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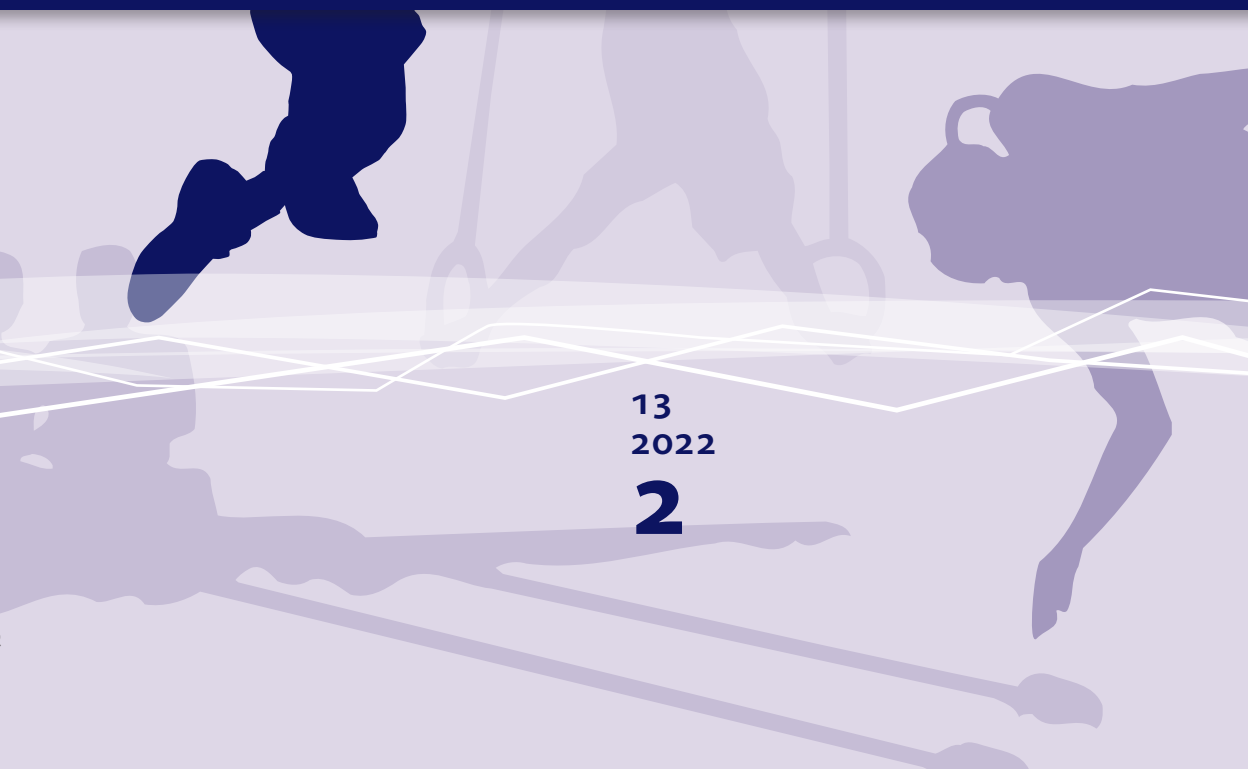

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EDITORIAL

Being physically active can improve your brain health, help manage weight, reduce the risk of disease, strengthen your bones and muscles, and improve your abilities in many everyday activities.

Professional athletes are well-known for the stress and strain they put on their bodies, and it is generally accepted that they will eventually suffer physical damage. However, as more male athletes report their personal experiences, more attention is being paid to mental health as well. Stress can be amplified in elite sports, and the pressures they experience in terms of competition and performance can be compounded by adverse life events. The fields of sport psychology and sport psychiatry are rapidly evolving and aim to understand, diagnose, treat and rehabilitate athletes. In this issue, we present a study that examined the prevalence of eating disorders and other behaviours in male and female Slovenian athletes relating to depressive symptoms and alcohol use. Significant differences were found between male and female athletes, and an association was found between eating disorders and depression.

The unique repetitive nature of ballet dance, which often exceeds the stress limits of anatomical structures, leaves dancers vulnerable to injury. This volume evaluates the effectiveness of physiotherapeutic and athletic interventions in treating injuries in ballet dancers.

In recent years, numerous studies have attempted to gather as much information as possible about the abilities and characteristics of young soccer players. Based on the results, most of the conclusions of previous studies that investigated the morphological characteristics of young soccer players can be confirmed. These results indicate that younger soccer players have lower absolute values of morphological characteristics compared to older players.

Outdoor adventure education programming is often referenced as an effective intervention that encourages a wide range of outcomes in participants such as increased confidence, independence and communication skills. But as outdoor adventure education continues to grow globally, what does the academic literature say about outcomes related to these programs? In this issue, you will find a summary of the academic literature on one of the major international providers of outdoor adventure education, Outward Bound. Fifty-four studies published between 1995 and 2019 have been summarized in this review. Recommendations are made for developing more rigorous methods for understanding the role of the physical environment in the learning experience and for using theoretical approaches to integrate outdoor adventure education into broader academic fields.

James Parkinson recognized that progressive Parkinson's disease (PD) is associated with debilitating postural instability and gait difficulty (PIGD) such as falls and freezing of gait. PD initially causes physical symptoms but later, problems with cognitive function, including forgetfulness and difficulty concentrating, may occur. As the disease worsens over time, many people develop dementia. For this reason, we are pleased to report on the activities of the TwinBrain Summer School "Neuroscience of Movement:

Exploring Brain Dynamics in Parkinson's Disease and Related Disorders", which was held in Piran, Slovenia in July 2022. Two other activities that we are presenting in this issue are the 4th International Conference on Technology Innovations for Healthcare (ICDHT), Magdeburg, Germany, and the annual "Knowledge for Health" event, traditionally organised for the general public by ZRS Koper and the Izola General Hospital.

Mihela Jurdana,
Editor

UVODNIK

Gibalna/športna aktivnost lahko izboljša delovanje možganov, pomaga uravnavati telesno maso, zmanjša tveganje za bolezni, okrepi kosti in mišice in izboljša številne sposobnosti vsakega posameznika pri vsakodnevnih dejavnostih.

Poklicni športniki so dobro znani po tem, da zelo obremenjujejo svoje telo, in v splošnem velja, da bodo sčasoma utrpeli telesne poškodbe. Ker vse več moških športnikov deli svoje osebne izkušnje, se vse več pozornosti namenja duševnemu zdravju v vrhunskem športu. Stres se lahko v vrhunskem športu dodatno poveča, pritisk, ki ga doživljajo v zvezi s tekmovanjem in uspešnostjo, pa lahko povečajo še neugodni življenjski dogodki. Področji športne psihologije in športne psihiatrije se hitro razvijata ter sta usmerjeni v razumevanje, diagnosticiranje, zdravljenje in rehabilitacijo športnikov. V tej številki med drugim predstavljamo raziskavo, ki je proučevala razširjenost prehranskih motenj in vedenja pri slovenskih športnikih in športnicah v povezavi z depresijo in zlorabo alkohola. Ugotovljene so bile pomembne razlike med športniki in športnicami ter povezava med motnjami hranjenja in depresijo.

Zaradi edinstvene ponavljajoče se narave gibov pri baletnem plesu, ki pogosto presega meje obremenitve anatomskih struktur, so baletnice in baletniki pogosto izpostavljeni poškodbam. V tej številki avtorji predstavljajo oceno učinkovitost fizioterapevtskih in kinezioloških obravnav pri zdravljenju poškodb baletnih plesalcev.

V zadnjih letih so številne raziskave poskušale zbrati čim več informacij o sposobnostih in značilnostih mladih nogometašev. Na podlagi rezultatov je mogoče potrditi večino ugotovitev prejšnjih raziskav, ki so proučevale morfološke značilnosti. Ti rezultati kažejo, da imajo mladi nogometaši v primerjavi s starejšimi nižje vrednosti morfoloških značilnosti.

Programi izobraževanja na prostem se pogosto omenjajo kot učinkovita intervencija, ki pri udeležencih spodbuja širok nabor rezultatov, kot so večja samozavest, neodvisnost in komunikacijske spretnosti. Ker pa trend izobraževanja na prostem globalno narašča, se avtor članka v tej številki sprašuje, kaj o rezultatih, povezanih s tovrstnimi programi, pravi strokovna literatura. V temeljitem preglednem članku boste našli povzetek strokovne literature o enem od glavnih mednarodnih ponudnikov izobraževanja na prostem Outward Bound. V pregledu je povzetih 54 raziskav, objavljenih med letoma 1995 in 2019. Navedena so priporočila za razvoj strožjih metod za razumevanje vloge fizičnega okolja pri učni izkušnji in za uporabo teoretičnih pristopov za vključevanje izobraževanja na prostem v širša akademska področja.

James Parkinson je ugotovil, da je progresivna Parkinsonova bolezen (PB) povezana z izčrpavajočimi značilnostmi posturalne nestabilnosti in težavami s hojo (PNTH), kot so padci in zamrznitev hoje. PB sprva povzroča telesne simptome. Pozneje se lahko pojavijo težave s kognitivnimi funkcijami, vključno s pozabljivostjo in nezmožnostjo koncentracije. Ko se bolezen sčasoma poslabša, se pri številnih ljudeh razvije demenca. Zato z veseljem poročamo o dejavnostih poletne šole TwinBrain Nevroznanost gibanja: Raziskovanje možganske dinamike pri Parkinsonovi bolezni in sorodnih motnjah, ki je

julija 2022 potekala v Piranu. Drugi poročili se nanašata na 4. mednarodno konferenco o tehnoloških inovacijah v zdravstvu (ICDHT), ki je potekala v Magdeburgu v Nemčiji, ter na vsakoletni dogodek Znanje za zdravje, ki ga za širšo javnost tradicionalno organizirata ZRS Koper in Splošna bolnica Izola.

Mihaela Jurdana,
urednica

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INJURY PREVENTION AND PHYSIOTHERAPY PROCEDURES FOR ANKLE INJURIES IN BALLET DANCERS: A LITERATURE REVIEW

Pia Lina VILAR[1], Tine KOVAČIČ[1], Mitja GERŽEVIČ[1,2]

[1]Alma Mater Europaea – ECM, Department of Physiotherapy
[2]MILLEO, Sports, Tourism and Education, Mitja Gerževič s.p.

Corresponding author:
Mitja GERŽEVIČ
Department of Physiotherapy, Alma Mater Europaea – ECM,
Slovenska ulica 15, 2000 Maribor, Slovenia
e-mail: mitja.gerzevic@almamater.si

ABSTRACT

The aim of this study was to investigate the most frequent, effective and up-to-date injury prevention and physiotherapy procedures used in relation to ballet dancers' ankle injuries. A literature review with a qualitative analysis was performed using the following databases: PubMed, SAGE, ScienceDirect, PlosOne and Cochrane Library. The inclusion criteria were: both genders, age > 18, journal impact factor > 0, age of study ≤ 10 years and the following search keywords were used: "ankle", "injury", "ballet", "dancers", "physiotherapy", "physical therapy" and "prevention". A total of 520 articles were found, out of which six were determined to be appropriate according to the inclusion and exclusion criteria. They dealt with the prevention/rehabilitation of ankle sprains (N=2), tendinopathy of the Achilles tendon (N=2), tendinitis of the m. hallucis longus (N=4), rupture of the Achilles tendon (N=2), and anterior (N=3) and posterior (N=4) impingement syndrome. It was found that for injury prevention in ballet, strengthening and stretching exercises are the most often used methods, while rest, ice therapy, muscle strengthening exercises, foot braces and dance technique optimisation are the most frequently used methods in injury management. These seem to also be the most up-to-date injury prevention and physiotherapy procedures, while the most effective procedures could not be retrieved due to a lack of relevant studies, which prevented the quantitative comparison of their effectiveness. The published clinical evidence endorses physiotherapy/kinesiotherapy as an effec-

tive ankle injury prevention and management modality in ballet dancers, although additional studies with a better quality of methodology are required.

Keywords: *rehabilitation, ballet, ankle, injury, physiotherapy, prevention*

PREVENTIVNA VADBA IN FIZIOTERAPEVTSKI POSTOPKI PRI POŠKODBAH GLEŽNJA BALETNIH PLESALCEV: PREGLED LITERATURE

IZVLEČEK

Cilj študije je bil raziskati najpogostejše, najučinkovitejše in najsodobnejše preventivne in fizioterapevtske postopke pri poškodbah gležnja baletnih plesalcev. Pregled literature s kvalitativno analizo je bil opravljen s pomočjo naslednjih podatkovnih baz: PubMed, SAGE, ScienceDirect, PlosOne in Cochrane Library. Pri tem smo uporabili naslednje vključitvene kriterije: oba spola, starost > 18 let, faktor vpliva publikacije > 0, starost študije ≤ 10 let ter naslednje iskalne ključne besede: »ankle«, »injury«, »ballet«, »dancers«, »physiotherapy«, »physical therapy« in »prevention«. Skupno smo našli 520 člankov, izmed katerih je bilo glede na vključitvene in izključitvene kriterije primernih 6 člankov. Ti so obravnavali preventivo/rehabilitacijo zvina gležnja (N=2), tendinopatijo Ahilove tetive (N=2), tendinitis m. hallucis longus (N=4), rupturo Ahilove tetive (N=2) ter anteriorni (N=3) in posteriorni (N=4) utesnitveni sindrom. Ugotovili smo, da se v preventivne namene najpogosteje uporabljajo krepilne in raztezne vaje, za fizioterapevtsko obravnavo poškodb pa počitek, terapija z ledom, vaje za krepitev mišic, nožne opornice in optimiziranje plesne tehnike. Slednji so kot kaže tudi najsodobnejši preventivni in fizioterapevtski postopki, medtem ko najučinkovitejših preventivnih in fizioterapevtskih postopkov ni bilo mogoče izluščiti, saj je bilo premalo študij za kvantitativno primerjavo učinkovitosti med postopki, kar nakazuje potrebo in možnosti za nadaljnje raziskovanje. Objavljeni klinični dokazi potrjujejo, da je fizioterapija/kinezioterapija učinkovito preventivo in kurativno sredstvo pri poškodbah gležnja baletnih plesalce, čeprav so potrebne dodatne študije z bolj kakovostno metodologijo.

Ključne besede: *rehabilitacija, balet, gleženj, poškodba, fizioterapija, preventiva poškodb*

INTRODUCTION

Classical ballet is considered a high-performance dance art form that requires an advanced level of technical skills (Campbell, Lehr, Livingston, McCurdy, & Ware, 2019). It demands from the dancer a similar level of development of motor and functional abilities and physiological characteristics as some top athletes have. Due to strict schedules and repetitive movements during exercise, training sessions and performances, where specific ballet movements are often performed with large amplitudes and in extreme positions at the limits of the range of motion, where muscles, tendons and other passive structures are weaker and thus more prone to injuries, ballet dancers experience relatively large loads on joints, muscles, tendons and ligaments. Therefore, they have an increased chance of acute and chronic injuries (Bickle, Deighan, & Theis, 2018; Leanderson et al., 2011; Nunes et al., 2019). Ballet dancers can jump up to 200 times in an hour and a half. The force acting on the lower limbs during jumps can represent up to 12 times their body weight, which increases the risk of injury to the lower limbs, especially the ankle (Steinberg et al., 2018).

Previous research has shown that the lower extremities account for the largest share (77%) of ballet dancer injuries (Bickle et al., 2018; Leanderson et al., 2011; Rietveld, 2013; Nunes et al., 2019). More specifically, ankle injuries account for up to 33% of all injuries (Ekegren, Quested, & Brodrick, 2014) in ballet, which, according to most authors, is also the most frequently injured body part in rhythmic gymnastics (Meeusen & Borms, 1992). In ballet, the most common of these injuries is the lateral sprain, which most often occurs during the landing phase or when rising to the tips of the toes, when the foot is less stable (Morton, 2013). In addition to ankle sprains, the following are common ankle injuries: fractures, Achilles tendinopathy, Achilles tendon ruptures, posterior and anterior impingement syndromes, and m. flexor halluces longus tendinitis (Kadel, 2014; Morton, 2013). A meta-analysis by Doherty et al. (2014) found that the female gender is a risk factor for lateral ankle sprain (LAS), with a cumulative incidence rate for females of 13.6 per 1000 exposures (95% CI: 13.25, 13.94). Conflicting evidence exists that previous LAS elevates risk for a subsequent LAS (Vuurberg et al. 2018). There is also conflicting evidence on the role of injury severity in the clinical course after a LAS, as well as weak evidence for primary injury prevention regarding the use of prophylactic balance training exercises in individuals who have not experienced a first-time LAS (Martin et al. 2021). Regarding the secondary prevention of recurrent LAS following an initial sprain, there is strong evidence that physiotherapists should use proprioceptive and balance-focused therapeutic exercise training programmes to address impairments identified during physical examination to reduce the risk of a subsequent injury in patients with a first-time LAS (Martin et al. 2021), yet there is a lack of evidence for the use of these interventions for ballet dancers. Vuurberg and colleagues (2018) reported that while there is evidence to support the use of exercises to prevent recurrent sprains, there is a lack of evidence to support the use of prophylactic exercises to prevent first-time ankle sprains and a lack of evidence to support the use of these interventions in professional ballet dancers. According to Vera

and colleagues (2020), their randomised controlled investigation of an injury prevention programme was the first of its kind for professional ballet dancers. Due to the high incidence of ankle injuries (Bickle et al., 2018; Ekegren et al., 2014; Leanderson et al., 2011; Rietveld, 2013; Nunes et al., 2019) and based on current Clinical Practice Guidelines (CPG) (Martin et al., 2021) there is conflicting evidence as to the best way to augment the components of rehabilitation programmes (e.g. by written instructions, exercise-based videos or app-based instruction) in patients with acute and post-acute ankle sprains and other injuries. The physiotherapist should determine what actions to take according to the individual's specific motor and functional abilities, learning needs and access to relevant treatment options such as proprioceptive and neuromuscular therapeutic exercises in order to improve dynamic ankle stability and patient-perceived stability during function (ballet training sessions and performances) in individuals with chronic ankle instability (CAI) in order to prevent further injuries. Although the CPG describe evidence-based physiotherapy practice, including diagnosis, prognosis, intervention, and assessment of the outcome of patients with ankle injuries commonly managed by orthopaedic or sports physiotherapists, there is a lack of evidence for the use of these approaches for professional ballet dancers due to extremely high demands on dynamic ankle stability. As Biernacki, Stracciolini, Fraser, Micheli, & Sugimoto (2018) established, there is no consensus in the literature regarding risk factors for ballet-related injury in females, despite the high prevalence of dance injuries among this group. This may stem from methodological inconsistencies including a lack of standard definition of injury, time loss and medical attention, and limited high-quality original studies. In the previous systematic reviews of studies which assessed the effects of the therapeutic alliance on the effectiveness of primary and secondary prevention strategies for ankle injuries there is a lack of evidence pertaining to the therapeutic alliance in rehabilitation of musculoskeletal conditions (Doherty et al., 2014; Vuurberg et al., 2018). Due to the heterogeneity of impairments and activity limitation experienced by individuals with LAS and CAI, methods should be tailored to the specific needs of the patient. Furthermore, intrinsic and environmental factors that mediate outcomes should also be addressed when prescribing treatments for individuals with LAS and CAI (Martin et al., 2021).

