ORIGINAL ARTICLE

TRENDS in
Sport Sciences
2019; **2**(26): 63-69
ISSN 2299-9590
DOI: 10.23829/TSS.2019.26.2-4

Back pain in Optimist sailors

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Abstract

Introduction. Back pain syndromes occur in 30-40% of kids and adolescents, aged 7-17 years, with prolonged sitting position or leisure time activities as usually mentioned possible causes. Sailing is a multifaceted sport, with relatively long periods of static positions and quasi-isometric muscle overload. Back pain in sailing results from either sailing it-self or from boat-related activities. Aim of Study. The aim of this study was to investigate the back pain epidemiology and etiology in Optimist dinghy sailing. Material and Methods. Eighty four optimist sailors (60 boys and 24 girls; 11 to 15 years) and their 18 coaches were surveyed, using 23 and 9 points questionnaires, respectively. Results. As much as 43% of analyzed Optimist sailors sensed back pain during the sailing season. Mainly thoracic and lumbosacral pain occurred during on-land boat-related activities and while sailing. On average, the sensed pain was occasional, lasting usually more than three months, of stabbing or radiating type and intensity of 2-6 on 10-point scale. Only six respondents underwent adequate physical examination and treatment. All trainers declared caring about their sailors' need for healthy development, however 85% of them do not recommend, as a recovery strategy, the use of physio- or kinesio-therapy, and 30% omit implementing special exercises related to spinal pain prophylactics and/or compensation. The trainers are not informed or informed occasionally about pain sensed by their trainees. Conclusions. There is the considerable need for the development of educational program of preventive and/or compensatory character to introduce in polish Optimist sports clubs.

KEYWORDS: sailing, youth, pain, boat-related activities.

Received: 24 March 2019
Accepted: 15 May 2019

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Introduction

In Optimist sailing class compete kids and adolescents aged 7-15 years. In this age group, around the adolescent growth spurt in particular, there is a significant variability in somatic and biological maturity between individuals [21]. Kids and adolescents, apart from school obligations, often participate in various additional indoor and outdoor activities, which may lead to positive benefits like e.g. learning practical skills, development of social confidence, social relationships or motivation to study on one side [8], but also to some adverse effects, with inappropriate posture development or pain syndromes of different origin [31]. Activities demanding prolonged sitting position (e.g. during learning, watching TV, playing computer games), participation in different sports, music (instrument playing) or dance activities are the only few possible causes of perceived back pain – especially of musculoskeletal origin [4, 10, 14, 24, 27]. Back pains are recently one of the major health problems and causes of pain-related functional limitations (during physical activity, sitting, learning) in youth, with syndromes usually increasing with age [13, 16, 31].

Sailing is a multifaceted sport, where sailors morphology, strength, physical and psychological endurance, as well as sailing technique and tactics play an immense role in sports success [1, 6, 7, 18]. During regatta sailor has to be simultaneously focused on the boat, weather conditions

and other sailors' maneuvers (during optimist regatta: up to 80 boats in one race). Due to specific yacht design Optimist sailors are defined as one-handed sailors and "dynamic hikers" (because of high sailor to yacht weight ratio) [2, 11]. Sailing is considered as endurance type of dynamic physical exercise, however there are – mainly during up-wind courses – relatively long periods of quasi-isometric hiking [3, 18, 20, 30]. Therefore, while maintaining the prolonged static positions physiological consequences occur – the muscle blood flow is limited (especially in quadriceps and hamstring muscles) and, as result, cardiac system is overloaded [11, 34].

In Poland Optimist sailing class is divided into two sub-groups, A: where finer and older (usually ≥ 12 years) sailors compete, and B: for younger and less experienced. While trainings and regatta all Optimist sailors are constantly dealing with numerous intrinsic and extrinsic risk factors for developing back pain. The severity of those factors differ in two sub-groups of Optimist sailing class.

