

Yachters in Korea suffer considerable injuries

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Although there is a limited amount of data regarding injuries incurred from yachting, identifying important trends can assist clinicians and yachters in the successful evaluation, treatment, and rehabilitation of injuries. Similar to other research studies related to sailing, the majority of injuries consist of orthopedic problems, with the highest rate of injury occurring in the lower legs and trunk. The most prevalent causes of injury were due to 'over-action,' followed by 'insufficient practice,' and lastly, 'insufficient skill' according to the responses among yachters.

Gaining a better understanding of the causes of injury and the affected sites of injury will assist in developing a fitness training program for injury prevention and creating a rehabilitation program to ensure optimal conditions and safety for yachters.

Keywords: Yachting, Injury, Over-action, Insufficient skill, Rehabilitation program

INTRODUCTION

In recent years, participation in leisure sports has steadily risen. Among the leisure sports, yachting, which is sailing a recreational boat or ship, is enjoying the limelight. Modern yachting includes two different classes of watercraft: sailboats and motorboats. Yachts differ from commercial ships mainly due to their purpose of leisure, but it was not until the advent of steamboats and other powered ships that sailing vessels in general came to be perceived as luxury or recreational vessels. In South Korea, yachting is becoming popular and the number of recreational experts is increasing. Recreational yachting is purely for enjoyment and has a number of distinct technical disciplines to cater to a variety of interests, such as competitive yachting, speed motor boat racing, competitive canoeing, kayaking, rowing, and navigational contests.

Yachting itself is generally known as a safe sport, but there are potential dangers. In fact, yachters often suffer from injuries or illnesses, especially during periods of high training volume (Gabbett, 2004; Jones et al., 1993; Neville et al., 2006).


Effective preventive and therapeutic interventions require a clear understanding of the injury, as well as the incidence, severity,

and risk of injuries (Fuller and Drawer, 2004). Unfortunately, previous descriptive reports of injuries have not only lacked clarity in their definition of injury and method of data collection, but also have not included incidence and severity (Allen, 1999; Blondelle and Simmonet, 1984; Branth et al., 1996; Bugge, 1986; Hyun et al., 2015; Miller, 1987; Nilson, 1994; Price et al., 2002). Furthermore, these surveys have not yet been reported in Korea, thus limiting access to published research on injury epidemiology. The aims of this study were to document the injuries and illnesses of yachters and to provide insight into the incidence, severity, and causes of injury.

MATERIALS AND METHODS

Participants

The participants of this study were members of the Korea Aqua-leisure Safety Association (KASA) who were certified yacht instructors. The samples were collected from a total 43 yachters, who were 46.28 ± 9.60 yr old. The demographic characteristics of the participants are summarized in Table 1.

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Table 1. Demographic data for the yachters

Variable	Value
Male sex	43
Age (yr)	46.28±9.60
Height (cm)	173.74±3.89
Weight (kg)	74.49±6.88
Carrier (mo)	120.33±87.21

Values are presented as number or mean ± standard deviation.

Study tool

For this study, a questionnaire was used to analyze the pattern, frequency, and cause of injury from yachting and Cronbach α was calculated from the content of the questionnaire to verify the reliability. The reliability of the questionnaire used by this study was estimated at Cronbach $\alpha = 0.877$.

Data processing

After collecting the questionnaires designed for analysis of pattern, frequency, cause of injury, and other factors related to yachting, each of them was entered and stored into a database, which was later computerized according to analysis purposes. All data is expressed in the mean value and standard deviation. Frequency analysis was used as an analysis method and verification was performed at a significance level of $P < 0.05$.

RESULTS

For data and analysis, 43 yachters participated by returning completed questionnaires.

Purpose of yachting and other factors related to yachting

To investigate the purposes and other factors of yachting, the items listed below in Table 2 were analyzed.