Therefore, it was the aim of this study to determine, through a literature review, the most up-to-date, most common and most effective prevention and physiotherapy procedures for ballet dancers' ankle injuries. Based on this, the following two research questions were posed: i) *"What are the state-of-the-art physiotherapy treatments for ankle injuries in ballet dancers?"* and ii) *"What are the most common and the most effective prevention procedures for ankle injuries in ballet dancers?"*

METHODS

Procedures

In this literature review, a qualitative research method was used. A compilation method was used to collect the most relevant original scientific and review articles and to describe and summarise their findings. The method of analysis and synthesis was used to analyse and integrate the facts already known in order to deepen the knowledge of the problem we identified in this literature review. The method of comparison was used to compare the different findings and conclusions of the collected articles in an attempt to arrive at the most common, effective and up-to-date preventive and physiotherapeutic procedures in the management of various ankle injuries in ballet dancers. The conclusion and findings were thus formulated using the method of deduction.

In the introduction, the known facts were described and the key concepts, problem, aim and research questions were defined based on a review of domestic and international literature as well as based on our professional experience in the field of classical ballet. The literature review was performed using the following specialised scientific databases: PubMed, SAGE, ScienceDirect, PlosOne and Cochrane Library, and the following keywords: "ankle", "injury", "ballet", "dancers", "physiotherapy", "physical therapy" and "prevention".

The search syntax was performed in four stages, using four combinations of keywords (search strings). The first search string was related to rehabilitation with the following combination of keywords used in all databases: "rehabilitation" AND "ballet" AND "dancers" AND "ankle" AND "injury", while the second one was related to prevention and was also used in all databases with the following keywords combination: "prevention" AND "ballet" AND "dancers" AND "ankle" AND "injury". Since there were no hits in the Cochrane Library using the previous two search strings, the next two were used in the Cochrane Library only, first "ballet" AND "injury" AND "prevention" and then "ballet" AND "dancer" AND "ankle" (Table 1).

The literature review included articles that dealt with professional ballet dancers over the age of 18, to avoid the influence of growth and development on the results. The focus was on the most up-to-date, most common and most effective prevention and physiotherapy procedures for ballet dancers' ankle injuries. All articles were first evaluated for adequacy based on title, then based on the abstract, then based on a quick full-text overview and finally based on the following specific inclusion and exclusion criteria. The inclusion criteria were: i) both genders, ii) age of dancers > 18 years, iii) professional ballet dancers with ankle injuries in rehabilitation, iv) prevention exercise for ankle injuries, v) age of the study ≤ 10 years, vi) publication impact factor > 0, and vii) articles accessible in full-text, while the exclusion criteria were other injuries of ballet dancers and/or no physiotherapy treatment and/or without ankle injury prevention exercises.

Data analysis

To facilitate editing and data collection, Microsoft Office Excel 2016 (Microsoft Corporation, New York, USA) was used and the results were presented with the help of tables and diagrams. The search process and the final selection of articles was performed and presented using the PRISMA diagram (Page et al. 2021). Also presented are all the physiotherapy procedures discussed in the studies. The content and characteristics of the studies found in the field of prevention exercises and physiotherapy for ankle injuries were qualitatively analysed and described in detail. On this basis, guidelines and practical examples of exercises and training methods for prevention of ankle injuries in ballet dancers were prepared.

RESULTS

Results of the search and selection procedure of articles

Based on search keywords and their combinations (search strings) in connection with ballet and ankle injuries of ballet dancers, we found a total of 520 articles in the research databases. Out of these, 30 were repeated in different databases, which gave a final total number of 490 articles. Of these, 130 matched by title, 60 by abstracts and 33 by quick full-text overview. Finally, there were 6 full-text articles on the defined topic matching also the inclusion and exclusion criteria. An overview of the search and selection procedure is presented in the PRISMA diagram in Figure 1, while the extended and detailed search results for individual databases using different search strings (syntaxes) are presented in Table 1. An overview of the finally selected articles' titles, journals' impact factors, field of study and injuries considered are shown in Table 2.

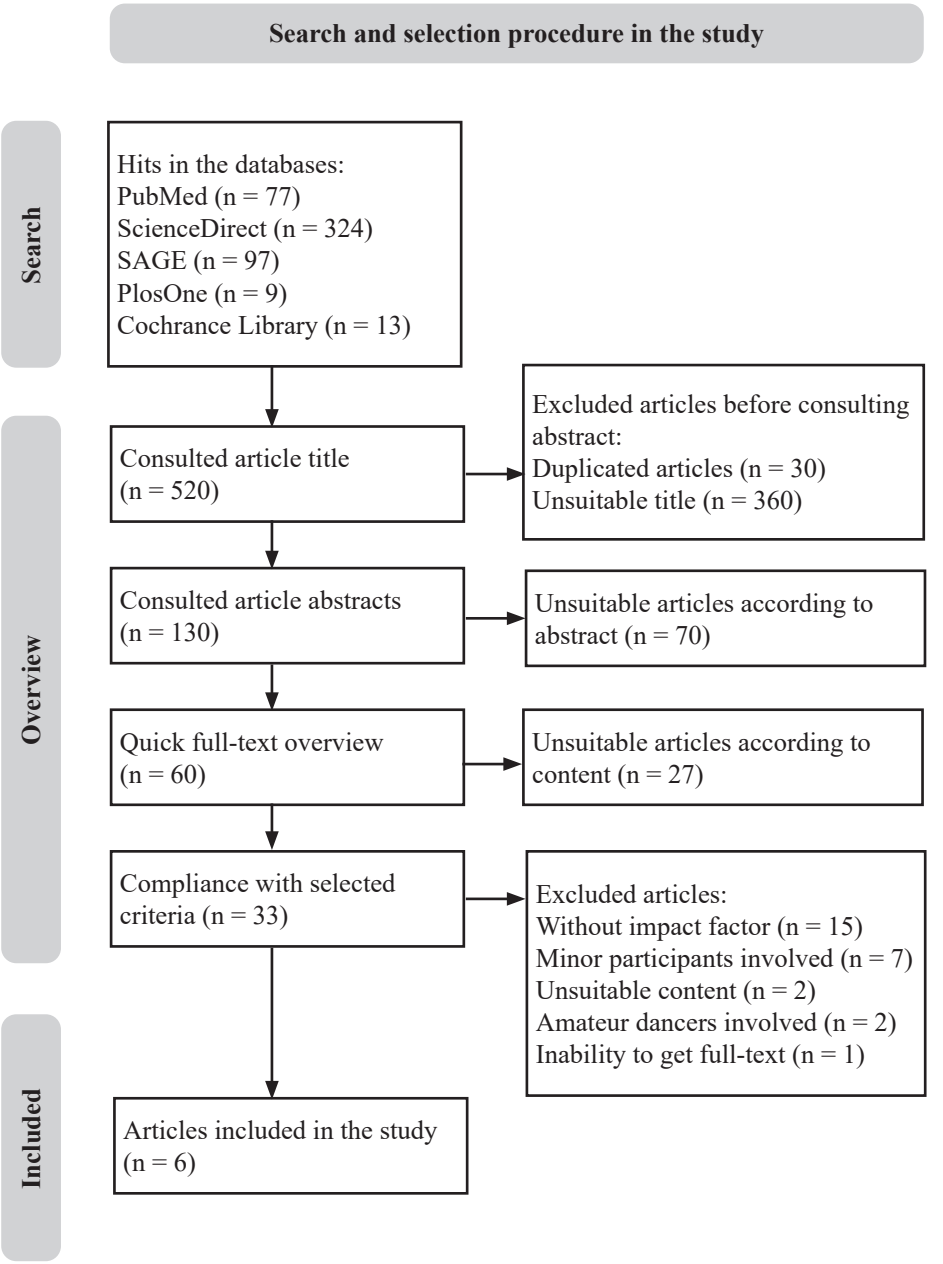

Figure 1: Search and selection procedure for the literature review

Table 1: Detailed search results across databases using different search strings (syntaxes)

No.	Search strings	Database	Total hits	Suitable articles by title	Duplicated articles	Suitable articles by title	Suitable articles by quick full-text overview	Suitable articles by impact factor	Suitable articles by the criteria and full-text
1	*"rehabilitation"* and *"ballet"* and *"dancers"* and *"ankle"* and *"injury"*	SAGE	42	7	1	5	5	0	0
		ScienceDirect	205	54	11	6	2	0	0
		Pubmed	31	17	0	14	8	6	3
		PlosOne	0	0	0	0	0	0	0
		Cochrane Library	0	0	0	0	0	0	0
			278	78	12	25	15	6	3
2	*"prevention"* and *"ballet"* and *"dancers"* and *"ankle"* and *"injury"*	SAGE	55	17	8	4	4	0	0
		ScienceDirect	119	34	3	13	5	2	1
		Pubmed	46	22	6	13	6	7	1
		PlosOne	9	2	0	1	1	0	0
		Cochrane Library	0	0	0	0	0	0	0
			229	75	17	31	16	9	2
3	*"ballet"* and *"injury"* and *"prevention"*	Cochrane Library	6	2	0	2	1	1	1
			6	2	0	2	1	1	1
4	*"ballet"* and *"dancer"* and *"ankle"*	Cochrane Library	7	5	1	2	1	2	0
			7	5	1	2	1	2	0
TOTAL			520	160	30	60	33	18	6

Table 2: Finally selected articles' titles, journals' impact factors, field of study, injuries considered and summary of studies' results

No.	Author (year of publication)	Title	Impact factor	Article type	Field of study (prevention, injury, rehabilitation)	Results	Ankle sprain	Ankle fracture	Achilles tendinopathy	Rupture of Achilles tendon	Posterior impingement syndrome	Anterior impingement syndrome	Tendinitis of flexor hallucis longus
1	Vera et al. (2020)	An Injury Prevention Program for Professional Ballet	2.492	Clinical study	Prevention (dance-specific injury prevention programme)	82% decrease in injury rate for the intervention group and an extended period from previous injury to subsequent injury.							
2	Morton (2013)	The virtuoso foot	1.774	Review	injury	1. Any injury to the foot and ankle will have a ripple effect further up the kinetic chain. 2. Any clinical examination should involve a global perspective. 3. Correct early diagnosis and treatment is vital to their physical, psychological and financial well-being. 4. When treating a dancer, the clinician should also be aware of the high tolerance for pain in this elite group of athletes.	x		x	x	x		x
					rehabilitation				x	x	x		x
3	Rietveld (2013)	Dancers and musicians' injuries	1.774	Review	injury	1. Unilaterally painful arabesque is a spondylolysis / stress fracture of the vertebral arch until proven otherwise. 2. Posterior ankle impingement, with or without tenovagnitis of the m.flexor hallucis longus is the most common dancers' injury. 3. The rule of thumb is to not operate on a hallux valgus in an active dancer or dance-teacher.					x	x	x
					rehabilitation						x		x

No.	Author (year of publication)	Title	Impact factor	Article type	Field of study (prevention, injury, rehabilitation)	Results	Ankle sprain	Ankle fracture	Achilles tendinopathy	Rupture of Achilles tendon	Posterior impingement syndrome	Anterior impingement syndrome	Tendinitis of flexor hallucis longus
4	Vosseller et al. (2019)	Ankle Injuries in Dancers	2.286	Review	injury	1. A team approach to treatment with knowledgeable physical therapists can obviate the need for surgical treatment. 2. If surgical treatment proves necessary, good results can be achieved with sound surgical technique and a well-thought-out rehabilitation programme.					x		x
					rehabilitation								
5	Kadel (2014)	Foot and Ankle Problems in Dancers	0.930	Review	injury	1. To keep dancers healthy, the health care team and the dancer must work together. 2. The physician must be an advocate for the dancer and work to provide an accurate diagnosis and an effective treatment strategy. 3. Monitoring performance and rehearsal load, fitness, and general health of the dancer will help to maximise the dancer's healing potential. 4. Correction of muscle imbalances, attention to proper technique, sequential skill progression, and proper shoe fit may help limit acute injuries to the dancer. 5. Creativity is needed to modify treatment plans to accommodate the dancer's need to maintain strength, flexibility, and fitness during recovery.	x		x	x	x	x	x
					rehabilitation		x		x		x	x	x

No.	Author (year of publication)	Title	Impact factor	Article type	Field of study (prevention, injury, rehabilitation)	Results	Ankle sprain	Ankle fracture	Achilles tendinopathy	Rupture of Achilles tendon	Posterior impingement syndrome	Anterior impingement syndrome	Tendinitis of flexor hallucis longus
6	Campbell et al. (2019)	Intrinsic modifiable risk factors in ballet dancers: Applying evidence-based practice principles to enhance clinical applications	1.926	Review	Prevention (risk factors and screening tools identification)	1. Identification of seven intrinsic modifiable factors specifically for ballet dancers and seven appropriate screening tools. 2. Intrinsic modifiable risk factors: hypermobility, fatigue, overuse, neuromuscular dysfunction, degree of turnout, weakness of core and lower extremity musculature, and lower extremity range of motion (ROM) discrepancies. 3. Appropriate screening tools: Movement Competency Screening (MCS), Beighton Hypermobility Scale (BHS), Rolling (to detect compensation and neuromuscular dysfunction), Star Excursion Balance Test (SEBT), Functional Agility Short-Term Fatigue protocol (FAST-FP), Slow Linear Oxidative Fatigue protocol (SLO-FP) and Total Passive Turnout (TPT).							

Results of the most common prevention and treatment procedures of ankle injuries in ballet dancers

The physiotherapy procedures discussed in the reviewed articles have been collected and arranged by individual types of injuries in Table 3. The review showed that the most common procedures in the treatment of ankle injuries in ballet dancers are the following: rest (Kadel, 2014; Morton, 2013), ice therapy (Kadel, 2014; Vosseller, Dennis, & Bronner, 2019), muscle strengthening (Kadel, 2014; Morton, 2013), night brace (Kadel, 2014; Vosseller et al., 2019) and optimising ballet technique (Morton, 2013; Kadel, 2014; Vosseller et al., 2019; Rietveld, 2013). For injury prevention purposes, mainly strengthening and stretching exercises are used, to which functional joint stabilisation and plyometric exercises can be added (Vera et al., 2020).

Results related to ankle sprain

Kadel (2014) states that the ankle sprain is the most common ballet injury. Most often, an inversion ankle sprain occurs (the foot turns inward). Conservative rehabilitation should thus include: a compression bandage, ice therapy, ankle brace, wearing good athletic shoes outside of ballet training and rest from training as long as the ankle is painful. Some sprains also require the wearing of a special therapeutic shoe, which the ballet dancer wears when walking and sleeping. It is recommended that dancers who have had multiple ankle sprains perform floor barre ballet classes, combined with pilates and gyrotonics training before returning to the ballet halls (Kadel, 2014).

Results related to Achilles tendinopathy

Morton (2013) states that Achilles tendinopathy occurs in both men and women and can be seen in many other dance styles as well. For conservative rehabilitation, both authors recommend rest, use of physiotherapy and careful active stretching of the Achilles tendon and triceps surae muscles. Kadel (2014) states that it is useful to add deep tissue massage, while Morton (2013) adds that it is also necessary to correct any incorrect ballet technique (e.g. foot tilt in the direction of pronation, incomplete landing) so that dancers avoid new injuries and, in their free time, to wear shoes that are large, wide, hard and supportive for the feet.

Results related to Achilles tendon rupture

Kadel (2014) and Morton (2013) state that Achilles tendon rupture occurs after the age of 30 and that the injury is more common in men than in women. Kadel (2014) adds that the rupture of the Achilles tendon is felt as a sharp pain and that the ballet dancer

Table 3: Physiotherapy and other procedures discussed in the articles included in the literature review

Author(s) (Year of publication)	Injury	Physiotherapy and other procedures
Morton (2013) Kadel (2014)	Sprain	Compression bandage, ice therapy, ankle brace, wearing good athletic shoes outside of ballet training and taking a rest from training, wearing a special therapeutic shoe, ankle and core strength exercises, sensorimotor training, range of motion (ROM) training, manual therapy (ankle mobilisation) and edema control
Morton (2013) Kadel (2014)	Achilles tendinopathy	Rest, physiotherapy, careful active stretching of the Achilles tendon and triceps surrae muscles, deep tissue massage and elimination of incorrect ballet technique
Morton (2013) Kadel (2014)	Rupture of Achilles tendon	There is no conservative treatment, as surgery is recommended
Morton (2013) Kadel (2014) Rietveld (2013) Vosseller et al. (2019)	Posterior impingement syndrome	Limiting painful activities, including stopping tiptoe dancing, physiotherapy (muscle strengthening and ankle mobilisation), eliminating improper ballet technique, ice therapy and anti-inflammatory medications
Rietveld (2013) Vosseller et al. (2019) Kadel (2014)	Anterior impingement syndrome	Avoiding ballet jumps, squats/demi-pliés; raising the heel with an insole in both ballet shoes and day shoes; physiotherapy (correction of incorrect foot posture) and the use of day and night braces.
Morton (2013) Kadel (2014) Rietveld (2013) Vosseller et al. (2019)	Tendinitis of m. flexor hallucis longus	Rest; discontinuing the use of ballet pointe, grand plié and jumps; physiotherapy, stretching the flexor hallucis longus; optimising dance technique; anti-inflammatory medications, ice therapy, ultrasound therapy; functional exercise; good everyday footwear and use of a night brace.
/	Ankle fracture	/

is unable to rise to half-toes or demi-pointe. An Achilles tendon rupture usually occurs during a rebound or eccentric load landing. It also means that the Thompson's test is positive. The authors do not mention conservative treatment, as surgery is recommended for this injury. Despite undergoing surgery, the dancer will be able to continue their dance career, but rehabilitation may take up to a year (Morton, 2013; Kadel, 2014).