Extrinsic risk factors for developing sailing-related musculoskeletal disorders are: varying water and wind conditions, amount of races during one day or regatta (A: 12-15; B: 6-9), distance covered, and race duration (A: 60 min; B: 40 min) [12, 26]. Intrinsic factors are more related to sailing it-self (hiking, sheeting and tacking) or boat-related activities (e.g. lifting, carrying, turning around and pulling the boat out of water), where musculoskeletal overstressing frequently occurs [3, 18, 20, 30]. The most overloaded, up to 87% of maximal voluntary contraction (MVC), are thigh (quadriceps and hamstrings), shin (tibialis anterior), lumbar and abdominal muscle [3, 5, 7, 20]. During hiking the non-physiological position of the head may also cause an overload to sternocleidomastoideus muscle. Hand, arm and shoulder muscles are under strain during sheeting (mainly in up-wind courses). Dependently on the weather conditions and the type of dinghy the elbow flexors work on average with 30% of predicted MVC, with peak forces up to 70% of predicted MVC [18].

In competitive sailing the acute injuries are rather rare and mainly limited to extremities (contusions, lacerations, sprains, fractures) with "trip/fall", "hit by object", and "caught in lines" as the most common mechanisms of injury [22, 28]. In Optimist class, the risk of sudden trauma primarily results from ergonomically poor, unexpected actions (e.g. sudden, uncoordinated tacking) performed due to unpredictable situation (human or environmental).

In competitive dinghy sailing there is a big likelihood of chronic injury development, primarily resulting from repetitive activities like hiking, where sailor has to withstand great overloads while counterbalancing the heeling moment (created by the wind that blows into the sail). The most common health-related complains in sailors are chronic pain of musculoskeletal origin resulting from cumulating muscle micro-tears or muscles' tension disbalance [28]. Musculoskeletal complaints, especially back and knee pain, are typical health problems of elite sailors [23]. Pain episodes usually occur during heavy-wind conditions, during dynamic hiking, and at the latter stages of an annual training cycle and/or sailing carrier [22, 28].

Pain is a distressing feeling, being a physiological symptom of an underlying disorder. However pain sensation weakens humans' physical and psychological condition, when it is of small intensity is usually ignored, self-treated and not reported to specialists [25]. When an underlying disorder is not treated properly the severity of trauma usually arises, additional side effects appear, and the pain becomes chronic. Therefore in sport, where there are repeated heavy training loads, it is of big importance to monitor the level of perceived pain, diagnose the pain-related circumstances, cure all health problems and implement adequate prophylactic activities. This is especially important in young athletes because pain, and its' causing health problem, when not treated appropriately may trigger the athletes' drop-out from competitive sport or lead to future health problems in senior sailing.

Therefore the aim of this study was to investigate the back pain epidemiology in Optimist dinghy sailing. The diagnosis of typical pain-related circumstances, prophylactic activities and the analysis of trainers' awareness of frequency and severity of pain sensed by athletes were the additional aims of the study.

Material and Methods

Eighty four Optimist sailors from polish group A and their 18 coaches were surveyed during main Regatta – Polish Youth Olympic Games in sailing (Zegrze, August 2017) and International Polish Championships organized by Polish Optimist Dinghy Association (PSKO) (Dziwnów, September 2017).

The anthropometric characteristics of young athletes (60 boys and 24 girls) are presented in Table 1. Due to big differences in participants age (11 to 15 years) and their biological development their height and body mass were very diverse: 142 to 173 cm and 32 to 58 kg, respectively.

Both surveys were self-prepared (available from authors) and consisted of closed questions with single or multiple

Table 1. Anthropometric characteristics of studied sailors (mean values)

Age categories(years)	11	12	13	14	15
Number of sailors	8	19	28	24	5
Height (cm)	150.88 ± 4.64	154.74 ± 5.65	160.57 ± 7.42	163.91 ± 7.29	166.90 ± 7.21
Weight (kg)	37.19 ± 3.91	42.55 ± 6.16	46.02 ± 6.62	47.28 ± 4.89	51.13 ± 4.15

choice answers; athletes were asked to answer 23 questions, while trainers only to 9 questions.
All data were analyzed and presented as a number of indicated answers or as percentage of positive answers among whole group of sailors or trainers.

