are the differences?

2. Are there any differences in your role as a coach vs. a trainer? –explain.
   • Is it better to have the same person/ different person?

As a Trainer:

3. How do you plan the training for a group of sailors?
   • Year, Season, Months, Weeks?
   • Personal – on what level?

4. How do you construct the daily training?
   • What do you always include?
   • How much time do you spend on each section? –warming up –sailing – physical-strength – stretching –debriefing

5. Living in Sweden makes sailing harder at winter time, how does the climate affect the balance in the physical training for a sailor?
   • Do you train enough over the regatta season? (Summer)
     - What affect does the abnormal imbalance have on a sailor’s performance?
   • What time of the year (season wise) do you think the most injuries occur?

6. What is physical training for you?
   • Is physical training important? – Why?
   • What is important to think about when you perform physical training?
   • What physical qualities are most important for sailors? –Why

7. What level of condition do you think the elite sailors of Sweden have today?
   • What country do you think is ahead of the rest of the world today?
     - what can we learn from them?
   • How many injuries did you work with last year?
   • How many injuries have you work with so far this year?

8. What injuries do you think are the most common within Swedish sailing?
   - What do you think is the reason for that?
   • How can we prevent those injuries?
   • Have it changed over the years? – Development – weight belt forbidden..
   • Do you think we need to train differently – often overload injuries – start preventing earlier?
• What support do you give to an injured sailor?
  - Building reports?

Interview questions – Physiotherapist

1. Facts about you…
   • Education
   • Experience
   • Relationship with sailing – your knowledge about sailing.

2. Do you think elite sailors in Sweden are in a good physical condition?

3. What physical qualities do you think are most important for a sailor?
   • Is there anything sailors need to focus more on?

4. How can you help an injured sailor?
   • How many sailing related injuries have you worked with over the last year?

5. What are the most common injuries for sailors?
   • When do the most injuries occur? – during winter when focus is on physical training or during summer and regatta season when sailors sometimes lack time for physical training?

6. What is your view of physical training/conditioning?
   • What is important to think about when you perform physical training?
   • In what age should sailors start specific training for injury prevention?

7. Do you see any difference in injuries between girl/boys, woman/men?

8. Sailors have always struggled with warming up properly as they are out on the water long before the racing starts etc, do you have any suggestions to come around this problem?

9. Is a pre exercise as “warming up” important before you go sailing? – Why?
   • What should be included?
   • How long should it be?

10. Is stretching important after sailing? – Why?
Participant Information Form

My name is Helena Skarp and I am currently enrolled in the Bachelor of Sport degree in the School of Sport at Unitec New Zealand (Sweden; Tränarprogrammet at Gymnastik och Idrottshögskolan, Stockholm) and seek your help in meeting the requirements of a research project course which forms a substantial part of this degree.

My aim for this is to quantify the incidence and type of injuries sustained by competitive sailors in Sweden. The Study is divided into two phases: phase one involves voluntary questionnaires distributed to sailors in Sweden and in phase two, where I now seek your help, I will research the professionals’ (coaches/trainers/physiotherapists) view of training and sailing injuries. The professionals’ results will then get compared for possible similarities and differences.

By taking part in this study you will help us understand what is relevant for sailors in regards to sailing movements and prevention of sailing related injuries.

I request your participation in the following way:

- An interview over Skype (internet) - approximately 30-40 minutes
- If applicable, use of webcam
- Email communication if further clarifications needed.

Information that may identify you will be kept completely confidential. All information collected from you will be stored in a locked facility and only you, the researcher and the research supervisor will have access to the information.

I hope that you will agree to take part and that you will find your involvement interesting. If you have any queries about the research please contact my supervisor.

My supervisor is Dr. Graham Fordy, phone 09 8154321 ext. 7908 email gfordy@unitec.ac.nz

UREC REGISTRATION:
This study has been approved by the UNITEC Research Ethics Committee. If you have any complaints or reservations about the ethical conduct of this research, you may contact the Committee through the UREC Secretary (ph: 09 815-4321 ext 7248). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.
Participant consent form

I have had the research project explained to me and I have read and understand the information sheet given to me.

I understand that I may withdraw myself or information I have provided any time prior to the completion of the research project.

I understand that this interview will be interpreted and translated from Swedish to English and used in the study “Sailor for life, injuries for life – sailing related injuries among dinghy sailors today”. A brief presentation of my experience will be presented but none of the information I give will identify me and that the only people who will know what I have said will be the researcher and the supervisor.

I understand that I can see the finished research document.

I have had time to consider everything and I give my consent to be a part of this project.

Participant Signature: …………………………… Date: ……………………………

Project Researcher: ………………………………… Date: ……………………………

UREC REGISTRATION:
This study has been approved by the UNITEC Research Ethics Committee. If you have any complaints or reservations about the ethical conduct of this research, you may contact the Committee through the UREC Secretary (ph: 09 815-4321 ext 7248). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.
**Bilaga 5**

**KÄLL- OCH LITTERATURSÖKNING**

**Frågeställningar:** In relation to age groups what are the most common injuries? Are there differences between male and female? How common is preventative training?

**VAD?**
Vilka ämnesord har du sökt på?

<table>
<thead>
<tr>
<th>Ämnesord</th>
<th>Synonymer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yachting, injury, sport injuries, hiking, pumping, strain, posture, back pain, knee injuries, females, Olympic sailing classes</td>
<td>Sailing, boating, overload, woman, over aching, lower back pain,</td>
</tr>
</tbody>
</table>

**VARFÖR?**
Varför har du valt just dessa ämnesord?


**HUR?**
Hur har du sökt i de olika databaserna?

<table>
<thead>
<tr>
<th>Databas</th>
<th>Söksträng</th>
<th>Antal träffar</th>
<th>Antal relevanta träffar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sport Discus</td>
<td>Yachting AND injuries</td>
<td>107</td>
<td>5</td>
</tr>
<tr>
<td>PubMed</td>
<td>Yachting AND back pain</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Yachting AND overuse injuries</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sailing AND posture</td>
<td>12</td>
<td>3</td>
</tr>
</tbody>
</table>

**KOMMENTARER:**