Table 2 describes the purpose of yachting and other related yachting information. The main purpose of yachting was 'occupation' (51.2%), which was followed by 'hobby' (34.9%), 'stress reduction' (6.9%), and followed by other reasons. For yachting frequency per day, 14 participants (32.6%) reported that they yachted less than once a day. Twelve participants (27.9%) answered that they yachted twice a day. In yachting time per day, most participants (69.7%) reported that they yachted more than 60 min. In yacht training intensity, in which rating of perceived exertion (RPE) was used, 15 participants (34.9%) answered 'little heavy,' followed by 12 participants (27.9%) who reported 'light,' and seven participants (16.3%) who reported 'heavy.' Most partici-

Table 2. The purpose of yachting and other related factors

Variable	Multiple responses, n (%)
Purpose of yachting (n=43)	
Occupation	22 (51.2)
Hobby	15 (34.9)
Interpersonal relations	2 (4.7)
Stress reduction	3 (6.9)
Health promotion	1 (2.3)
Others	0 (0)
Yachting frequency per day (n=43)	
≤ 1	14 (32.6)
2	12 (27.9)
3	2 (4.7)
4	2 (4.7)
≥ 5	9 (20.9)
Others	4 (9.3)
Yachting time per day (n=43)	
< 15 min	3 (7.0)
15–30 min	1 (2.3)
31–60 min	9 (20.9)
> 60 min	30 (69.7)
Yacht training intensity (RPE) (n=43)	
Lightest	2 (4.7)
Very light	2 (4.7)
Light	12 (27.9)
Little heavy	15 (34.9)
Heavy	7 (16.3)
Very heavy	3 (7.0)
Heaviest	2 (4.7)
Yachting frequency per week (n=43)	
≤ 1 day per week	11 (25.6)
2–3 days per week	23 (53.5)
> 5 days per week	6 (14.0)
Others	3 (7.0)
Yachting period	
≤ 1 yr	6 (14.0)
2–3 yr	8 (18.6)
3–5 yr	7 (16.3)
> 5 yr	18 (41.9)
Others	4 (9.3)

RPE, rating of perceived exertion.

pants reported yachting 2–3 days per week (53.5%) and 25.6% reported less than 1 day per week. Only six participants (14.0%) reported yachting more than 5 days per week. Lastly, 18 participants (41.9%) reported having yachted for more than 5 yr.

The site, diagnosis, and treatment of injury

To investigate the site, diagnosis, and treatment of injury incurred from yachting, the items listed below in Table 3 were analyzed.

The self-perceived cause of injury was categorized into five items. The highest number of responses indicated 'over-action' (42.9%), followed by 'insufficient practice' (19.0%), 'insufficient

Table 3. The site, diagnosis, and treatment of injury

Variable	Multiple responses, n (%)
Self-perceived cause of injury (n=42)	
Insufficient warm-up	4 (9.5)
Insufficient skill	8 (19.0)
Over-action	18 (42.9)
Insufficient practice	8 (19.0)
Others	4 (9.5)
Site of Injury (n=30)	
Head (eyes)	1 (3.3)
Chest (costal bones)	3 (10.0)
Lumbar	9 (30.0)
Upper extremity	4 (13.3)
Lower extremity	13 (43.4)
Upper extremity (n=4)	
Shoulder joint	1 (25.0)
Wrist joint	1 (25.0)
Hand	1 (25.0)
Fingers	1 (25.0)
Lower extremity (n=13)	
Femoral region	2 (15.4)
Knee joint	4 (30.7)
Ankle joint & foot	6 (46.2)
Toes	1 (7.7)
Injury type diagnosed by medical staff (n=30)	
Fracture	3 (10.0)
Ligament sprain	7 (23.3)
Muscle strain	1 (3.3)
Abrasion	3 (10.0)
Contusion	10 (33.3)
Cramp	4 (13.3)
Bleeding	1 (3.3)
Rupture	1 (3.3)
Caregiver (n=30)	
Oneself	16 (53.3)
Leader	3 (10.0)
Colleague	6 (20.0)
Doctor	4 (13.4)
Family	1 (3.3)

skill' (19.0%), and 'insufficient warming-up' (9.5%). For the site of injury, the lower extremity (43.4%) was most common. Although only four sites were injured in the upper extremity, 13 sites were injured in the lower extremity. Ankles and feet accounted for most of the injuries involving the lower extremity (6 participants, 46.2%), followed by knee joint injuries (4 participants, 30.7%), and injuries in the femoral region (2 participants, 15.4%). For injuries diagnosed by medical staff, contusions (10 participants, 33.3%) were revealed as the most common injury type. Lastly, most participants treated their injuries by themselves (16 participants, 53.3%).