Results related to posterior impingement syndrome

The authors describe posterior impingement syndrome or "dancer's heel" as a painful condition occurring due to the compression of soft tissues on the back of the tibiae and calcaneus during plantar flexion (Rietveld, 2013; Vosseller et al., 2019; Kadel, 2014; Morton, 2013). For conservative treatment, it is first recommended to limit ballet activity that is painful, including ceasing to dance on the toes (Kadel, 2014; Morton, 2013; Vosseller et al., 2019), as well as using physiotherapy, where muscle strengthening and ankle mobilisation (Kadel, 2014; Morton, 2013), eliminating incorrect ballet technique (Kadel, 2014; Vosseller et al., 2019) and using ice therapy and anti-inflammatory drugs (Vosseller et al., 2019). Rietveld (2013) recommends that if the condition does not subsequently improve, an injection of cortisol is used, which also acts as an anti-inflammatory drug (corticosteroid). If conservative treatment does not help, surgery is recommended (Rietveld, 2013; Vosseller et al., 2019; Kadel, 2014; Morton, 2013).

Results related to anterior impingement syndrome

Anterior impingement syndrome can be the result of hypertrophied (thickened) soft tissues or osteophytes at the anterior edge of the tibiotalar joint (Kadel, 2014). Kadel (2014) hypothesises that osteophytes are the result of repeated ankle sprains or microtraumas from extreme dorsiflexion and plantarflexion positions. In conservative treatment, Kadel (2014) recommends avoiding ballet jumps and squats/demi-pliés and heel elevation with insoles in both ballet shoes and day shoes. Physiotherapy should also include correcting incorrect foot posture. Using day and night splints can relieve pain and inflammation. If the pain persists, surgery is recommended (Kadel, 2014).

Results related to tendinitis of flexor hallucis longus

Flexor hallucis longus tendinitis injury is very common in dancers. This injury is also called "dancer's tendinitis" (Morton, 2013; Kadel, 2014; Rietveld, 2013). It is more common in the female population due to the repetitive movement from dorsiflexion (demi-plié) to plantarflexion (standing on the tips of the toes). For conservative treatment, it is recommended to rest and stop using ballet pointe shoes, stop performing grand plié and jumps (Kadel, 2014; Morton, 2013; Vosseller et al., 2019), use physi-

otherapy (Kadel, 2014), stretch the flexor hallucis longus, optimise dance techniques (Rietveld, 2013; Vosseller et al., 2019), use anti-inflammatory drugs (Kadel, 2014; Vosseller et al., 2019), ice therapy, ultrasound, functional exercise, good daily footwear and, if necessary, night braces (Kadel, 2014; Vosseller et al., 2019).

Results related to ankle fracture

Unfortunately, the ankle fracture was not mentioned in the analysed articles, nor was rehabilitation.

Results related to the prevention of ballet dancers' injuries

Out of all the retrieved articles, injury prevention exercises in ballet dancers were discussed by Campbell et al. (2019) and Vera et al. (2020) only. Campbell et al. (2019) identify seven different intrinsic modifiable risk factors for injury: i) hypermobility, ii) fatigue, iii) overuse, iv) degree of turnout, v) neuromuscular dysfunction, vi) weakness of core and lower extremity musculature, and vii) lower extremity range of motion discrepancies, which are all commonly present in the ballet population. The authors emphasise that much care must be taken when creating an injury prevention programme for ballet dancers and take into account the mentioned seven internal factors in order to avoid the most common ballet injuries.

Vera et al. (2020), however, addressed a general whole-body injury prevention programme for ballet dancers. The study was conducted on 39 professional dancers with 19 dancers in the control group (9 men and 10 women, average age 26.6 ± 4.0 years) and 20 dancers in the experimental group (11 men and 9 women, average age 25.1 ± 5.1 years). The dancers carried out the injury prevention programme 3 times a week. It included a total of 24 exercises, which were arranged in such a way that each training day included different exercises. The injury prevention exercise programme lasted 30 minutes per session over a period of 52 weeks. Dancers performed 10–30 repetitions or 15–45 seconds of each exercise in 2 to 3 sets with 30 to 60 seconds of rest between sets. When the exercises were no longer challenging enough for the participants the intensity was increased by carrying out more difficult variants of the exercises, using stronger elastics and free weights. The dancers carried out the injury prevention programme without supervision, however, they had supervision for as long as they needed. The results of this study showed an 82% reduction in injuries and a longer period of time passing before the reappearance of old or appearance of new injuries.

DISCUSSION

The aim of this literature review was to identify the most common, most effective and up-to-date injury prevention and physiotherapy procedures for ankle injuries in ballet dancers. The results of the review and qualitative analysis performed showed that, despite the small number of studies in this field, the research questions on the state-of-the-art physiotherapy treatments and the most common and effective prevention procedures for ballet dancers' ankle injuries could be at least partly answered.

Most of the articles were review articles (5 out of 6), which means that relatively few original scientific studies on prevention and physiotherapeutic procedures for ankle injuries have been performed in the last 10 years. This prevented the authors from directly answering the question of which prevention and physical therapy procedures are most effective. However, it was possible to identify the state of the art and the most common physiotherapy treatments and prevention procedures for ankle injuries in ballet dancers.

It was found that among all injuries, ankle injuries are the most common in ballet dancers and seven different ankle injuries were most commonly evidenced in the reviewed literature. These are ankle sprain, Achilles tendinopathy, rupture of the Achilles tendon, anterior and posterior impingement syndromes, tendinitis of m. flexor hallucis longus and ankle fracture. This is in accordance with earlier studies, where the incidence of Achilles, peroneal, flexor hallucis longus and tibialis posterior tendinopathies, ankle impingement, stress fractures and metatarsalgia was the highest in ballet dancers (Nilsson et al., 2001 in Sobhani, Dekker, Postema, & Dijkstra, 2012) or in theatrical dancers (Rovere et al., 1983 in Sobhani et al., 2012), as well as in running and soccer (Sobhani et al., 2012). Comparing the results of this literature review to studies in other sports, where most frequently studied are soccer, running and gymnastics, it has been similarly shown that the most frequently studied overuse injuries are Achilles tendinopathy (in 44% of studies) and tendinopathy of other foot and ankle muscles, such as toe extensors and flexors, the tibialis anterior and posterior, and peroneal tendinopathies, as well as plantar fasciitis and stress fractures (Sobhani et al., 2012). However, weak methodology and poor reporting were highlighted, especially lack of a clear case definition, description of assessment procedures and reporting sample characteristics (Sobhani et al., 2012), showing the need for more and better original scientific studies.

Regarding rehabilitation, the most frequently used modalities and/or interventions for the management of ankle injuries in ballet dancers are rest, ice therapy, muscle strengthening exercises, foot braces and dance technique optimisation. Of course, treatment of each individual injury has also some individual and specific modalities and procedures, as presented in Table 3. Interestingly, among all evidenced injuries, specific physiotherapy treatments for ankle fractures could not be found in this literature review, even though earlier studies identified stress fractures as one of the prevalent injuries in ballet and theatrical dancers as well as in athletes of other sports (Sobhani et al., 2012).

For ankle sprains, as the most common injury in sports, at the time of injury, Chen, McInnis and Borg-Stein (2019) first recommend the application of the Ottawa Ankle

Rules to assess risk of fracture and reduce unnecessary radiographs, since these rules represent highly sensitive tools for detecting fracture in the setting of acute ankle sprain. Further, they report that modalities, such as RICE therapy (rest, ice, compression and elevation), electrical stimulation, oral and topical nonsteroidal anti-inflammatory drugs (NSAID) and Tylenol do not accelerate recovery, but are reasonable interventions for short term pain reduction. They also suggest early mobilisation (manual therapy) after acute lateral sprain as it has been shown to improve ankle dorsiflexion, pain reduction and stride length and thus accelerate return to play. Besides this, the introduction of early neuromuscular training programmes, typically balance and proprioception tasks with recurrent voluntary or involuntary destabilisation during exercise showed to be beneficial in all athletes with ankle sprains to reduce the risk of recurrent sprains, since ankle joint position sense, muscle reaction time and functional outcome scores improve with such exercises (Chen et al., 2019). In addition, the same authors found that although neuromuscular training programmes are effective for the prevention of recurrent sprains, the evidence for reducing the rate of first-time ankle sprains is not so robust. In addition, non-rigid ankle bracing is recommended for 1 year after ankle sprain to prevent recurrent sprain. Finally, Chen et al. (2019) endorse surgical referral and consideration of stabilisation for cases of chronic ankle instability that do not respond to non-operative measures after concomitant pathologies have been ruled out.

The retrieved studies in this literature review and the presented physiotherapy modalities, procedures and/or treatments are also the most up-to-date ones for ballet dancers' ankle injuries, which are in line also with professional guidelines for physical therapy, medical and sports rehabilitation such as the Clinical Practice Guidelines (Martin et al., 2021).

Regarding the most up-to-date and effective prevention procedures for ankle injuries in ballet dancers, based on the only available study of Vera et al. (2020) it is clear that too little original scientific studies, especially randomised controlled investigations, have been performed in the last 10 years. Nevertheless, Vera et al. (2020) found out as much as an 82% reduction in injuries after a 52-week period of a whole-body prevention exercise, as well as longer period of time for the recurrence of old or occurrence of new injuries in ballet dancers. However, for all sports/athletes in general, Chen et al. (2019) recommend the introduction of early mobilisation after acute ankle sprain injuries and early (as soon as tolerated after injury) as well as preventive neuromuscular training programmes for reducing the risk of recurrence of ankle sprains, resulting in higher overall activity levels without increasing pain, swelling, or the rate of reinjury when compared with traditional RICE therapy (Bleakley et al., 2010).

On the other hand, due to lack of original scientific studies it was not possible to determine whether and which of these procedures are the most effective. To answer this question, we would need to quantitatively analyse, using meta-analysis, the results of the control and experimental groups before and after the intervention in a larger or more relevant number of original scientific articles/studies and compare the effect sizes of each intervention in these studies.

In addition to an injury prevention programme, which should be implemented by all ballet dancers regardless of age and gender, the authors believe that it is also necessary to reduce or limit the risk factors of elite/professional ballet injuries, as found out by Biernacki et al. (2018) and Campbell et al. (2019). These parameters are: alignment, poor lumbopelvic movement control, inappropriate transversus abdominis contraction, decreased lower-extremity strength, and poor aerobic fitness (Biernacki et al., 2018), and hypermobility, fatigue, overload, degree of leg opening, neuromuscular dysfunction, trunk and lower extremity weakness, and lower extremity range of motion commonly present in the ballet dancer population (Campbell et al., 2019).

This means that firstly, the duration of the ballet class could be reduced by focusing on the quality of the training and optimising the training techniques, means and methods used. This could reduce one of the essential training parameters that affects injuries, i.e. the extent or the volume of exercise (duration, number of repetitions, sets, etc.), which would affect both the onset of fatigue and the possibility of acute and chronic overuse injuries. Secondly, nutritional consultants or nutritionists should be involved in ballet institutions, as this would avoid injuries resulting from malnutrition or nutritional deficiencies, as well as too frequent nutritional disorders, especially among female ballet dancers (Obrul, 2020). Thirdly, as far as environmental conditions are concerned, the ballet dancers themselves have no influence on them, but the management of the ballet institution has and as such should ensure that the dancers have optimal and safe working or training conditions (e.g. suitable temperatures, the right choice of floor and work space). Ballet dancers are ultimately responsible for choosing suitable training/dance shoes – ballet pointe shoes, but also for choosing suitable everyday shoes, because the wrong ones can also cause certain micro-injuries, which over time can lead to other, more serious injuries. Unfortunately, the individual has no influence on certain causes or risk-factors, such as general accidents and anatomical factors. However, they have an influence on previous injuries or on their occurrence in the future, namely by following prevention guidelines and recommendations as much as possible in the given situation.

This literature review showed that in the future more original scientific studies based on different injury prevention programmes for the whole body or specific body parts, for instance for the foot and ankle, are needed or studies older than 10 years should be analysed. However, by analysing older studies, it would be inappropriate to consider the prevention procedures to be the most up-to-date.

In addition, future research should involve more professional ballet dancers so that the findings have less variance and greater statistical power. It would also be advisable for researchers to work with dance or ballet institutions so that ballet dancers would have injury prevention exercise programmes included in their daily or at least weekly schedules. In this way, a greater and more accurate insight into the effectiveness of injury prevention procedures could be achieved.

The findings of this literature review should also be tested with further studies to determine which physiotherapy and injury prevention procedures are the most appropriate and efficient in the treatment or prevention of ankle or other injuries in ballet dancers.

It would thus make sense to conduct randomised controlled clinical research to verify the success and effectiveness of specific injury prevention programmes in practice.

Limitations of the study

One of the major limiting factors of this study was the quite restrictive inclusion and exclusion criteria, which most probably significantly limited the amount of literature retrieved. Especially the age of the study and the impact factor, as could be seen from the PRISMA diagram in the Methods section (Figure 1).

CONCLUSION

In this literature review the most common, effective and up-to-date injury prevention and physiotherapy procedures for ballet dancers' ankle injuries were qualitatively analysed. It was found that ballet dancers experience a high incidence of ankle injuries, which is also the case in other sports, especially in soccer, running and gymnastics, yet there have been very few in-depth and original scientific studies on this topic in the last 10 years, with only one randomised controlled investigation in the field of prevention of ballet injuries in general. Due to the small number of retrieved articles, it was not possible to directly answer the question on what the most successful physiotherapy procedures for the treatment of ankle injuries in ballet dancers are. However, it was possible to determine the most up-to-date procedures that were used in the reviewed literature, which actually represent the general guidelines for treatment, regardless of where the injury occurs.

The most common procedures for treating ankle injuries in ballet dancers were shown to be rest, ice therapy, muscle strengthening, use of a night brace and optimising ballet technique (Morton, 2013; Kadel, 2014; Vosseller et al., 2019; Rietveld, 2013). For prevention purposes, mainly strengthening and stretching exercises are used, to which functional joint stabilisation and plyometric exercises can be added (Vera et al., 2020). Clearly, further high-quality research designs with a low risk of bias are necessary to further evaluate the effectiveness of specific prevention exercises programme and the optimal timing of the intervention for the prevention of ankle injuries in ballet dancers. Also, future studies are needed to validate this conclusion regarding injury prevention exercise programmes to properly and efficiently address future ankle injuries and to reduce the risk of a subsequent injuries in professional ballet dancers.

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DISORDERED EATING ATTITUDES, DEPRESSIVE SYMPTOMATOLOGY AND ALCOHOL CONSUMPTION IN YOUNG ATHLETES

Uroš PERKO[1], Maša ČERNELIČ-BIZJAK[2]

[1] Institute Mitikas, Slovenia
[2] University of Primorska, Faculty of Health Sciences, Slovenia

Corresponding author:
Uroš PERKO
Institute Mitikas,
Cankarjeva street 39, Mekinje, SI-1241 Kamnik, Slovenia
Phone: +386 31 828 782
E-mail: uros.perko@siol.net

ABSTRACT

Purpose: *The aim of the study was to investigate the prevalence of disordered eating behaviours and attitudes in Slovenian male and female categorized athletes in relation to depressive symptoms and their alcohol consumption.*

Methods: *The sample included 198 categorized athletes between 18 and 20 years of age. The Eating Attitude Test, the Center for Epidemiologic Studies Depression Scale, and the Alcohol Use Disorders Identification Test were used to measure disordered eating behaviours, level of depression, and alcohol use, respectively.*

Results: *Significant differences were found between female and male athletes, with female athletes reporting higher levels of disordered eating attitudes and depressive symptoms. 13.90% of athletes reported clinically significant eating disorder symptoms, 40% reported clinically significant depressive symptoms, and 10.50% reported risky alcohol use. Results also showed that athletes with higher eating disorder attitudes had higher depressive levels.*
Conclusion: *These findings have important practical value and point to the importance of building a professional team trained to recognize mental health problems in athletes in order to provide appropriate help.*

Keywords*: disordered eating behaviours, athletes, depression, alcohol consumption*

MOTENO PREHRANJEVANJE IN ODNOS, DEPRESIVNA SIMPTOMATIKA IN VNOS ALKOHOLA PRI MLADIH ŠPORTNIKIH

IZVLEČEK

***Namen**: Namen raziskave je bil ugotoviti razširjenost motenega prehranjevalnega vedenja med slovenskimi kategoriziranimi športniki in športnicami v povezavi s simptomi depresivnosti in uživanjem alkohola.*

***Metode:** V vzorec je bilo vključenih 198 kategoriziranih športnikov, starih od 18 do 20 let. Za merjenje motenega prehranjevanja, stopnje depresivnosti in uživanja alkohola so bili uporabljeni test odnosa do prehranjevanja, lestvica depresivnosti Centra za epidemiološke študije in test identifikacije motenj uživanja alkohola.*

***Rezultati:** Ugotovljene so bile pomembne razlike med športnicami in športniki, pri čemer so športnice poročale o višjih stopnjah motenega prehranjevanja in depresivnih simptomov. 13,90 % športnikov je poročalo o klinično pomembnih simptomih motenj hranjenja, 40 % o klinično pomembnih depresivnih simptomih in 10,50 % o tveganem uživanju alkohola. Rezultati so tudi pokazali, da so imeli športniki z več simptomi motenega prehranjevalnega vedenja višje ravni depresivnosti.*

***Zaključek:** Te ugotovitve imajo pomembno praktično vrednost in potrjujejo pomembnost oblikovanja strokovnega tima, usposobljenega za prepoznavanje duševnih težav in nudenja ustrezne pomoči športnikom.*

***Ključne besede**: moteno prehranjevalno vedenje, športniki, depresivnost, uživanje alkohola*

INTRODUCTION

In sports that emphasize leanness or a low body weight, especially in endurance, aesthetic and weight class sports, athletes adhere to rigid diets and strenuous exercise regimens to optimize performance. This may increase the risk of disordered eating behaviours and vulnerability to develop ED (Knapp, Aerni, & Anderson, 2014). EDs are serious mental disorders, characterized by an excessive preoccupation with food, body weight and figure, and are classified in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), or in the International Classification of Diseases (ICD-10; World Health Organization, 2018). To meet clinical criteria, the conditions must impair physical health or psychosocial functioning. The DSM-5 categorizes EDs into several specific types, including: Anorexia Nervosa (AN), Bulimia Nervosa (BN), Binge Eating Disorder (BED), Unspecified Feeding or Eating Disorder (UFED) etc. The aetiology of EDs is multifactorial, being influenced by genetic, environmental and psychological factors but also factors specific to the practicing of sport (Sanchis, Balmaseda, & Hidalgo, 2022). These factors are particularly present in some disciplines involving endurance, those that have weight categories, or where low weight is a competitive advantage and aesthetics are important (Sanchis et al., 2022; Joy, Kussman, & Nattiv, 2016; McDonald, Pritchard, & McGuire, 2019). Athletes face a unique set of ED risk factors related to sport participation, such as performance pressure, and injury (Bratland-Sanda & Sundgot-Borgen, 2013; Sundgot-Borgen & Torstveit, 2010).