Results

Sailors' survey
In order to objectively define their sports' level young sailors indicated the total number of regatta races they took part in throughout all sailing career: 0-200 races: 9 indications; 201-400 races: 34 indications; 401-600 races: 24 indications; 601-800 races: 11 indications; over 800 races: 6 indications. Fifty-six respondents subjectively defined their sports' level as experienced, 28 as professional sailors.
When asked about including the warm-up activities 72 respondents declared undertaking warm-up during the regatta (86% of the total), however the vast majority of sailors (55) performed it only before the first race. Only 17 sailors warm-up before first race and between consecutive ones.
During analyzed sailing season only 6 sailors suffered from injuries, with lower limbs contusions in 5, and arm injury in one. What is alarming, almost half of analyzed Optimist sailors (36 respondents; 43%) replied that during the sailing season they sensed back pain. All following results concerning the type, duration or causes of pain episodes were restricted only to this group of subjects.
Pain syndromes occurred in all aspects of sailors' daily routine: boat-related activities in bent position (21 indications), activities related to lifting, carrying, turning around and pulling the boat out of water (15 indications), hiking (17 indications), but also in activities of daily living (6 indications) and in the evening after training (5 indications).
The most frequently indicated location of pain was the thoracic spine (27 indications), followed by lumbosacral (17 indications). Some participants experienced the back pain in more than one location. The frequency of pain episodes was rare in 12 sailors, occasional in 21, and frequent in 3 respondents. Yet, twenty-seven Optimist sailors suffered from pain for more than three months: five experienced pain for 2-3 months, three for 1-2 months and only single one declared feeling back pain for 2-3 weeks.
The type of pain and its intensity are presented in Figures 1 and 2. The most frequently identified pain types were stabbing, radiating and strain pains. The back pain was predominantly of moderate intensity (2-6 degrees in 10-point scale), with two or four points intensity indication the most common.

Figure 1. Type of pain felt by Optimist sailors

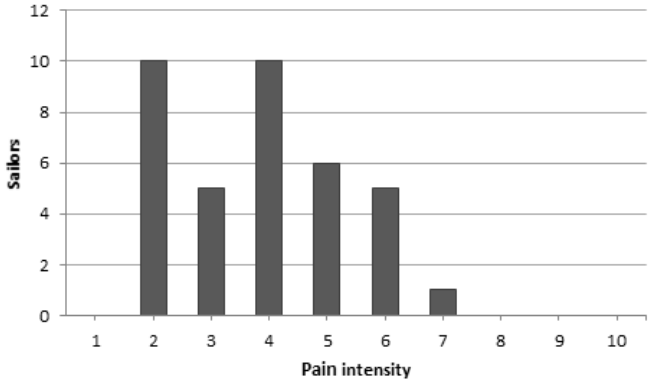

Figure 2. The sailors' evaluation of pain intensity on 10-point scale

First symptoms of back pain respondents felt or during sailing – mainly during hiking in strong (5-6 Bf) or moderate wind conditions (2-4 Bf) – or during land activities. Among activities intensifying their current back pain, 22 sailors marked maintaining static position

for prolonged periods of time, 12 indicated sailing and 8 pointed at work with equipment.
Only six out of 36 respondents, who suffered from back pain underwent physical examination and went through medical treatment during analyzed sailing season.