Table 4. The mechanisms of injury related to sailing or yachting (n=43)

Variable	No. of injured persons (%)
Shin abrasions from colliding with tiller	9 (20.9)
Abrasions from old lifelines	8 (18.6)
Finger injuries from getting stuck on the side-stay	4 (9.3)
Finger injuries from getting pinched by mooring lines	7 (16.3)
Bruises from the main boom when jibing	3 (7.0)
Bruised legs from bumping on cabin stairs	11 (25.6)
Burns and abrasions caused by the jib sheet	9 (20.9)
Falling overboard from slipping off the deck	12 (27.9)
Falling overboard due to collision	6 (14.0)
Scrotal stenosis from prolonged sitting in Bosun's chair	1 (2.3)
HIVD or back spasm from long-distance sailing	4 (9.3)
Skin and eye burns induced by ultraviolet rays	8 (18.6)
Dehydration	3 (7.0)
Hypothermia	4 (9.3)
Eczema and hair loss	3 (7.0)
Insomnia	2 (4.7)
Constipation	3 (7.0)
Injury from hitting things inside the cabin when waving	8 (18.6)
Knee joint injury from jumping off when berthing	5 (11.6)
Witness of a drowning accident due to flooding	3 (7.0)

HIVD, herniated intervertebral disc.

Results of mechanisms of injury related to sailing or yachting

To investigate various questions related to injuries from sailing or yachting, 20 items listed below in Table 4 were analyzed. Participants answered by selecting either 'yes' or 'no.'

As shown in Table 4, 12 participants (27.9%) watched or experienced 'falling overboard from slipping off the deck' and 11 participants (25.6%) experienced bruised legs when they went up and down the cabin stairs. In addition, they had shin abrasions on their legs by missing the tiller (20.9%) followed by skin or joint problems. Specifically, there were also dehydration (7.0%), hypothermia (9.3%), eczema and hair loss (7.0%), constipation (7.0%) and insomnia (4.7%) in the yachters.

DISCUSSION

Most yachters in this study were middle-aged men who had sailed for many years. Among the yachters who participated in this study, 'occupation' and 'hobby' were selected as the main purposes for yachting. In terms of yachting frequency per day, once a day took up the highest percentage at 32.6%. In yachting time per day, most participants (69.7%) reported yachting more than 60 min. For yacht training intensity measured by RPE, 15 partic-

ipants (34.9%) answered 'little heavy' whereas seven participants (16.3%) reported 'heavy.' Most participants reported that they sailed 2–3 days per week (53.5%). The data from the survey indicated sailing conditions that were not optimal for the participants and could be a factor contributing to the high rate of injury. Carmont (2013) reported that the injuries related to yachting numbered approximately 100 injuries for every 1,000 days of sailing in 1999. This is a considerable discrepancy, which is thought to be due to more adverse sailing conditions. This may also have been due to the incompetence of the yachters. A 2006 study using an online survey of recreationally competitive sailors investigated the relative frequency, patterns, and mechanisms of sailing-related injuries (Nathanson et al., 2010) in which a total of 1,715 injuries were reported from 1,188 respondents. The rates of injury and severe injury were 4.6 of 1,000 and 0.57 of 1,000 days of sailing, respectively.

Of particular importance in the present study is the reported injury rate. Although it is encouraging that only 30 of 43 yachters (69.7%) reported such injuries, these numbers are not insignificant. According to the results, each of these participants experienced repeated injuries to some part of their body. Thirteen point three percent (13.3%) of the injured 69.7% indicated injuries in the upper extremity. Thirty percent (30.0%) reported lumbar joint pain or problems, whereas 43.3% reported injuries in the lower extremity. Of the lower extremity, ankles and feet accounted for 46.2%, followed by knee joints (30.7%), and the femoral region (15.4%). Carmont (2013) reported that when the anatomical regions were compared with where injury was reported, there appeared to be a distinction between those injuries reported by elite competitors, including recreationally competitive sailors, versus beginners. A review of the 2002 Brazilian Olympic team revealed that the most common painful areas were the lower back (52.9%) and the knee (25%–32%). Legg et al. (1997) also reported that 57% of reported injuries by New Zealand Olympic sailors in the preceding 3 yr consisted of the lower back (45%), knee (22%), shoulder (18%), and arm (15%). The most common injuries in another survey indicated back pain (44%) and knee pain (30%) (Shephard, 1994). The results of many other research studies seem to support the results of this present study. In other words, middle-aged yachters may incur more injuries in their lower extremity and lumbar joint.