In addition, teammates are also an important source of influence on athletes' eating attitudes and behaviours, and critical comments and body comparisons among teammates may promote disordered eating (Scott, Haycraft, & Plateau, 2019). This context might put athletes at risk for the development of pathological attitudes or behaviours, as seen in clinical ED. While research indicates an increase in ED point prevalence in the general population in recent years from 3.5% in 2000–2006 to 7.8% in 2013–2018 (Galmiche, Déchelotte, Lambert, & Tavolacci, 2019), the estimated prevalence of DE and/or EDs in athletes ranged from 0% to 19% in men and 6% to 45% in women (Reardon et al., 2019; Kristjánsdóttir, Sigurðardóttir, Jónsdóttir, Þorsteinsdóttir, & Saavedra, 2019; Ackerman et al., 2019), with higher prevalence compared to the general population (Martinsen & Sundgot-Borgen, 2013). Identifying eating disorders in this population is complicated (Chapa et al., 2018) and the nature of the relationship between athletic involvement and eating problems is still unclear.

However, athletes suffer from a number of negative effects on their health and performance related to their disordered eating behaviours (Joy et al., 2016), which can negatively affect the well-being of the athlete. More specifically, several findings showed a significant association between depression and eating disorders (Deepthi, Praveen, Chandrashekhar-Rao, Vincent, & Kishore, 2014), as depression is one of the comorbid illnesses of EDs (Godart et al., 2015; McIntyre & Calabrese, 2019), and the relationship is interrelated and bi-directional (Villamisar, Dattilo, & Pozo,

2012). Depression is manifested by a constant feeling of sadness and lack of interest in pleasurable activities, lack of energy, changes in appetite or weight, disruptive sleep disorders, anxiety, lack of attention, feelings of guilt and self-harm or suicidal thoughts. Some studies showed that depression leads to progression of eating pathology (Villamisar et al., 2012; Jones, Buckner, & Miller, 2014); in addition, improper nutrition and severe fasting can create chemical imbalances that play a significant role in causing certain types of depression (Sathyanarayana, Asha, Ramesh, & Jagannatha, 2008). In a study assessing depression in collegiate athletes over a 3-year period (Wolanin, Hong, Marks, Panchoo, & Gross, 2016) results showed that 23.7% of athletes reported clinically relevant depressive symptoms, with 6.3% reporting moderate to severe depression, similar to non-athletes.

The relationship between EDs and alcohol consumption has also attracted considerable attention as it is well known that EDs often co-occur with substance use disorders (SUD) (Fouladi et al., 2015). It has also been suggested that depressive symptoms are an underlying factor for the relationship between the clinical variables and the comorbidity between alcohol use and EDs, such as bulimia nervosa (Vaz-Leal et al., 2015). When considering alcohol consumption in the population of athletes, most studies have found that participation in sports is positively associated with alcohol use, and recent meta-analyses showed that the prevalence for alcohol misuse ranged around 19% (Gouttebarge et al., 2019), while some studies report less susceptibility to problematic alcohol consumption (Purcell, Rice, Butterworth, & Clements, 2020).

The serious health consequences of disordered eating behaviours and the short- and long-term consequences that can impair athletic performance, as well as the conflicting findings in the literature on ED in sport, argue for the need to further investigate the prevalence of disordered behaviours, related symptoms in athletes and its associated risk factors. For these reasons, the aims of the current study were: to examine the prevalence of disordered eating behaviours and disordered attitudes in male and female categorized athletes and to examine the relationships between eating behaviours and psychological dimensions such as depression and behavioural dimensions such as alcohol use, and to assess the difference between groups based on these variables.

METHODS

Study design

This study is a descriptive, correlational study with a cross-sectional design based on self-reporting. We used a non-random, purposive sample. To participate in the study, we invited athletes who were categorized in the year of the implementation of the research plan according to the standards for categorization of athletes established by the Olympic Committee of Slovenia. The inclusion criteria for participation in the study were: the age of the athlete between 18 and 20 years and the categorization of the at-

hlete at the beginning of the study. The exclusion criteria were either lack of consent to participate in the study or failing to complete the questionnaires. The athletes were contacted through the coaches of their clubs and national teams, who invited them to participate. All subjects voluntarily chose to participate in the study without compensation.

Participants

The participants were 198 categorized Slovenian athletes (according to the Olympic Committee of Slovenia, 2018). There were 120 male and 95 female athletes who participated in both individual and group sports and were between 18 and 20 years old. The average age of the athletes was 18.34 years with a standard deviation of 0.48 years.

Instruments and measurements

The evaluation protocol consisted of three self-reported measures to assess symptoms of disordered eating, depression, and alcohol consumption. Informed consent was obtained from the authors for the use of the questionnaires. We followed the ethical principles of using and adapting the questionnaires into the Slovenian language and carried out the intended methodological procedures of translation and adaptation.

The 26-item Eating Attitudes Test (EAT-26) is a commonly used tool to assess eating disorder risk and symptoms and concerns characteristic of EDs (Garner & Garfinkel, 1979). It is one of the most widely used screening instruments in the field of eating disorders, in both clinical and epidemiological studies, to assess a range of behaviours and attitudes toward eating, weight, and abnormal eating habits and concerns about weight (Garner, Olmsted, Bohr, & Garfinkel, 1982). It consists of a self-administered questionnaire with 26 items. Each item is a 6-point Likert scale ranging from "never" to "always" and is a valid instrument for examining and assessing the risk of an eating disorder. Twenty-six of the items make up the following three subscales: Dieting (13 items) assesses inadequate food intake and obsession with weight loss; Bulimia and preoccupation (6 items) assesses excessive eating with loss of control (binge eating) with vomiting and various thoughts and preoccupations with food and eating; the oral control scale (7 items) assesses self-control in food intake and environmental pressure for weight loss. The cut-off point proposed in the original 1979 version is 20. Scores above 20 indicate the need for further assessment by a qualified professional. Low scores (below 20) may nevertheless indicate serious eating problems, as denial of symptoms can be a problem in eating disorders. In the present study, the Cronbach's alpha coefficient was 0.82.

The Center for Epidemiologic Studies Depression Scale — CES-D (Radloff, 1977) was used to assess depression symptoms. This is a self-report assessment of symptoms associated with depression, such as restless sleep, loss of appetite, and loneliness. It contains 20 items rated on a 4-point scale with subscale scores ranging from 0 to 60,

with higher scores indicating a more severe symptom of depression. A total score of 16 or higher indicates clinically significant depression (Okun, Stein, Bauman, & Silver, 1996; Junge & Feddermann-Demont, 2016; Prinz, Dvorak & Junge, 2016). In this study, the Cronbach's alpha was 0.9.

The Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) was used to assess alcohol use. The AUDIT is a well-validated and reliable 10-item questionnaire developed by the World Health Organization (WHO) to identify individuals whose alcohol use has become hazardous or harmful. AUDIT -a total score of 8 and above has been shown to be a reliable indicator of hazardous alcohol-related behaviour. The AUDIT consists of three subscales that assess alcohol use (AUDIT-C; three items assessing frequency and quantity of alcohol use), symptoms of alcohol dependence (AUDIT-D; three items), and harmful consequences of alcohol use (AUDIT-H; four items assessing frequency of negative events). The subscale AUDIT-C is considered a sensitive indicator of alcohol use. In the present study, we use only the AUDIT total score ($\alpha = 0.81$) in the analyses.

Procedure

Data and contacts were obtained through the individual coaches and selectors of each national team and federation. Athletes who met the inclusion criteria received an email invitation to participate in the study with a detailed description of the research, goals, and objectives. The purpose of the study and procedures were explained in detail to all participants. The survey was completed electronically; the link was sent to participants' email addresses. This study was conducted in accordance with the guidelines of the Declaration of Helsinki. Ethical considerations such as anonymity, confidentiality, and voluntary participation were ensured in accordance with the Ethical Principles for Psychologists of the American Psychological Association. This study was approved by the National Medical Ethics Committee of Slovenia (KME, No. 0120-95/2018/6).

Statistical analysis

The data were edited in Microsoft Excel 2019 (Microsoft Corporation, Redmond, Washington, USA) and statistical analysis was conducted in IBM SPSS 20.0 (Statistical Package for Social Sciences Inc., Chicago, USA). Cronbach's alpha was calculated to assess internal consistency of the measurement instruments. Frequency distribution was calculated for descriptive variables, and averages and standard deviations were calculated for numerical variables. To determine the differences in studied symptoms between participants we used the Mann-Whitney U-test.

RESULTS

Descriptive statistics for the enrolled subjects (mean, standard deviation, skewness and kurtosis values) are presented in Table 1. The average score on the CES-D questionnaire was high, indicating possible more serious depressive symptoms. The average score on AUDIT and EAT-26 was relatively low. The results revealed that most of the data did not follow normal distribution, therefore non-parametric statistics were performed in further analysis. Moreover, correlational analysis with Spearman test was applied in order to explore the relations between the main variables. The eating attitude test (EAT-26) had a statistically significant positive correlation with depression, that is, as the scores in the subscales of depression increased, the attitude to eating worsened (Table 1).

Table 1: Descriptive statistics and correlations for study variables (n=198)

Variable	n	M	SD	Skewness	Kurtosis	1	2
1. EAT-26	180	9.05	8.88	1.95	5.24	-	
2. CES-D	198	15.59	9.83	0.99	0.87	0.44**	-
3. AUDIT	172	3.32	3.80	2.40	8.56	0.15*	-0.01

Note: *p<.05. **p<.01. ***p<.001.

Next, we found that 25.3% of the female athletes demonstrated problematic eating attitudes (EAT-26 > 20), and report clinically significant eating disorder symptoms (Table 2). The authors of EAT-26 give a cut-off point of 20, which helps identify individuals with clinically (in)significant eating disorder symptoms, with good sensitivity and specificity and high internal consistency (Garner et al., 1982). A score of 20 or above on the EAT-26 test indicates that further clinical investigation is needed. As shown in Table 2, 13.9% of athletes report clinically significant symptoms of eating disorders.

Moreover, a score above 16 on the CES-D may indicate a high level of depressive symptomatology, e.g. clinical depression, with good sensitivity and specificity and high internal consistency (Lewinsohn, Seeley, Roberts, & Allen, 1997). In studies (Armstrong & Oomen-Early, 2009; Junge & Feddermann-Demont, 2016; Prinz et al., 2016), the cut-off value of 16 points is most frequently used, while some studies (Nixdorf, Frank, Hautzinger, & Beckmann, 2013; Nixdorf, Frank, & Beckmann 2016) used a more conservative score value of 22 points. In this study, both values were considered. Moreover, the proportions of young athletes exceeding the cut-off value of 16 points on the CES-D test was very high, i.e. 40.9%. The highest score, i.e. CES-D ≥ 22, was observed in 25.2% of participants, which means that they very likely experience clinically significant depressive symptoms. In the results separated by gender, we can see

that 59.1% of women report experiencing clinically significant depressive symptoms, (CES-D ≥ 16). The highest score, i.e. CES-D ≥ 22, was reported by 38.6% of women. For men, 26.3% of respondents exceed 16 points, and 14.5% exceed 22 points or more.

The authors of the AUDIT test (Babor et al., 2001) give a cut-off point of 8, which helps to identify individuals with risky and harmful drinking patterns with good sensitivity and specificity and high internal consistency (Conigrave, Saunders, & Reznik, 1995). In this study 10.50% of athletes reported risky and harmful alcohol consumption and drinking patterns. The results, separated by gender, showed that 12.2% of men exceed AUDIT > 8, slightly less women, 8.1%.

Table 2: Results split across cut-off point relevant clinical categories

Variable/ total score	Male		Female		Total	
EAT-26	N	%	N	%	N	%
Low score	96	95.00	59	74.70	155	86.10
High score	5	5.00	20	25.30	25	13.90
CES-D						
Low score	81	73.70	36	40.90	117	59.10
High score	13	11.80	18	20.50	31	15.70
Severe score	16	14.50	34	38.60	50	25.20
AUDIT						
Low score	86	87.80	68	91.90	154	89.50
High score	12	12.20	6	8.10	18	10.50

In addition, the analysis revealed some statistically significant differences between the groups of male and female elite athletes, which are shown in Table 3. On EAT-26, female athletes scored statistically significantly higher than male athletes ($U = 5.012$, $p = 0.003$), indicating that female athletes are at higher risk for eating disorders. Females also achieve statistically significantly higher mean scores than males on the CES-D ($U = 6.707$, $p = 0.000$), thus reporting higher levels of depressive symptoms. On the AUDIT, there were no statistically significant differences in mean scores between genders ($U = 3.150$, $p = 0.135$).

Tabela 3: Comparison of male and female athletes on EAT-26, CES-D, and AUDIT questionnaires

	EAT-26			**Diference**	
	N	M	SD	U	p
Male	101	6.92	5.97	5.012	0.003*
Female	79	11.78	11.03		
	CES-D			**Diference**	
	N	M	SD	U	p
Male	110	12.58	7.80	6.707	0.000**
Female	88	19.36	10.80		
	AUDIT			**Diference**	
	N	M	SD	U	p
Male	98	3.47	4.37	3.150	0.135
Female	74	2.40	2.80		

DISCUSSION

The purpose of the current study was to examine the prevalence of disordered eating behaviours and attitudes in male and female categorized athletes and to examine the relationships between eating behaviours and psychological dimensions such as depression and behavioural dimensions such as alcohol use. The serious health consequences of eating disorders, depression, and alcohol abuse, as well as the short- and long-term consequences that can impair athletic performance, point to the need for further investigation of these risk factors in athletes.

We found a significantly increased prevalence of pathological attitudes or behaviours as seen in clinical eating disorders. As many as one quarter (25.30%) of young female athletes reported behaviours and attitudes related to food, weight, abnormal eating habits, and concerns about weight that indicate risk for an eating disorder, as well as symptoms and concerns characteristic of EDs. Among male athletes, this percentage is much lower at 5%. Lower scores may still be associated with severe eating disorder symptomatology, as symptom denial can be a major problem in eating disorders (Garner et al., 1982). Therefore, some authors use a cut-off point of 10 (Rosendahl, Bormann, Aschenbrenner, Aschenbrenner, & Strauss, 2009). These findings are consistent with the known fact that women are affected by ED to a greater extent than men (Keel & Forney, 2013; Kristjánsdóttir et al., 2019). Furthermore, reports of ED prevalence in sport worldwide vary by gender, sport, and level of competition from 0% to 19% in male athletes and 6% to 45% in female athletes (Bratland-Sanda & Sundgot-Borgen,

2013). However, the question of whether athletes really represent a subgroup at risk of developing an eating disorder remains controversial.

Moreover, the results of this study showed a significant association between increased attitudes toward EDs and depression symptoms. These results are consistent with those of other studies showing that depression is significantly associated with eating disorder (Deepthi et al., 2014; Manaf, Saravanan, & Zuhrah, 2016; McIntyre, & Calabrese, 2019; Wolanin et al., 2016). 40% of all participating athletes exceed the cut-off point of 16 on the CES-D. Of particular note is the percentage of 59.10% of young categorized athletes who have clinically significant depressive symptoms. Even when using a more conservative cut-off point of 22, the number is still extremely high, with 38% of young athletes exceeding the above cut-off point. Of concern is the fact that more than half of the young female athletes and slightly more than a quarter of the young male athletes showed clinically significant symptoms of depression. Compared to other studies, our athletes showed clinically significant symptoms of depression (CES-D $\geq$ 16) more frequently than athletes in other studies (Armstrong & Oomen-Early, 2009; Junge & Feddermann-Demont, 2016; Nixdorf et al., 2013; Prinz et al., 2016). In the aforementioned studies, the percentage of athletes exceeding 16 points on the CES-D ranges from 12% to 20%, and the mean scores range from 8 to 12 points. The results also showed some differences in reported depression symptoms related to gender. Similar to other studies, our female athletes were more likely to report significant depressive symptoms and achieved higher mean scores than men. In a well-designed study (Wolanin et al., 2016) using the CES-D scale to assess depression in 465 athletes over a 3-year period, it was found that females had the highest rates of depression on the CES-D scale. They also found that 23.7% of athletes reported clinically relevant depressive symptoms, with 6.3% reporting moderate to severe depression, similar to non-athletes (Wolanin et al., 2016).

The scores obtained in our study on the AUDIT questionnaire were not high. The average score for the participants was 3.01. However, it should be noted that still 10.50% of the participants obtained a score higher than 8 points on AUDIT, among them 12.20% of male athletes and 8.10% of female athletes. The percentages may not seem high, but great caution must be taken when interpreting them, as the issue of excessive alcohol consumption, harmful patterns, and alcohol dependence is very complex and sensitive. If we consider the three facts, first that participants do not usually report actual amounts and that we can usually add one point to each score (Babor et al., 2001); second, that alcohol has different effects depending on age and gender, so that the cut-off point for women and adolescents is often recommended at 7 rather than 8, leaving the determination of the cut-off point to judgment even by national and cultural standards; and third, that any time when young people drink alcohol is a risky drinking pattern (Sorko & Boben, 2014). Based on what has been written we can assume that the observed average scores are not particularly low. However, considering the low age of the athletes in our sample, the results are concerning. Importantly, four participants reported a value higher than 17 points. However, this is a value that may already indicate alcohol dependence syndrome.