Trainers' survey
All surveyed trainers responded that when planning and realizing training they take into consideration their sailors' need for general, healthy development. Therefore, beyond shaping muscles specific for sailing and emphasizing the coordination skills, they use wide range of exercises to develop and strengthen all basic muscle groups.
When asked about recommended recovery strategies coaches indicated compensation of fluid and electrolyte losses (12 indications), rational diet (9 indications) and vitamin deficiency supplementation (5 indications). At daily basis polish Optimist trainers do not recommend, as a recovery strategy, the use of physio- or kinesio-therapy to their competitors (only 3 indications).
During the preparatory phase of the annual training plan twelve out of eighteen interviewed coaches implement special exercises strengthening spinal muscles, related to spinal pain prophylactics and/or compensation of typical for sailing uneven muscle strain. The other six coaches (30%) entirely omit this aspect in their training plans.
During analyzed training season only 11 trainers were informed that their sailors suffer from pain: mostly from back pain (9 indications) and lower extremities (8 indications). Coaches claim that pain complaints did not occur (8 indications), were occasional (7 indications) or seldom (5 indications).

Discussion
The main finding of our study is that the episodes of back pain frequently occur in Optimist class sailors under 15 years of age. Apart from back pain episodes triggered by dynamic hiking in difficult weather conditions (strong wind, high waves, long up-wind courses) there are numerous incidents of pain sensations while on-shore activities, mainly connected with boat-related actions. Young athletes rarely report back pain episodes and undergo medical examinations or treatments. Coaches are not always aware of existing or probable pain issue and not all of them implement prophylactic activities and/or encourage trainees to undergo adequate medical or physiotherapeutic treatments.
Recently more and more adolescents complain about having back pain. WHO Collaborative Cross-National survey estimated the prevalence of three forms of pain in 404,206 participants aged 9.8 to 17.3 years, and found that 37% of surveyed adolescents suffered from backache [31]. Another study, exploring the prevalence of spinal pain among 46,726 Danish children (11-14-year-olds, participating in the Danish National Birth Cohort) showed that severe spinal pain was reported by almost 10% of boys and 14% of girls, and moderate pain by 30% of analyzed children [13]. The potential causes of such tendency, compared to previous generations, are relatively weak muscles responsible for core stabilization and differences in day-to-day activities. Fast biological development and substantial morphological changes characteristic for adolescent growth spurt is usually connected with long school days and more hours spent in sitting position while both: learning/reading and leisure time activities, like watching TV, gaming, etc. [13, 31]. Yet, in children practicing sports, adolescence time frame is usually connected with scheduled increment of exercise intensity and training volumes. Same is in sailing sport – kids pass to group A in age of 12 or 13 years [26].
In sailing, back pain, a typical physiological symptom of some underlying disorder, is usually caused by physical overload resulting from either sailing it-self or from boat-related activities. What is alarming, nearly half of respondents sensed back pain in analyzed training season. Our study shows that majority of the respondents felt back pain while on-land activities connected with boat-related motions. Twenty one suffered during activities performed in bent position, fifteen during activities related to lifting, carrying, turning around and pulling the boat out of water. The Optimist dinghy's weight is 35 kg without a mast and sail, so the weight of all set nearly equals or even exceeds the body weight of a sailor [12]. When youth is not educated in terms of boat ergonomics, e.g. safe positions while cleaning, lifting, carrying or even sail adjustments, some adverse muscular tensions may arise. Static muscular strain while twisted and/or bent position, prevailing at such moments, causes faster muscular fatigue development, and therefore provoke the discomfort in back and neck muscles. In longer period of time it may lead to accumulation of micro-traumas of tendons, ligaments and muscles, resulting in sustained muscle pain sensation. Because the pain felt by young sailors was mainly of moderate intensity, stabbing character and occasional in frequency, it suggests its muscular origin (not nervous) and points to muscular physical overloading as the main cause.
While hiking, sheeting and tacking, in continuously varying wind and wave conditions, in order to control the balance of the vessel, sailor's body has to overcome