Mechanisms of injury on the boat included grinding (30%), lifting (24%), and impact from objects (16%), but small portions of injuries occurred off the boat during fitness training (Allen and De Jong, 2006). Specific sailing activities are high-repetition ac-

tivities such as grinding, top-handle winching, sail trimming, and steering (Neville and Folland, 2009). The forward flexed and rotated position of the spine during activities of grinding, pulling ropes, and trimming sails make yachters susceptible to low back pain (Allen, 1999). Helmsmen are affected due to steering the yacht for long periods of time. Studies on the America's Cup report a common theme of nonspecific overuse etiology: joint and ligament sprain and tendinopathies being the most common. Grinders and bowmen are at the highest risk of injury, with the repetitive nature of grinding as a contributing factor (Allen and De Jong, 2006; Hadala and Barrios, 2009a; Neville et al., 2010). Hadala and Barrios (2009b) determined that 76.6% of injuries were a result of overuse.

The results related to mechanisms of injury are shown in Table 4. Twelve participants (27.9%) answered that they watched or experienced 'falling overboard from slipping off the deck.' Eleven participants (25.6%) experienced bruises on legs from bumping against the cabin stairs. In addition, they had shin abrasions on their legs from colliding against the tiller (20.9%) followed by skin or joint problems. When we analyzed these mechanisms of injury, 'over-action' accounted for 42.9%, followed by 'insufficient practice' and 'insufficient skill' which both equally accounted for 19.0% of the entire responses among yachters (Table 3). The miscellaneous injuries described in Table 4 vary considerably. This list was developed from an open-ended question inviting yachters to note any other injuries suffered; however, it is likely to significantly underestimate the many minor injuries frequently sustained by recreational yachters. For example, minor skin burns and infections are often sustained. The results of many other research studies seem to support the results of this present study.

Among the seven injury types diagnosed by medical staff, contusions (33.3%) ranked highest. In response to how participants recovered from their injuries, most answered that they did so on their own (53.3%). The results of the study show that overaction and poor sailing techniques are the main causes of injury among beginner and intermediate yachters. It also suggests that regular practice and effort to improve skills are needed to prevent yacht-related injuries. Furthermore, it is important to develop an effective rescue procedure so that first-aid is provided immediately after an injury occurs. With regard to first aid performers, more effort is needed to encourage yachters to seek specialists for treatment so that further injuries can be prevented. Schönle (1998) showed that bleeding wounds (26.4%), contusions (22%), and fractures (17.6%) were very commonly reported during regatta sailing. Injuries were mainly caused by collision with the boom,

stumbling on the board, and jumping on the landing stage. It must not be forgotten that with the changing of tides, there is considerable variation of height between the water level and the level of the landing stage.

Yacht members involved with sail trimming require highly trained legs, trunk, shoulders, and upper arms. Grinders and other big-boat sailors should particularly focus on aerobic endurance as well as muscular strength, power, and endurance. Vangelakoudi et al. (2007) found that elite Laser sailors correlated strongly with maximal voluntary contraction of the quadriceps, isometric endurance, and tolerance of muscle fatigue. Yacht training may result in increased tolerance of aerobic exercise through decreased lactate production for a given heart rate and oxygen consumption. These training methods should especially be provided to beginner sailors, although these would also be useful to more experienced yachters. Injury prevention is best addressed in all sports through appropriate fitness training and proper care of previous injuries. Effective prevention programs involve a combination of flexibility, muscular mobility, and core stability. Moreover, ergonomic developments, particularly in big-boat designs, also holds potential for injury (Carmont, 2013). The goals of rehabilitation of a yachter dealing with conditions unique to sailing include: pain-free muscles, specifically trunk and lower leg muscles; resolution of edema; full range of motion in all of the joints; increased joint stability, balance, and proprioception; maintenance of fitness for sailing; and returning to pain-free sailing. Sailors of all classes and abilities seem to be at risk of injury particularly from acute impacts with equipment that may be mitigated by wearing protective clothing. Moreover, safe cruising across long distances requires a degree of self-sufficiency and a wide range of skills beyond handling the boat. Knowledge of topics such as navigation, meteorology, mechanical and electrical systems, radio, first aid, sea survival, nutrition and more are needed and can be life-saving when cruising to distant shores.

This study has several limitations. First, only KASA members were surveyed. Second, because participation in the study was voluntary, it is possible that the sample was skewed toward yachters who had sustained sailing injuries; thus, some injury rates may be overrepresented or underrepresented. Third, the sample size was small and represents only a fraction of the active recreational yachters in Korea.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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