Different authors (Brenner & Swanik, 2007; Diehl, Thiel, Zipfel, Mayer, & Schneider, 2014; Dunn, Thomas, Swift, & Burns, 2011; Dunn & Thomas, 2012; Du Preez et al, 2017; Lakasing & Mirza; 2009; Lisha & Sussman, 2010; Lorente, Souville, Griffet, & Grélot, 2004; O'Brien, Ali, Cotter, O'Shea, & Stannard, 2007; Peretti-Watel et al., 2003) indicate a positive association between sport participation and alcohol consumption, and that alcohol consumption among athletes is often risky and can lead to dependence. Based on our results we cannot conclude that there is a positive association between sport participation and alcohol consumption.

Regarding the difference between our population and the general population of 18–20-year-old young adults, it should be noted that comparison is difficult because diagnostic and screening methods are different. Globally, it is estimated that 12–50% of college students have at least one diagnostic criterion for one or more mental disorders (Bruffaerts et al., 2018). Studies conducted on different samples of college students have found a moderate to high prevalence of depression in this population (Al Bahhawi et al., 2018, Ramón-Arbués et al., 2020). In the study conducted with 1210 participants in 194 cities in China using online questionnaires, 69.7% of participants were found to have normal depression, 13.8% had mild depression, 12.2% had moderate depression, and 4.3% had severe or extreme depression (Wang et al., 2020). Another recent study found that of the participants, 47% had minimal depression symptoms and 5% had severe depression symptoms (Ustun, 2021). In our study, the response rate (exceeding the cut-off value) for depressive symptoms was very high, 40.90%. In a study of Hong Kong college students using AUDIT (n = 345), 35.4% scored 8–15 points and 7.8% scored 16–19 points, and 0.9% scored 20 or more points (Chow, Ling Poon, Lui, Chan, & Lam, 2021). An Australian study reported an average AUDIT score of first-year college students of 10.79 (Corney & du Plessis, 2022), compared with our result, i.e. 3.01. Worldwide, many epidemiological studies have been conducted on ED with different prevalence rates. In India, among 1600 students aged 15–25 years, 10.6% of the total population had high EAT -26 scores (Nivedita, Sreenivasa, Rao, & Malini, 2018). The prevalence scores from our study (13.90% with high score in EAT-26) are higher than this report. Another study (Syed et al., 2018) conducted on 250 adolescent college students in Pakistan found that 29.2% of young girls had EAT-26 scores of 20 or higher.

It should be emphasized that it is not necessarily the case that elite sport and its demands are factors that directly cause the occurrence and frequency of symptoms of certain mental health problems (Perko, 2021). Sport, for example, can act as a positive factor that alleviates the unpleasant symptoms of mental disorders, and as such is only a training ground where latent or pre-existing problems can manifest themselves. Of course, to confirm this assumption, a long-term study would have to be conducted.

CONCLUSION

The findings of the present study suggest that the percentage of young athletes presenting clinically significant symptoms of eating disorders, depression, and risky alcohol consumption is high. Male and female athletes reported clinically significant symptoms of depression in 40.90%, clinically significant symptoms of eating disorders in 13.90%, and risky and harmful alcohol abuse in 10.50%. It is important to treat and recognize the symptoms and build a professional team trained in recognizing mental problems in athletes in order to provide adequate help.

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BODY COMPOSITION OF YOUNG SOCCER PLAYERS

Erol KOVAČEVIĆ[1], Denis ČAUŠEVIĆ[1], Seth SPICER[3], Siniša KOVAČ[1], Ivor DODER[1], Slavenko LIKIĆ[1], Boris METIKOŠ[2]

[1]University of Sarajevo, Faculty of Sport and Physical Education
[2] University of Applied Sciences, Zagreb
[3] Rowan University School of Osteopathic Medicine, Stratford, New Jersey, USA

Corresponding author:
Denis ČAUŠEVIĆ, PhD
Faculty of Sport and Physical Education, University of Sarajevo, Bosnia and Herzegovina,
Patriotske lige 41, 71000 Sarajevo, Bosnia and Herzegovina
E-mail: denis.causevic@fasto.unsa.ba

ABSTRACT

Purpose: *The main aim of this study was to examine and analyse the body composition of young soccer players across different age groups.*

Methods: *A cross-sectional study was carried out among 126 young soccer players divided into age categories: U15 – 53 players (age=14.68±0.47); U17 – 51 players (age=16.47±0.50); U19 – 22 players (age=18.05±0.38). The subjects' height was measured using an anthropometer, while their body composition was measured using the TANITA BC-420MA digital scale.*

Results: *On average, soccer players in the U15 group had significantly lower body height, weight, body mass index and fat free mass than U17 and U19 players, but had a higher percentage of body fat ($p < 0.05$). In addition to the percent of body fat mass, which tends to significantly decrease with age, the results also demonstrate significant non-linear increases in body height, weight, and lean body composition concurrent with the players' ages.*

Conclusion: *These results indicate that younger soccer players have lower absolute values of morphological characteristics compared to senior players.*

Keywords: *BMI, anthropometry, fitness, body fat, soccer*

TELESNA SESTAVA MLADIH NOGOMETAŠEV

IZVLEČEK

Cilj: *Glavni cilj te raziskave sta bili proučitev in analiza telesne sestave mladih nogometašev v različnih starostnih skupinah.*

Metode: *Med 126 mladimi nogometaši, razdeljenimi po starostnih kategorijah U15 – 53 igralcev (starost = 14,68 ± 0,47) –, U17 – 51 igralcev (starost = 16,47 ± 0,50) – in U19 – 22 igralcev (starost = 18,05 ± 0,38) –, je bila izvedena presečna študija. Telesna višina vseh udeležencev je bila izmerjena z antropometrom, telesna sestava pa z digitalno tehtnico TANITA BC-420MA.*

Rezultati: *Nogometaši iz skupine U-15 so imeli v povprečju bistveno nižjo telesno višino, težo, indeks telesne mase in maso brez maščobe kot igralci U-17 in U-19, vendar so imeli višji odstotek telesne maščobe ($p < 0,05$). Poleg odstotka telesne maščobne mase, ki se s starostjo značilno zmanjšuje, rezultati kažejo tudi značilno nelinearno povečanje telesne višine, telesne mase in puste telesne sestave, sočasno s starostjo igralcev.*

Zaključek: *Ti rezultati kažejo, da imajo mlajši nogometaši nižje absolutne vrednosti morfoloških značilnosti v primerjavi s starejšimi.*

Ključne besede: *ITM, antropometrija, telesna pripravljenost, telesna maščoba, bioelektrična impedanca*

INTRODUCTION

Soccer is one of the most popular sports today, played by men, women and children all over the world. In the last few years, numerous studies have tried to gather as much information as possible about the abilities and characteristics of young soccer players (Čović et al., 2017; Nikolaidis et al., 2016; Castillo, Yanci, Cámara, & Weston, 2016; Figueiredo, Gonçalves, Coelho e Silva, & Malina, 2009), with the aim of achieving better planning and programming of sports training, but also of higher-quality selection. Studies have confirmed the importance and role of body composition as one of the key indicators of physical fitness and general health of athletes in soccer (Mala, Maly, Zahalka, & Hrasky, 2015). Body composition provides us with an athlete‘s detailed physiological profile (Mala et al., 2015), which is considered one of the key elements of the soccer game because it greatly affects the possibility to complete 90 minutes of competitive play. Researching the influence of body composition on player performance in soccer is particularly complex, because success in the game depends on how the individual characteristics of 11 players come together to form a dynamic team. Previous research has pointed to the negative effects of excess adipose tissue, considering that it acts as dead weight in activities during which the body’s mass must be repeatedly raised against gravity during locomotion and jumping (Reilly, 1997; Talović et al., 2018), which ultimately leads to reduced performance and increased energy requirements in the soccer game. In contrast, a high percentage of fat-free mass is a desirable indicator given that it contributes to the production of power during high-intensity activities such as soccer. Body composition data can be an indicator of an athlete’s nutritional state; moreover, it can provide information on current body fluid homeostasis (Andreoli et al., 2003). Andreoli et al. (2003) state that the assessment of intracellular and extracellular mass is one of the best predictors of muscle efficiency that can ultimately predict physical performance. Changes in body composition, such as an increase in lean mass or a decrease in fat-free mass, can therefore be expected to improve a player’s performance in regards to the specific speed and agility demands experienced during a soccer game.

It has been proven that age influences physical performance, especially in young people, because of its strong relationship to the growth of individuals and their level of experience (França et al., 2022; Mroczek, Golachowska, & Kaczorowska, 2022). However, to date there has been little research on the body composition trends of adolescent soccer players (U15, U17 and U19). This information is of great interest for coaches, especially when it comes to optimizing and selecting training programmes that can improve players‘ long-term development. Therefore, the aim of this study was to examine and analyse the body composition of young soccer players across different age groups.

METHODS

Sample of subjects

This cross-sectional study included 126 young soccer players. Players were categorized by age categories: U15 – 53 players (14.68±0.47 years); U17 – 51 players (16.47±0.50 years); U19 – 22 players (18.05±0.38 years). All participants had competed at the regional level in Bosnia and Herzegovina. The testing was conducted at the Institute of Sport at the University of Sarajevo by the Faculty of Sports and Physical Education. The protocols were carried out by qualified personnel of the research team. Participation in this study was voluntary, all players and their parents were fully informed verbally and in writing about the demands and nature of the study, and written parental consent was obtained for all participants.

Body composition

Body height in all subjects was measured with a possible error of 0.1 cm using an anthropometer (Holtain 610, Crymych, United Kingdom), and body composition was measured using the Tanita scale (Tanita BC-418, Tokyo, Japan). The measurements took place early in the morning (09:00) for three consecutive days. A group of 40 to 45 players was evaluated each day and the average time between the first and last review was approximately 35 minutes. At the time of evaluation, participants were in a fasted state and wore only their underwear. During the testing procedure all participants were barefoot with their arms held nearly 45° from their trunk. Body composition variables included: body mass (BM), body mass index (BMI), body fat percentage (BF%), fat mass (FM) and fat-free mass (FFM) (Kapo et. al., 2018).

Statistical analysis

Descriptive statistics were presented as means ± standard deviation (Mean±SD). Normality and equality of variance of the variables were assessed using a Shapiro-wilk test. A one-way analysis of the variance (ANOVA) and post hoc comparisons using the Bonferroni adjustment were conducted to investigate differences in age and body composition between groups. All data were processed using IBM SPSS Statistics software 22.0 (SPSS Inc., Chicago, IL, USA). The significance level was set at $p \leq 0.05$.

RESULTS

The variables for body composition (U15, U17 and U19) of subjects are shown in Table 1. The results of the one-way ANOVA between groups suggest significant differences in body composition. The U15 group had significantly lower body mass ($F = 29.308$, $p \leq 0.01$); body height ($F = 42.636$, $p \leq 0.01$), greater BF% ($F = 15.003$, $p \leq 0.01$), and lower FFM ($F = 39.543$, $p \leq 0.01$) than their older peers. In terms of FFM, the U17 group also had a significantly lower mean value than the U19 group (Table 2).

Table 1. Results of descriptive parameters of U15, U17 and U19

	U15 (n=53)	U17 (n=51)	U19 (n=22)	ANOVA	
	Mean±SD	**Mean±SD**	**Mean±SD**	**F**	**p**
Age [years]	14.68±0.47	16.47±0.50	18.05±0.38	687.822	**.000***
BM [kg]	53.61±7.85	61.52±9.80	69.43±6.28	29.308	**.000***
Height [cm]	165.14±6.48	174.55±7.38	179.22±6.01	42.636	**.000***
BMI [kg · m^{-2}]	19.72±2.35	19.91±2.85	21.65±1.43	5.121	**.007***
BF [%]	13.48±5.29	9.77±2.84	8.86±2.98	15.003	**.000***
FM [kg]	7.45±3.82	6.22±2.69	6.20±2.21	2.348	.100
FFM [kg]	46.21±5.76	54.32±10.03	63.22±5.70	39.543	**.000***

Table 2. Differences among the categories

	Group (I)	Group (J)	Mean Difference (I-J)	Sig.
BM [kg]	U15	U17	-7.90	**.000***
	U15	U19	-15.81	**.000***
	U17	U19	-7.91	**.001***
Height [cm]	U15	U17	-9.41	**.000***
	U15	U19	-14.08	**.000***
	U17	U19	-4.67	**.024***
BMI [kg · m^{-2}]	U15	U17	-0.19	.693
	U15	U19	-1.92	**.002***
	U17	U19	-1.73	**.007***
BF [%]	U15	U17	3.71	**.000***
	U15	U19	4.61	**.000***
	U17	U19	0.90	.385
FM [kg]	U15	U17	1.23	**.049***
	U15	U19	1.24	.123
	U17	U19	0.01	.990
FFM [kg]	U15	U17	-8.10	**.000***
	U15	U19	-17.00	**.000***
	U17	U19	-8.89	.000*

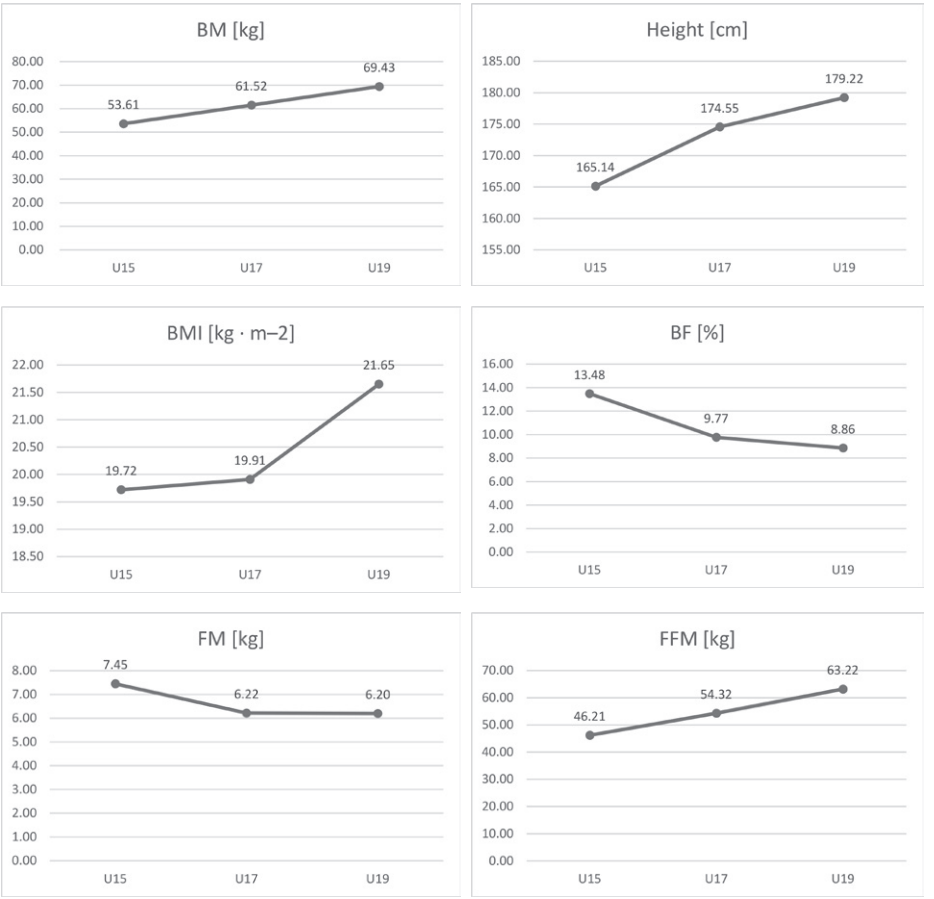

Figure 1. Body composition trend lines according to age groups

DISCUSSION

The aim of this study was to examine and analyse the body composition of young soccer players across different age groups (U15, U17, U19). To generalize the findings of this study, the age of a soccer player effects their body composition (Graph 1). The mean body height, weight, body mass index and fat-free mass of U15 soccer players was significantly lower than those of the U17 and U19 age groups, while the percentage of body fat mass and total fat mass was significantly higher. Our results showed that the U19 group was substantially taller and heavier than the younger groups while exhibiting a lower BF% and greater FFM. In comparison to the previous studies (Spehnjak et al., 2021; Nikolaidis et al., 2016), the current sample of soccer players has similar body size when comparing height and weight. It is evident that there is a trend of increasing height and body mass from U15 to U19. These results indicate that the morphological growth of young soccer players continues during that period, which is in agreement with previous studies (Spehnjak et al., 2021, Matta, Figueiredo, Garcia, & Seabra, 2014, Da Silva, Bloomfield, & Marins, 2008).

Body mass index results show that young soccer players in all selections have BMI values in a normal range. These results are also in agreement with the results of previously published studies (Spehnjak et al., 2021; Nikolaidis et al., 2016; Mroczek et al., 2022).

However, as a predictor of high performance and especially motor and functional abilities, indicators of FFM play a significantly greater role (Milsom, Barreira, Burgess, Iqbal, & Morton, 2014). Regarding the FFM expressed in kg, the results show that there is an evident increase from an average of 46.2 kg in the U15 selection, over 54.3 kg in the U17 all the way to 63.2 kg in the U19. These increases of 16.1% between U15 and U17 and 15.1% between U17 and U19 are attributable primarily to increased muscle mass considering the results in Figure 1. Similar results were obtained in some earlier studies by Milsom et al. (2015), who reported that FFM increased by 29.1% between U15 to U17. Evidently, this is the period in which there is a significant increase in fat free mass in young soccer players, and Mala et al. (2020) state that the highest percentage of relative lean mass was observed in the U18 category. The same authors state that age had a significant influence on the proportions of muscle mass, and thus a significant increase in the percentage of muscle mass.