the boat's leeward tilting moment and the influence of the waves. Therefore it is not only counterbalancing the heeling force, generated by the wind on the sail (lateral balance), but also finding the longitudinal boat's stability [1, 3, 9, 19]. Prolonged maintenance of twisted upper body, short or long hiking positions and sustained hauling the sheets strains sailor's muscles, especially medial quadriceps, hamstrings, paraspinal muscles, abdominals, and the arm and hand muscles [7, 15, 20, 32]. There are many research done in elite Olympic classes sailors, which define their main health problems, with chronic back pain and knee join dysfunctions the most common [3, 23]. In our junior group of sailors back pain sensation occurring during hiking was indicated by 17 sailors (20%), with suggestion of strong or moderate wind intensity. In all sports, the poor technique and/or insufficient muscle strength usually lead to pain sensations. When analyzing the results obtained in Optimist class the following issues have to be considered: 1) the Optimist dinghy is not so physically demanding as senior sailing classes (e.g. Laser), 2) youth do not compete so often in very strong-wind conditions, 3) regattas are not so demanding, and 4) young tissues have greater regeneration potential. However, these young athletes, if thinking about continuing sports carrier, will soon be put in much more intensive training. So, there is a significant probability of future musculoskeletal overload intensification.

Our research showed that coaches declare implementing various forms of exercises strengthening all basic muscle groups (also in order to provide a comprehensive physical development of youth), and taking into account the specificity of sport by putting greater emphasis on motor coordination skills [6]. In Poland yearly training plan of Optimist sailors is divided, due to weather conditions, into two phases out-of-water training in the winter and sailing trainings during warmer months. Realization of mentioned declarations take place mainly during preparatory phase, in winter time. Majority of coaches (67%), as a completion to typical sailing strength and conditioning exercises [5] implement special exercises strengthening spinal muscles, related to spinal pain prophylactics and/or compensation of typical for sailing uneven muscle strain [17]. Six coaches however, omit such need in their training plans. The occurrence of back pain during boat-related activities and while sailing in respectively 25% and 20% of group A sailors, shows that there is not enough prophylactic actions undertaken (like more central stabilization and spinal muscles strength trainings, along with improvements in ergonomics of boat-related activities). Unfortunately we did not examine whether sailors sensing back pain are trained only by the coaches not implementing any prophylactic kinds of exercises. On the other hand not all of surveyed coaches know about the episodes of pain in their trainees, therefore the scale of the problem may be even bigger.

Sailors sensing back pain rarely report such incidents to their trainers. It might be due to ignoring the pain (rare or occasional frequency and moderate intensity of pain) and/or fear of losing trainings or regattas. Such situation is not a singular issue or related only to sailing sport. Whatman et al. [35], when investigating coach and player attitudes to injury in New Zealand's secondary schools, showed that as much as 87% of netball, football and basketball players reported hiding an injury to continue playing.

What is worrying, is that kids training sports, suffering from back pain in wide range of sailing-related activities, for longer periods of time, do not undergo adequate medical examinations and later treatments. Our results clearly show the considerable need for a collective dialogue between parents, coaches and young sailors on one side and medical doctors and physiotherapists on the other, in order to undertake suitable preventive or compensatory activities in future.

Apart from health problems of orthopedic origin dinghy sailing is also known of specific dietary problems [29, 33]. Because of spending up to 6 hours afloat, performing 4-5 one-hour races, usually in windy and sunny conditions, proper hydration and energy intake is endangered. Studies done in Optimist and Laser class sailors revealed that hypohydration and carbohydrate below recommendations for normal sports activity are typical for dinghy competitors [29, 33]. Such results are due to restricted consumption time (constant four-limb quasi-isometric activity required to stabilize the boat) and limited in-boat storage space to keep big amounts of food and fluids. However we did not measure sailors' nutrition and hydration status in this study, we asked their coaches what recovery strategies they recommended. Compensation of fluid and electrolyte losses was indicated by 12 coaches and rational diet only by 9 of them. Such results suggest the big need of further detailed research in this field of interest and, above all, inclusion of dietician into proposed dialogue, with rational recommendations about proper hydration and energy intake in young Optimist sailors. Implementation of science support program in 1994 by Yachting New Zealand for its elite dinghy sailors, during three following years, led to improved understanding and accomplishments in the areas of nutrition, psychology and physical conditioning [19].

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