In previous studies, it has been reported that the BF% tends to decrease with age (Leão et al., 2019; Milsom et al., 2015; Nikolaidis et al., 2011) which was also confirmed in this study. BF% in young soccer players in our research ranged from approximately 8.86±2.98% in the U19 selection to 13.48±5.29% in the U15 category. These results are consistent with most previously published studies. Thus, Marković and Bradić (2009) state that elite soccer players have a relatively low percentage of body fat of around 10%. These results are consistent with the results of Mala et al. (2020), who state that the percent of adipose tissue in younger players (U12 to U15) was greater than 10%, while older players (U16 to adult) had lower BF% values. In this study, it is interesting that young soccer players from the U15 selection have body fat percentage

values close to the older categories, which deviates from some earlier research. Specifically, in the study by Spehnjak et al. (2021), the percentage of body fat in the U15 category was 12.9 ± 6%, and in the study by Nikolaidis et al. (2016) was 17.4 ± 3%. The reason for this may be the higher training load of the players in this study, but since there are no objective indicators, this remains based on assumptions.

This study has some limitations. One of the limitations was that the athlete's dietary intake was not monitored during the stay-at-home orders. Another is that longitudinal data would be more informative to account for the fact that this study did not assess the players maturity status.

CONCLUSION

Based on the results of the realized study, it is possible to confirm most of the conclusions of previously conducted studies that studied the morphological characteristics of young soccer players. The determination of the morphological profile is important from the aspect of selection and prediction of future success in the game. The process of identification and selection of young soccer players is very demanding, and morphology is one of the factors that can influence the final success of individuals in the soccer game. The results of this study, as well as the conclusions of earlier research, indicate that younger soccer players have lower absolute values of morphological characteristics compared to senior players. These values should be taken into account, especially when it comes to the U15 category as well as all younger categories, which means, when the process of growth and development has not yet concluded, and which is known to depend on a large number of both exogenous and endogenous factors. Finally, it should be noted that the morphological profile is the basis for monitoring growth and development, and that it most often follows the development curve of young soccer players with minor individual deviations.

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OUTWARD BOUND AND OUTDOOR ADVENTURE EDUCATION: A SCOPING REVIEW, 1995-2019

Timothy J. MATEER[1], Joshua PIGHETTI[1], B. Derrick TAFF[1], & Pete ALLISON[1]

[1] The Pennsylvania State University

Corresponding author:
Pete ALLISON, PhD
The Pennsylvania State University,
701H Donald H. Ford Building, University Park, State College, PA 16802, USA
Phone: +1 814 470 5954
e-mail: pra7@psu.edu

ABSTRACT

Outdoor adventure education (OAE) programming is often referenced as an effective intervention that encourages a wide array of outcomes in participants such as increased confidence, independence, and communication skills. However, as outdoor adventure education continues to increase globally, what does the academic literature say about the outcomes related to these programs? Hattie, Marsh, Neill, and Richards (1997) conducted the last major review of program efficacy in this realm. This updated scoping review, largely following PRISMA guidelines (Tricco et al., 2018), aims to summarize the academic literature on one of the primary outdoor adventure education providers internationally, Outward Bound (OB). Fifty-four studies, published between 1995 and 2019, have been summarized in this review. Utilizing Outward Bound International's (OBI) framework of "people", "place", and "process", themes and gaps in the literature are explored. Specifically, the OB literature has progressed since 1995 in demonstrating social and emotional outcomes in a variety of settings, a better understanding of the nature of effective programming, and further documenting the role the instructor plays in the learning experience. Recommendations are provided on developing more rigorous methodologies for future research, understanding the role of the physical environment in the learning experience, and utilizing theoretical approaches to integrate outdoor adventure education into broader academic realms.

Keywords: *outdoor education, adventure education, Outward Bound, emotional learning, experiential learning, scoping review*

ORGANIZACIJA OUTWARD BOUND IN IZOBRAŽEVANJE SKOZI PUSTOLOVŠČINE NA PROSTEM: PREGLEDNA ŠTUDIJA, 1995–2019

IZVLEČEK

Programi izobraževanja na prostem se pogosto omenjajo kot učinkovita intervencija, ki pri udeležencih spodbuja širok nabor rezultatov, kot so večja samozavest, neodvisnost in komunikacijske spretnosti. Ker pa trend izobraževanja na prostem globalno še naprej narašča nas zanima, kaj o rezultatih, povezanih s temi programi, pravi strokovna literatura? Hattie, Marsh, Neill in Richards (1997) so opravili zadnji večji pregled učinkovitosti programov na tem področju. Namen tega posodobljenega pregleda obsega, ki sledi smernicam PRISMA (Tricco et al., 2018), je povzeti znanstveno literaturo o enem od glavnih ponudnikov izobraževanja skozi pustolovščine na prostem na mednarodni ravni, Outward Bound. V tem pregledu je bilo povzetih štiriinpetdeset študij, objavljenih med letoma 1995 in 2019. Z uporabo okvira Outward Bound International „ljudje“, „kraj“ in „proces“ so raziskane teme in vrzeli v literaturi. Natančneje, literatura o Outward Boundu je od leta 1995 napredovala pri dokazovanju socialnih in čustvenih rezultatov v različnih okoljih, boljšem razumevanju narave učinkovitega programiranja in nadaljnjem dokumentiranju vloge, ki jo ima inštruktor pri učni izkušnji. Podana so priporočila za razvoj strožjih metodologij za prihodnje raziskave, razumevanje vloge fizičnega okolja pri učni izkušnji in uporabo teoretičnih pristopov za vključevanje izobraževanja na prostem v širša akademska področja.

***Ključne besede**: izobraževanje na prostem, izobraževanje skozi pustolovščine, Outward Bound, čustveno učenje, izkustveno učenje, pregledne študije*

INTRODUCTION

Time spent outdoors has been associated with both mental and physical benefits (Kuo, 2015), and research has found that outdoor experiential learning programs, such as those offered by Outward Bound (OB), can promote positive development for adolescent participants (Orson, McGovern, & Larson, 2020). OB is one of, if not the, largest provider of Outdoor Adventure Education globally.

How effective these educational experiences are is unclear. It has been over 20 years since Hattie, Marsh, Neill, and Richards (1997) stated in their prominent meta-analysis on outdoor adventure education that "adventure programs can obtain notable outcomes and have particularly strong, lasting effects. It is clear, however, that adventure programs are not inherently good. There is a great deal of variability in outcomes between different studies, different programs, and different individuals" (p. 77). Since this meta-analysis, research on outdoor adventure education has paralleled the field's growth, becoming a focal area for several academic journals such as *Journal of Outdoor Recreation, Education, and Leadership*; *Journal of Experiential Education*; *Journal of Outdoor and Environmental Education;* and *Journal of Adventure Education and Outdoor Learning*. While the body of research around these educational programs has continued to grow, the reviews that have been undertaken are weak and easily criticized. For example, Fiennes et al. (2015) noted that "We found 15 systematic reviews of the effects of outdoor learning. They provide extensive evidence of the effects of outdoor learning. However, the set is somewhat confusing because many of them overlap in terms of the primary studies they include." (p. 5) and go on to note that "Almost all outdoor learning interventions have a positive effect" (p. 7). However, the methodological challenges of the previous systematic and scoping reviews of outdoor learning literature have not been addressed primarily because they have repeatedly used too wide a definition, thus creating too much diversity in the evidence. Thus, in this work, we focused exclusively on one organization to minimize this problem.

A lack of recent synthesis on outdoor adventure education has potentially hindered progress in research moving forward given the inability to clearly state what is known and unknown about the subject. By reviewing the current state of knowledge about these educational programs, more effective studies and practices can be informed. While summarizing the entire field of research on outdoor adventure may be too broad and unrealistic in a single review, compiling information from specific programs and the associated educational interventions will prove useful and provide opportunities to generalize to the broader literature and practices.

OB exists as one of these arguably representative programs, serving as a primary provider of outdoor adventure programming in countries across the world. Originally founded in Britain in 1941 by Kurt Hahn and Lawrence Holt, OB originally focused on character development for young men (Millikan, 2006). Since these early stages, OB's focus has transitioned from character development to personal growth while also expanding its program internationally to include a wide variety of audiences (Freeman, 2011; Millikan, 2006). Like many other outdoor adventure programs, OB attempts to

provide transformative learning for individuals of all ages through challenging experiences in natural environments (OB Trust, 2017). Since its founding years, OB has now expanded to serve over 150,000 students each year in over 30 countries (OBI, 2020).

As such, OB has been associated with a number of positive outcomes identified as essential for the labor market and associated with positive youth development, such as improved goal-setting (Ang, Farihah, & Lau, 2014), resilience, leadership skills, the transfer of learning (Jostad, Paisley, & Gookin, 2012), general psychological well-being, improved sense of belonging, and empowerment (D'Amato & Krasny, 2011). Additionally, research suggests that participation in OB has been associated with increases in youth autonomy and self-confidence (Orson et al., 2020).

The studies reviewed in this article generally reflect the diversity of the courses: some explore day-programs utilizing high ropes courses to facilitate teambuilding activities, others examine extended backcountry expeditions and their associated outcomes, and others still look at classrooms utilizing the OB framework to facilitate experiential learning, amongst many others. While diverse in nature, understanding the commonalities and differences amongst these educational experiences can help work towards developing a general model of learning for the OB experience. A limited understanding of these common traits between programs was a weakness in the academic literature identified by Hattie et al. (1997). Therefore, the research question guiding this review is What is known of the outdoor adventure education process through OB from academic literature published following Hattie and colleagues' (1997) meta-analysis? We utilize OB's conceptualization of "people", "place", and "process" as educational components to present our findings in an attempt to bridge this gap between research and practice. What constitutes each of these components within the OB experience is detailed further in the methods section and those that follow. The upcoming sections of this paper outline details on how the scoping review was conducted. This is followed by three sections outlining trends and progress on how the academic literature has developed since Hattie et al. (1997) within the categories of people, place, and process. Each of these sections conclude with recommendations for future research on how forthcoming studies can better understand these concepts and integrate them into a more holistic understanding of the OB process. Finally, a general discussion follows each of these three sections in which we present an argument for greater theoretical rigor in OB research.

This scoping review, largely following PRISMA methodologies and previous methodological guidelines established through Arksey and O'Malley (2005), Levac, Colquhoun and O'Brien (2010), and specifically the extension for scoping reviews (Tricco et al., 2018), is intended to be of use for two primary audiences: OB practitioners who wish to understand the best practices supported by previous research, and educational researchers looking to build upon the previous work examining OB courses and methodology.

METHODS

Scoping Review Process

This study utilized a scoping review methodology (Arksey & O'Malley, 2005; Levac et al., 2010; Moher, Liberati, Tetzlaff, & Altman, 2009; Tricco et al., 2018) to summarize the academic literature on OB. This approach looks to review the literature with the goal of summarizing and reporting what is currently known on the subject and identifying gaps in current understanding (Arksey & O'Malley, 2005). It is considered especially useful when the field being reviewed is heterogeneous (Pham et al., 2014), as is the case with research done on OB programming given the variety of programs offered and methodologies utilized to study the program. As will be obvious when discussing the findings, a broad array of methods have been used to study OB programming. These methods have ranged from intensive ethnographic studies to widely distributed surveys. Due to the wide variety of data being interpreted, a scoping review methodology was chosen over the meta-analysis technique utilized by Hattie et al. (1997).

Locating Studies Relevant to the Research Question

We identified relevant studies for inclusion through database searching. The following databases were utilized: WorldCAT, Academic Search Complete (Ebsco), ERIC (Proquest), and Google Scholar. For each of these databases, the following terms were entered: "Outward Bound" and "education", "Outward Bound" and "adventure", "Outward Bound" and "experiential", and "Outward Bound" and "learning". In addition, an email message was distributed via OBI requesting various practitioners across the OB network (in 37 different countries) to forward relevant studies to the authors for review. The following additional filters were applied to these searches to increase the relevance of the gathered studies:

- Articles must have been published in a peer-reviewed academic journal.
- The articles must have been published after 1995. Using Hattie et al. (1997) as a benchmark, this scoping review aims to summarize the research on OB programming from that point forward.
- Articles must have been published in English, the first language of all the authors of this review.

These inclusion criteria aim to parallel the recommendations made by Levac et al. (2010) where the established inclusion criteria allow for a breadth of studies to be collected that characterizes a given field while also acknowledging relevant limitations.

Selecting Studies that Meet the Inclusion Criteria

This initial search provided over 1000 potentially relevant research articles. The titles and abstracts of these initial results were reviewed by the first author. Many articles at this stage presented research on other outdoor adventure programs or were not presented in peer-reviewed academic journals and were thus excluded from further consideration in this review. This resulted in 148 research articles being downloaded for closer reading.

In following the recommendations for screening and eligibility criteria established by PRISMA, and those of previous studies (i.e., Arksey & O'Malley, 2005; Levac et al., 2010), the research team met regularly to discuss inclusion criteria. In total, 54 studies were determined to fully meet the inclusion criteria after overlaying these additional inclusion criteria and were included in this scoping review (indicated using an asterisk in the reference list).

Extracting Data from the Studies

The research team met regularly to determine the most useful data to extract from the included studies to best answer the outlined research questions. The information extracted from each study included study goals and research questions, study characteristics and data collection methods, and the primary findings from the study. As suggested by Levac et al. (2010), two authors extracted data from five of the same articles and the results were compared to establish consistency in the data extraction methods, and rather than quantifying the findings, we followed PRISMA methods for qualitative synthesis during this Inclusion phase of the research process. A similar process is used in establishing coding consistency in qualitative research projects (Saldaña, 2009). Differences in extraction methods were discussed and a mutual understanding of what to record from each included study was established. This allowed for greater consistency across the research team during data collection.

Summarizing and Synthesizing the Findings

Following the recommendations outlined in Levac et al. (2010), the process of summarizing the findings from this scoping review were developed referencing qualitative research techniques. As detailed by Saldaña (2009), broad thematic categories were developed from information extracted during the initial analysis. The initial information gathered from each research article studying OB was summarized into larger categories in order to present the findings within a cohesive, logical framework. This was done through an iterative process with the research team meeting regularly to discuss the emergent themes. These findings were considered within the context of their broader

implications of identifying productive directions for future research, as well as how research can inform more effective OB programming.

Given the broader themes found within the academic literature and the goals of this scoping review, it was decided that the "three Ps" of OB programming - people, place, and process - provided an effective framework for conceptualizing the findings. This framework has been recently adopted by OBI as a guide for implementing the curriculum across OB schools globally. By utilizing these categories to summarize the selected studies, the academic research on outdoor adventure education can be organized in a manner that is meaningful to the unique educational context it is intended for.

In implementing this framework to conceptualize the initial information extracted from each article, "people", "place", and "process" were adapted as follows to summarize the studies and findings for this scoping review:

1. People: The findings are relevant to a specific population of interest and how the OB experience is perceived by or impacts them.
2. Place: The findings are relevant to how the physical environment or setting influences the learning or developmental experience.
3. Process: The findings are relevant to program activities, elements, or instructional techniques and how they influence the OB experience, including the corresponding outcomes.

The following sections utilize this framework in categorizing papers based on their research goals and objectives. The broad themes and findings are reviewed within each of the "three Ps" categories.

REVIEW OF RESEARCH METHODS

Research Approach

Responding positively to Hattie et al's (1997) recommendation to consider alternative research designs beyond the dominant use of a pretest-posttest design, literature on OB programming between 1995 and 2019 is distributed nearly evenly between quantitative, qualitative, and mixed methodology approaches. Of the 54 studies, 18 studies (33.3%) were constructed as quantitative research, 19 (35.2%) as qualitative, and 17 (29.6%) as a mixed methodology approach based on their design characteristics compared to Creswell's (2014) definitions of the three approaches.

Quantitative Research

Regardless of the design, all 18 quantitative articles applied self-administered surveys, scales, or questionnaires. Examples of established surveys and scales used or modified among the studies are the OB Outcomes Instrument (OBOI; Ewert, 2014; Faircloth & Bobilya, 2013), the Mississippi Scale for Combat-Related PTSD and the

Impact of Events Scale (Hyer, Boyd, Scurfield, Smith, & Burke, 1996). These instruments were used to measure dimensions such as resilience (Ewert, 2014; Neill & Dias, 2001), positive and negative affect (Kirwin et al., 2019), long-term outcomes (Gassner, 2008; Gassner & Russell, 2008) and personal effectiveness and locus of control (Greffrath et al., 2011).

Qualitative Research

Throughout the qualitative studies, an array of data collection methods were utilized. Of the 19 qualitative articles, 14 employed one of the five qualitative designs highlighted by Creswell (2013) - six case studies, five ethnographies of various constructs, two phenomenological studies, and one each of grounded theory approach and narrative. The data collection methods used in the 14 studies demonstrating the five designs brought into focus by Creswell (2013) corresponded with the data collection methods characteristic of each design (see table 1). The remaining five studies were two historical analyses, two interpretive studies, and a heuristic design.

Table 1. Qualitative Data Collection

	Narrative	Phenomenology	Grounded Theory	Ethnography	Case Study
Literature in review	Video, interviews	Interviews, semi-participant observations, document analysis	Interviews	Interviews, document analysis, observation, self-reflection	Interviews, photography, moodboards, document analysis, observations, open response survey

Self-reported data in the qualitative research articles were collected through interviews and with open response surveys. Interviews were the most prominent self-reported qualitative data collection method, occurring in 13 studies. Data from open-ended questionnaires were utilized in only two case studies (Leberman & Martin, 2002; Martin, Leberman, & Neill, 2002). Observations were conducted in eight studies, one of which used video to record and observe afterwards (Benham & Shephard, 1995). Data from the observations were also used to construct narratives (Benham & Shephard, 1995), to explore through phenomenology (Broaddus et al., 2013), and to gain an ethnographic perspective (Lowan, 2009; Vernon, 2015). Two studies (Freeman, 2011; Millikan, 2006) were reliant solely on document analysis to develop their historical analyses of

OB programming. Other applications of document analysis have been exemplified in case studies (Hickman Dunne, 2018; Klein & Riordan, 2009; Klein & Riordan, 2011) and in ethnographies (Lowan, 2009; Newbery, 2004) as the documents acted as tools for triangulation.

Mixed Method Research

The majority of mixed-method research has predominantly been conducted using a dominant-less dominant design with quantitative data collection methods supplemented by qualitative data collection. Seven of the 17 mixed-method studies used surveys, ranging from mixed-response surveys with as few as three open-ended questions (Martin & Legg, 2002) to exclusively open-response surveys (Bobilya, Kalisch, & Daniel, 2014; McKenzie, 2003). The remaining 10 studies integrated more formal qualitative data collection methods such as observations (e.g., Hanna, 1995; McKenzie, 2003), document analysis (e.g., Jirásek & Dvorackova, 2016), and interviews (e.g., Gassner, Kahlid, & Russell, 2006; Mott & Martin, 2017). Although grounded theory, case study, and phenomenology are most typically categorized as a qualitative research strategy (Creswell, 2013), five studies incorporated quantitative data collection within these traditionally qualitative designs (Bobilya et al., 2014; Jirásek & Dvorackova, 2016; Martin & Leberman, 2008; McKenzie, 2003; Mott & Martin, 2017).

Data Collection

An analysis of the timing of data collection in OB programming literature was conducted to depict the length of time the data represent in relation to OB programming. Data collection across the literature occurred in a range from pre-program to up to eight years after OB programs conducted between 1995 and 2020. A frequency table of when data collection among the three research designs occurred is described in Table 2. Among the literature, 24 articles reported on data collected at one timepoint whereas the remaining 30 articles collected data at two or more timepoints. Studies using a single timepoint data collection period were non-experimental or qualitative in nature. Studies that gathered data at multiple time points took on a quantitative quasi-experimental or single-sample repeated measures design, or a longitudinal approach in a qualitative or mixed methods approach.

Table 2. Frequency of Data Collection Periods

	Pre-Program	During Program	Immediately Post-Program	Up to 6 months after	6 months – 1 year after	1 year + after	Unspecified
Quantitative (n = 18)	11	0	14	7	0	2	0
Qualitative (n = 19)	0	12	8	5	3	1	4
Mixed Methods (n = 17)	8	2	15	4	3	4	1
Total	19	14	37	19	3	7	5

Several notable findings on data collection arose. First, no qualitative research collected data prior to the OB programming. The data collection methods conducted during programming were primarily of a qualitative nature, except for Jirásek & Dvorackova (2016), who administered a quantitative frequency chart at three points during programming. While no qualitative data were collected pre-program in a qualitative study, eight mixed-method studies incorporated pre-program and post-program quantitative surveys in addition to qualitative data collection methods such as interviews, focus groups, observations, and document analysis that occurred during or after programming (e.g., Greffrath et al., 2011; Hanna, 1995; Harper, Norris, & D'astous, 2014). Finally, among all 54 studies, only one study under review (Mott & Martin, 2017) collected and examined data beginning with the pre-program and extending to over 1 year proceeding program participation.

PEOPLE, PLACE, AND PROCESS

The 54 reviewed studies provide insight into how research has further developed in understanding the people, place, and process of the OB learning experience since 1995. While these categories are not mutually-exclusive, we have used people, place, and process as a means to organize the results of this study. A brief overview of each study reviewed is provided in Table 3 (on pages 158 to 168). The information in Table 3 is intended to provide context on the diverse areas that these studies were conducted in and the various methodologies utilized to produce the current state of knowledge on

OB programming since Hattie et al. (1997). We hope this table will serve as a quick reference for individuals seeking more information on a study referenced in a later section as all relevant background information cannot be immediately included in the text of the manuscript. Findings within each of the people, place, and process categories are outlined briefly in the following paragraphs prior to being explored in greater depths in the subsequent categories.

Regarding the people aspect of the OB experience, a considerable amount of research in the past 25 years has focused on unique groups of interest and documented how the outdoor adventure education experience impacts these diverse populations. Specifically, a large portion of recent research has examined veterans and other at-risk populations and the expansion of OB outside of traditional Eurocentric and North American settings. Given that Hattie et al. (1997) noted the lack of participant background information incorporated into early OB research, this has been one area in which the literature has seen a notable expansion since 1995. While this progress has been promising, we recommend that researchers look to more modern research techniques in human development and educational literature to further build upon this initial progress.

Studies examining the influence of place on the OB educational experience have been surprisingly scant since 1995. Two primary lines of research have emerged from this relatively small body of literature, exploring the influence of the physical environment on the learning process or the influence of an OB course on the participants' pro-environmental learning outcomes. Given that learning in challenging outdoor environments is touted as a primary component of the OB experience (OB Trust, 2017), this presents a promising direction for future research. This could be an especially important gap in knowledge to explore if competing models of learning through outdoor adventure education are to be developed, something that has still not come to fruition in the academic literature since Hattie et al. (1997) called for it almost twenty years ago.

Lastly, and somewhat unsurprisingly, process represents a well-studied aspect of the OB educational experience since 1995. Research has examined specific parts of the OB experience such as the final expedition (the autonomous final journey independent of course instructors on OB expeditions), the solo camping experience incorporated into many expeditions, course facilitation by instructors, social relations, perceptions of challenge, and post-course learning outcomes. This represents considerable progress since 1995 as Hattie et al. (1997) noted that many outcomes from the outdoor adventure education experience were not linked back to specific course components or that the nature of many programs had not been well documented. Additionally, some of this research on the OB learning process has begun to "ascertain the effects of the instructor" (p. 72), another suggestion for future research made by Hattie et al. (1997). To further develop our understanding of the OB learning process, we point to other educational and psychological concepts that could add greater methodological rigor and theoretical grounding to the field of outdoor adventure education research.

The following three sections expand upon the information provided in the preceding paragraphs in greater detail. Each of the three outlined components of the OB learning experience – people, place, and process – are inherently interrelated with the other

components. We do not aim to explore each of these parts in isolation in the following sections. Rather, we attempt to explore the nuances that emerge in our understanding of outdoor adventure education when each element is the focal area of study. General themes and findings within people, place, and process are discussed and benchmarked against the state of the academic literature reviewed by Hattie et al. (1997). We then conclude each section with recommendations for future research and how studies on OB can continue to develop in rigor and applicability to practice. A brief general discussion is then presented in the conclusion making the case for greater theoretical rigor within the field of outdoor adventure education.

People

The academic literature on "people" has primarily explored the OB experience through two primary lenses: how programming helps veterans and other at-risk populations and how OB coursework manifests itself across multiple cultures in educating different audiences. For various populations acting as participants in the OB experience, social-emotional growth, defined in a variety of ways, was supported by findings. There was less evidence that the OB experience aided in helping specific psychological issues in at-risk populations. Furthermore, interactions between the culture of the participants and the cultural roots of the programming may play a role in determining program outcomes. Despite the mixed results on these fronts, the social-emotional growth provided evidence that most populations gained outcomes such as confidence, goal-setting skills, and interpersonal skills from their OB experience. While many of these findings parallel those reported by Hattie et al. (1997), significant progress has been made in the area of their call to better incorporate the background of the participants into the study design. We conclude this section by indicating some methodological approaches for quasi-experimental designs that may help researchers better understand the effects of the OB educational experience on unique populations.

Four studies specifically focused on OB's effect on veteran populations in Canada and the United States, examining how it helped ease their transition back into everyday life (Ewert, 2014; Harper et al., 2014; Hyer et al., 1996; Scheinfeld, Rochlen, & Russell, 2017). While each of these studies defined social-emotional constructs in slightly different terms, the OB experience was linked to various outcomes for veteran populations in North America such as increased interpersonal skills, goal-setting, and self-confidence (Ewert, 2014; Harper et al., 2014). Scheinfeld et al. (2017) similarly found that an OB course helped improve various aspects of mental health (e.g. distress and the perception of interpersonal relationships) for individuals. Despite these positive findings in other studies, Hyer et al. (1996) found that the OB experience had no effect on the post-traumatic stress disorder symptoms of veteran participants.

Similar studies examining the influence of OB educational experiences on other at-risk adult populations have paralleled the results found in veteran populations. Outcomes included improved goal-setting abilities, interpersonal skills, and confidence

(Leberman, 2007; Maxwell, Perry, & Martin, 2008; Walker, Onus, Doyle, Clare, & McCarthy, 2005). Maxwell et al. (2008) notably departed from approaches taken by other studies on populations of interest by purposively sampling individuals that dropped out of an OB educational intervention focused on helping those facing long-term unemployment. The findings indicate that a lack of social integration contributed to the individuals discontinuing their participation in the program (Maxwell et al., 2008). While this finding is largely in line with those of other studies, this study design presents a promising alternative to understanding OB programming. Additionally, as a notable parallel to Hyer et al.'s (1996) findings on veterans, Walker et al. (2005) also found that their at-risk adult population, those recovering from traumatic brain injuries, saw increased emotional growth but no improvement in their specific psychological condition after an OB course. While this body of evidence suggests that OB course participation can result in social and emotional growth for at-risk adult populations, it is not as effective in improving psychological conditions that are unique to specific at-risk groups (Hyer et al., 1996; Walker et al., 2005).

Four additional studies examined the impacts of the OB experience on at-risk youth in various contexts (Ang et al., 2014; Broaddus et al., 2013; Fischer & Attah, 2001; Pommier & Witt, 1995). These studies provided similar evidence for social-emotional growth to what was found within veteran OB participants and other at-risk adult populations. The varied contexts within which these studies were conducted provides interesting insight into how different cultures intersect with programming for at-risk youth. For example, Purdie and Neill (1998) examined under-achieving Japanese students enrolled in a 22-day OB Australia program. The participants showed a significant decrease in confidence and peer relations when surveyed post-program. When compared to a population of Australians enrolled in a similar course, the Japanese students rated the group cohesion and course value significantly lower than their Australian counterparts (Purdie & Neill, 1998). Alternatively, two other OB interventions for at-risk youth that were provided within the individuals' own culture, the United States (Broaddus et al., 2013) and Singapore (Ang et al., 2014) respectively, were more successful in achieving their desired goals. While this contrast was only examined explicitly by Purdie and Neill (1998), these findings suggest that cultural factors may play a role in determining the success of an OB educational program for at-risk individuals. This may be especially true as OB programming has had difficulty in moving past its roots in traditional character-building practices originating in the European context (Freeman, 2011; Millikan, 2006). In addition to these studies, Sibthorp, Funnell, Riley, Chan, and Meerts-Brandsma (2018) specifically examined how course language administration (as a potential proxy for the participants' cultural views) influenced program outcomes for youth in an OB Hong Kong program. This was found to have no effect on the course outcomes (Sibthorp et al., 2018). While this contrasts with the findings of other studies, this may be due to language preference not being an adequate representation of the participants' cultural views. As a whole, these studies suggest that the intersection of participant and program culture may matter for at-risk youth learning outcomes.

In complement to these trends within at-risk youth studies, a variety of research projects have explored how OB courses have become tailored to various geographical and cultural contexts of participants. The use of "dramaturgy" in the Czech Republic (Jirásek, Jirásková, Majewská, & Bolcková, 2017; Jirásek, Veselský, & Poslt, 2017; Martin, 2011; Martin et al., 2002) or incorporating indigenous perspectives into OB Canada courses (Lowan, 2009) are examples of this. The dialectic nature of individuals' cultural backgrounds interacting with OB course content exemplifies how the *people* of OB courses are continually co-creating the learning process and how the experiences are simultaneously influencing them. Jirásek, Veselský, et al. (2017) discuss how the "dramaturgical" approach to OB education in the Czech Republic is grounded in the unique people, place, and culture of the area. Martin (2011) used an autoethnographic approach to summarize his past work studying dramaturgical techniques, stating that the dramaturgy approach supported the holistic development of participants through a variety of games stimulating different learning and development styles, including physically, socially, psychologically, and spiritually (Martin, 2011). These assertions have been supported empirically by other studies (Jirásek & Dvorackova, 2016; Martin et al., 2002). Lowan (2009), utilizing a collaborative ethnographic approach in a Canadian context, asserts that "grounding Indigenous education programs in the teachings and traditions of respective Indigenous cultures in order to support decolonization and cultural revitalization" can help improve program efficacy. Taken as a whole, these studies examining OB across cultural contexts suggest that tailoring educational programming to the unique background of the participants may help improve the course outcomes.

While the findings across many of these unique groups parallel the social and emotional outcomes already reported by Hattie et al. (1997), studies within this variety of unique contexts represent significant progress in terms of their call to further incorporate participant background into the study design. As Lerner (2018) asserts in his writing on human development research, growth and change throughout the lifespan is a non-ergodic process. Therefore, researchers should take an idiographic approach and study a phenomenon of interest across many contexts. Commonalities should then be identified across these contexts to find generalizable concepts (Lerner, 2018). While social and emotional growth within these various unique populations and contexts may simply reinforce Hattie et al.'s (1997) general findings, the consistency across these various groups is encouraging.

We wish to conclude this section by briefly looking at other research approaches within the educational and human development literature to identify ways in which the people aspect of the OB experience may be studied more effectively. Many studies within this section took a broad array of descriptive and reductionist approaches to understanding OB programs. While much of the rich qualitative data presented through these studies have helped further the theoretical understanding of learning in outdoor adventure education, the pre- and post-test approaches utilized do not fully explore the complexity of the learning experience for participants. Approaches such as propensity score matching (Caliendo & Kopeinig, 2008; Dehejia & Wahba, 2002) and regression

discontinuity design (Cappelleri & Trochim, 2001; Cook, 2008) provide opportunities to more fully account for participant background when studying educational processes and outcomes. Propensity score matching allows researchers to "find in a large group of nonparticipants those individuals who are similar to the participants in all relevant pretreatment characteristics" (p. 32, Caliendo & Kopeinig, 2008). This way, quasi-experimental studies can more effectively isolate the effects of OB educational intervention while also acknowledging the relevant background characteristics of those involved in the learning process. Similarly, regression discontinuity design examines similar individuals who fall above or below a certain threshold in qualifying for a program or intervention. The regression analysis then explores whether "a treatment effect appears as a 'jump' or discontinuity at the cutoff point in the regression function linking the assignment variable to the outcome" (p. 152, Cappelleri & Trochim, 2001). This may prove to be a useful approach in designing future quasi-experimental studies, especially for OB programs that target qualifying at-risk populations such as that done by Ang et al. (2014). As OB research continues to explore the program's influence for new and different populations, methodological advances will also help to better understand the program effects in these different contexts.

Place

OB asserts that challenging experiences in outdoor environments are a central element of their programming (OB Trust, 2017). To cater for a wide array of participants around the world, there are OB schools in 37 locations across 34 countries on six continents around the world (OBI, 2023). The articles under review discuss research conducted in OB programs from 10 different countries, representing 28.6% of the countries covered by OBI. Given that the physical environment is touted as a critical component within OB, this section reviews research that has explored its role within the learning experience.

Relative to other areas of the OB experience, studies that have explicitly examined "place" as a central concept have been relatively scarce. Hattie et al. (1997) called for an expansion of competing models within the outdoor adventure education literature. Understanding the physical environment as an interrelated component of the learning experience is necessary if these models are to be developed. This section concludes with recommendations for future research on how to better incorporate place into future OB research. Recommendations include incorporating research on the sense of place and perspectives from environmental psychology.

The link between culture and place represents an interrelationship within which OB courses can ground their practice of promoting learning outcomes. This lens inherently acknowledges *people* grounded in *place* as a driver of the learning *process*. Lowan (2009) linked these elements via collaborative ethnography in a Canadian indigenous context. They assert that indigenous OB programming should be designed specifically around the symbiotic relationship indigenous peoples have with their unique geographi-

cal location (Lowan, 2009). Furthermore, a pair of studies examining the dramaturgical approach to OB programming in the Czech Republic found that the course helped to inspire a strong spiritual connection to nature and appreciation for human-nature relationships (Jirásek, Jirásková, et al., 2017; Jirásek, Veselský, et al., 2017). As outlined in the previous section, cultural context may play an integral role in OB programming outcomes. It is of note that a large portion of studies with findings relevant to the physical environment were also grounded in a specific culture. Two additional studies that did not find pro-environmental outcomes for OB participants were not as closely grounded in a specific culture or location (Hanna, 1995; Martin, Bright, Cafaro, Mittelstaedt, & Bruyere, 2009).

Other studies have more closely examined how the physical environment influences the OB learning process. Many of these studies focused on challenge and risk and how such elements promote learning amongst participants. Hickman Dunne (2018) explored how participants interpret their interactions with the physical environment in the context of outdoor adventure education in a British setting. Using an ethnographic approach, they found that participants derived both joy and unpleasant memories from their interactions with the physical environment. Outdoor adventure equipment and clothing also emerged as a dominant theme with participants often expressing frustration with its appearance or function, while its necessity was acknowledged by both participants and staff (Hickman Dunne, 2018). Given this challenge and the corresponding risk specifically associated with the physical environment on OB courses, a small body of studies also explored how safety and risk influenced the course outcomes (Holden, 2004; Leberman & Martin, 2002; Mott & Martin, 2017). The staff working for OB New Zealand saw risk mitigation as one of their primary jobs (Mott & Martin, 2017). This represents a balancing act for OB program managers as challenge via the physical environment is acknowledged as a central part of program learning (Hickman Dunne, 2018), yet risk mitigation is a vital component of program management (Mott & Martin, 2017). These findings indicate that the physical environment and the associated challenge are inextricably related to the OB learning process, much of which has already been acknowledged by OB practitioners. Despite this, the specific relationships between challenges involving the physical environment and learning outcomes have largely been unexplored.

As place remains a relatively understudied idea within the academic literature on OB, there are ample opportunities to look to other areas of research for inspiration on how to explore this concept. Research on sense of place (e.g. Kudryavtsev, Stedman, & Krasny, 2012; Stedman, 2003; White, Virden, & Van Riper, 2008) may provide one direction on how to study the physical environment embedded within the OB learning experience. The literature on sense of place often defines the concept as having three components: the physical environment, human behavior, and psychosocial processes (Stedman, 2003). Studies that have previously explored OB programs embedded within specific areas and cultural contexts somewhat unsurprisingly were found to have the strongest outcomes related to the physical environment (Jirásek, Jirásková, et al., 2017; Jirásek, Veselský, et al., 2017; Lowan, 2009). Despite this, none of the aforementioned

studies explored these relationships in a way that grounded the research in a broader sense of place theory. As OB presents the opportunity for individuals to experience a relationship with the physical environment in new and challenging ways (Hickman Dunne, 2018; Holden, 2004; Leberman & Martin, 2002; Mott & Martin, 2017), individuals may experience a shift within the tripartite framework that makes up a sense of place. This shifting sense of place may then have implications for the learning processes and outcomes.

Furthermore, while outdoor adventure education does not explicitly hold connectedness to nature as one of its primary goals, the wide variety of writings within the field of environmental psychology could help provide insight into how the physical environment influences the learning process. For example, concepts such as the affective forecasting of experiences in nature (Nisbet & Zelenski, 2011), linked pathways between nature and general health (Kuo, 2015), and the mental health benefits of outdoor recreation (Lackey et al., 2021) all indicate that individuals feel mentally and physically better when immersed in natural environments. These shifts linked to elements of the physical environment potentially hold implications for the learning experience in outdoor adventure education. Despite this possible connection, there are currently few studies exploring these relationships.

The physical environment represents an element of the OB learning experience that is inextricably linked to other parts of the process. The physical environment of OB courses helps to facilitate challenge (Hickman Dunne, 2018) while also connecting individuals to each other (Lowan, 2009). If the field is to develop effective models of learning in the setting of outdoor adventure education, as Hattie et al. (1997) called for over 20 years ago, these relationships need to be explored further. Research opportunities can take advantage by examining the role of 'place' in any one of the remaining 71.4% countries with OB programming yet to be studied. The research recommendations indicate ways forward in which the field of outdoor adventure education research can begin to explore these gaps in understanding.

Process

The following section focuses on the OB process, specifically exploring course activities that facilitate learning and the outcomes that correspond to these activities. In examining OB learning processes broadly, the relationships with other participants, course challenges, and instructor facilitation were all identified as elements of the OB experience that impact participant learning. Regarding expedition-based programs, the solo camping experience and the final expedition have both been retrospectively cited as specific course elements that also contribute heavily to the learning outcomes. A broader understanding of the learning outcomes linked to these course elements does not seem to have progressed significantly since the broad social and emotional components identified by Hattie et al. (1997). Despite a lack of progress on this front, linking outcomes back to course elements and the learning process does show a significant

step forward in the academic literature since 1995. We specifically explore the role the instructor plays in the learning process for individuals as Hattie et al. (1997) identified this as a major gap in the literature over 20 years ago. Finally, as in previous sections, this section concludes with recommendations for future research on how to better understand the learning processes of OB. Specifically, we recommend utilizing a life course approach to studying the relationship between the learning process and outcomes. Future researchers can also look at the ways specific OB organizations have built upon the general OB model in attempts to improve program efficacy.

The growth of social relationships (closely related to the people category previously outlined) and challenge (closely linked to the place category previously outlined) are two course components that have been consistently identified across studies as being impactful for OB participants. Regarding social relationships amongst participants, this has been found to be an impactful course element in a variety of contexts. Locations in which studies have identified the importance of social relationships for OB learning include: New Zealand (Martin & Leberman, 2005), Australia (Neill & Dias, 2001), Hong Kong (Sibthorp et al., 2018), the Czech Republic (Jirásek & Dvorackova, 2016), and the United States (Goldenberg, Klenosky, McAvoy, & Holman, 2002; Goldenberg, McAvoy, & Klenosky, 2005). As outlined previously in the section on people, Maxwell et al. (2008) exemplify the role social relationships play in the OB experience. In purposively sampling individuals who dropped out of an OB program focused on at-risk individuals, a lack of social integration into the program was cited as one of the predictive components leading to dropout (Maxwell et al., 2008). Given the need for teamwork on OB courses due to the challenging nature of the experience (Goldenberg et al., 2002; Goldenberg et al., 2005; Greffrath et al., 2011), social relationships seem to be a key component for success.

In examining the other end of the dialectic relationship between course components that lead to positive learning outcomes, course challenges, which are often an impetus to form close social bonds on OB courses, have also been cited frequently as an impactful element of the OB experience (Goldenberg et al., 2002; Goldenberg et al., 2005; Tolich, 2012). The challenge explored in this section is often facilitated by the physical environment in which OB courses are situated (Hickman Dunne, 2018). While these challenges leading to growth exist across OB course types (Greffrath et al., 2011), two specific challenging elements that have been frequently cited in previous studies are traditionally associated with expedition-based programs. These two course components are the solo camping experience and the final expedition in which participants autonomously complete a task without the guidance of the instructor (Bobilya et al., 2014; Gassner et al., 2006; Gassner & Russel, 2008; Kalisch, Bobilya, & Daniel, 2011). Bobilya et al. (2014) specifically explored perceptions of the final expedition for program participants at the North Carolina OB School. They found that the autonomy and teamwork associated with the experience were both impactful for participants (Bobilya et al., 2014). In a similarly structured study, Kalisch et al. (2011) explored participant perceptions of the solo camping experience. The participants reported feeling both peaceful and anxious while also taking the time to reflect (Kalisch et al., 2011). While it

is beyond the scope of this review to cover all the forms of challenge that have been documented by the OB literature, these examples indicate that both internal reflection and external collaboration facilitated by challenging experiences are part of the learning process in OB courses.

We now turn our attention to the influence of course instructors within the OB experience. As mentioned previously, this is a specific element of the learning process that Hattie et al. (1997) noted as under-researched. Since 1995, a wide variety of studies have been conducted examining the role of instructors and the broader administration within the OB experience (Hovelynck, 2001; Galloway, 2007; McKenzie, 2003; Sibthorp et al., 2018). Many of the reviewed studies list instructors as an impactful element of OB courses without exploring the relationship in further detail (Gassner & Russel, 2008; Martin & Leg, 2002; McKenzie, 2003; Sibthorp et al., 2018). This evidence indicates that course instructors play the primary role in facilitating the OB learning process but does not provide much context for the nature of the process.

As a beneficial complement to some of the previously cited studies, researchers have collected qualitative data to provide further context on the role of OB instructors. Interviews conducted by Hovelynck (2001) in Belgium with OB instructors found that group development is key to their educational model. The conversations they facilitate transition from technical aspects of an activity to the communication methods themselves, then to the group "owning up" to communication development, and finally to the development of a group theme. This process inherently weaves personal and group learning together (Hovelynck, 2001). Furthermore, Martin, Dench, and Paku (2016) conducted a broad study using semi-structured interviews to examine how school and executive directors perceive the culture of OB New Zealand. The findings show that these managerial positions believe that, while language has changed over the years, the primary learning outcome of this program is still self-discovery and that course instructors play a key role in facilitating experiences (Martin et al., 2016). This conceptualization of instructor roles aligns well with impactful elements of the learning process that have been previously cited. In both the solo camping experience and the final expedition, the instructor facilitates a learning process with the goal of eventually fully turning the leadership over to the group and individual (Bobilya et al., 2014; Gassner et al., 2006; Gassner & Russel, 2008; Kalisch et al., 2011). Within this thread of thought, OB instructors can be seen as catalysts coordinating learning experiences across various interrelated parts within an outdoor adventure education course.

Following the review of the course components that help to contribute to the OB learning process, we turn our attention briefly to the outcomes associated with these course components. While understanding how these course elements contribute to the learning process represents significant progress since Hattie et al. (1997), the understanding of course outcomes has seemingly not advanced as much. The inconsistent language across studies describing social and emotional growth has likely hindered the ability for studies to build upon each other. The following summarizes the social and emotional growth outcomes identified by studies in this section: savoring, mindfulness, and positive affect (Kirwin et al., 2019); initiative, self-confidence, and kindness

(Sibthorp et al., 2018); self-confidence, self-awareness, and time management (Martin & Leberman, 2005); accomplishment, autonomy, community, and teamwork (Bobilya et al., 2014); self-confidence and reliance, interpersonal effectiveness, and mental toughness (Bobilya, Kalisch, Daniel, & Coulson, 2015); and resilience (Neill & Dias, 2001), to name a few. These all fall under the umbrella of "personal growth" (Freeman, 2011) or "self-discovery" (Millikan, 2006), which are at the heart of the OB philosophy and programming.

We conclude this section with recommendations on how researchers examining OB programming can further their understanding of the learning process. It is notable that many studies simply examined the outcomes linked to course components without probing the learning process further. Taking a life course approach to understanding post-course outcomes (e.g. Colley, Currie, & Irvine, 2019; Tsang & Havitz, 2014) represents one direction that researchers could take to better understand how learning processes are effective beyond pre- and post-program measures. In this approach, researchers purposively sample individuals with a common experience (in this case, an OB course), and have participants reflect on the meaning and nature of the experience later in life (Colley et al., 2019; Elder, 1994; Tsang & Havitz, 2014). This can potentially help researchers understand how course components such as social relationships or the solo camping experience potentially trigger a cascading effect that leads to positive outcomes later in life (Masten & Cicchetti, 2010). This approach could help to add depth and understanding to the relationship between learning outcomes and the educational process.

Additionally, as has been done extensively with the dramaturgical approach to the OB experience (Jirásek, Jirásková, et al., 2017; Jirásek, Veselský, et al., 2017; Martin, 2011; Martin et al., 2002), purposively sampling and studying unique variations on the OB experience may help provide a better understanding of impactful learning processes. As Martin et al. (2002) did, these approaches to the learning process can then be piloted in other settings. These program variations can help provide new directions on how to further develop OB programming more broadly.

DISCUSSION AND CONCLUSION

We now conclude this scoping review by making a brief case for the incorporation of broader theory within the academic literature studying OB. In examining the studies reviewed within this manuscript, the following statement by Hattie et al. (1997) remains relevant: "Adventure programs have been conducted as if they operated in isolation from the educational world. There is little incorporation of research on group dynamics, attitude change, educational theory, and cognitive processes" (p. 77). The reviewed studies have provided rich descriptions of what makes the learning process effective on OB courses, but there have been only limited attempts to reintegrate findings into broader educational or developmental conversations following these descriptive results. In studying psychological processes such as learning in an OB program, it is important for theory to remain at the forefront of discussions (Bringmann & Eronen, 2016). This can

help to maintain a strong conceptual understanding of the relationships between course elements and provide direction on how to improve programming.

Considering perspectives such as the relational developmental systems metatheory (Lerner, 2018) in OB research may provide a useful shift in perspective for the future of the academic literature. This theory about theories acknowledges that "change across life occurs through mutually influential relations between individuals and their contexts" (p. 18, Lerner, 2018). This perspective presents the opportunity to acknowledge many of the tensions that we have probed throughout this review and incorporate them into the study design. These include but are certainly not limited to the relationship between the cultural roots of a program and the cultural roots of the participants, the connection between the challenge presented via the physical environment and the growing social relations between participants, and the relationship between participant backgrounds and the corresponding learning outcomes. Each of these elements creates a "layer" to the learning experience that is in dynamic tension with the other layers. The broader fields of human development and education have approached this tension through more specific theories, such as self-determination theory (Ryan & Deci, 2000) or transformative learning theory (Mezirow, 1997), which bring forward new perspectives for OB and outdoor adventure education researchers more broadly.

What other broader perspectives should researchers consider? It is our hope that the conceptual (e.g. utilizing sense of place as a research lens) or methodological (e.g. regression discontinuity for quasi-experimental designs) recommendations at the end of each section (people, place, and process) can provide some direction for these future directions. Obviously, there are innumerable theories and lenses for outdoor adventure education researchers to examine beyond those recommended in this paper, and we look forward to seeing the innovative perspectives that evolve in the future.

With this final recommendation, we return to the original goals of this paper. This scoping review was intended to provide perspective on how the academic literature has developed since the prominent meta-analysis conducted by Hattie et al. (1997) and provide recommendations for future directions for the field of study. Research has moved forward on several fronts, such as better incorporating participant background into studies, documenting effective program elements, and better understanding the role the instructor plays in the OB experience. Other areas, such as understanding the role the physical environment plays (place) within the OB experience and understanding the nature of outcomes beyond social-emotional growth have not progressed as quickly. We hope that by examining the other areas of academic literature recommended throughout this article, these gaps in knowledge can be explored more effectively in the future.

There is evidence that OB and outdoor adventure education more broadly provide impactful experiences for participants, and growing evidence supports this claim on an international scale. But as Hattie et al. (1997) stated, these programs are not inherently good. Academic research has the responsibility of helping OB and the broader field of outdoor adventure education build toward more effective programming. Progress has been made on this front since Hattie et al. (1997), and it is our hope that this scoping review can help this progress continue in the future.

Table 3. A brief overview of the studies included for review in this manuscript

Authors	Program Provider	Study Population	Study Methods	Sample Size
Ang et al., 2014	Outward Bound Singapore	At-risk youth participating in a five-day center-based outdoor adventure program	Youth At-Risk Program Evaluation survey administered at three points: pre-program, one month post-program, and three months post-program; behavioral data (number of classes and extracurricular activities skipped in the past week) collected from school pre-program and 3-months after the program	136 (Control=60, Treatment=76)
Benham & Shepard, 1995	Unspecified, program took place on the shore of Lake Michigan in the United States	African American school leaders participating in a center-based professional development program	Video recorded participants' activities at the professional development retreat for African American educators throughout the week; each participant participated in an interview at the conclusion of the week and three follow-up interviews over the following six months	5
Bobilya et al., 2014	North Carolina Outward Bound School	Individuals enrolled in expedition-based programs of 7-50 days	Final Expedition Survey soliciting open-ended responses completed on the last day of the final expedition	331
Bobilya et al., 2015	North Carolina Outward Bound School	Individuals enrolled in expedition-based programs of 8-28 days	Post-course survey: open-ended questions on content learned and the intention to transfer learning; two-year follow-up: open-ended questions on content learned and the ways skills were utilized post-course; the results were independently coded by three researchers.	Post-Course=369, Two-year=30
Bobilya et al., 2017	North Carolina Outward Bound School	Individuals enrolled in expedition-based programs of 4-28 days	Open-ended survey questions completed on the final day of programming on post-program learning and growth, the responses were coded and themes developed inductively	189

Authors	Program Provider	Study Population	Study Methods	Sample Size
Broaddus et al., 2013	Baltimore Chesapeake Bay Outward Bound	Baltimore police officers and middle school students participating in a one-day teambuilding program	Surveys used to measure both resilience and self-constructs; Outward Bound Outcomes Instruments was used to measure self-constructs; the Multidimensional Relationship Questionnaire was used to measure resilience	27
Ewert, 2014	Outward Bound for Veterans	United States Veterans in a five-day outdoor adventure program	Surveys used to measure both resilience and self-constructs; Outward Bound Outcomes Instruments was used to measure self-constructs; the Multidimensional Relationship Questionnaire was used to measure resilience	310
Faircloth & Bobilya, 2013	North Carolina Outward Bound School	Individuals enrolled in expedition-based programs of 4-28 days	Psychometric investigation of the North Carolina Outward Bound School Course Impression Survey, an adapted version of the Outward Bound Outcomes Inventory; analysis included descriptive statistics, inter-item correlations, test-retest reliability, exploratory factor analysis, and internal consistency	268
Fischer & Attah, 2001	North Carolina Outward Bound School	Teens in foster care participating in a seven-day outdoor adventure course	Pre- and post-program surveys consisting of both scaled and open-ended questions focusing on program participant behavior and experiences were given to the program participants, foster care workers, and foster parents at three points: pre-program, post-program, and three months post-program.	23
Fouhey & Saltmarsh, 1996	Thompson Island Outward Bound Education Center	University students enrolled in a service learning program	Examined course components through the lens of various experiential education and outdoor adventure theories.	6-10
Freeman, 2011	Historical Analysis	N/A	Historical analysis of prior research, writings from prominent educators, and other relevant documents.	N/A

Authors	Program Provider	Study Population	Study Methods	Sample Size
Galloway, 2007	North Carolina Outward Bound School; Voyageur Outward Bound School	Outward Bound course leaders	Outdoor Leader Experience Use History surveys and Factorial Decision Vignettes (providing leadership choices for various outdoor adventure-related medical decisions) provided to trip leaders, responses analyzed via a hierarchical linear model.	103
Gassner, 2008	Outward Bound Singapore	Adults who participated in the Classic Challenge course (21 day expedition)	Survey with participants rating how impactful different course components were on their current lives	318
Gassner & Russell, 2008	Outward Bound Singapore	Adults who participated in the Classic Challenge course (21 day expedition)	Survey with participants retrospectively examining the overall impact of their Outward Bound course on their current lives and how impactful various aspects of the experience were	318
Gassner et al., 2006	Outward Bound Singapore	Adults who participated in the Classic Challenge course (21 day expedition)	Questionnaire asking participants to rate the perceived impact of their Outward Bound course and the course components contributing to these impacts	318
Goldenberg et al., 2002	North Carolina Outward Bound School	Individuals enrolled in expedition programs of 4-21 days in length	Questionnaire asking participants to identify impactful course components, the outcomes related to those course components, and ultimately the broader values impacted by those outcomes; responses arranged into hierarchical value maps	216
Goldenberg et al., 2005	North Carolina Outward Bound School	Individuals enrolled in expedition programs of 4-21 days in length	Questionnaire asking participants to identify impactful course components, the outcomes related to those course components, and ultimately the broader values impacted by those outcomes; responses arranged into hierarchical value maps	216

Authors	Program Provider	Study Population	Study Methods	Sample Size
Greffrath et al., 2011	Outward Bound South Africa	3rd-year university students participating in two different outdoor adventure education programs	A crossover research design with two separate experimental groups participating in either a centre-based adventure program or an expedition-based wilderness program, the groups switched treatments after five months; groups completed pre- and post-program "Review of Personal Effectiveness and Locus of Control" surveys for each treatment; post-treatment semi-structured interviews and focus groups were also conducted	28
Hanna, 1995	Colorado Outward Bound School	Youth enrolled in programs of 10-11 days	Survey measuring minimal impact knowledge, basic ecological knowledge, wilderness issue attitudes, as well as predisposing factors, behavioral intention, and self-reported behavior for Outward Bound and Audubon Field Ecology Camps at three time points: pre-program, post-program, and six months after program conclusion	32
Harper et al., 2014	Outward Bound Canada	Canadian veterans participating in a seven-day outdoor adventure education program	Utilized the Outward Bound Outcomes Inventory to measure psychosocial constructs pre-program, immediately post-program, and six weeks post-program; 12 semi-structured interviews examining course outcomes, health and wellbeing, and the course in relation to participant's career and military service were also conducted	Survey=50, Interview=12
Hickman Dunne, 2018	Outward Bound Trust (United Kingdom)	School groups based in the United Kingdom on outdoor expeditions	Semi-structured interviews with Outward Bound Trust staff; an ethnography of four school group trips through the Outward Bound Trust; paired follow-up interviews with participants including mood board activity	Staff=26, Participants=44

Authors	Program Provider	Study Population	Study Methods	Sample Size
Holden, 2004	North Carolina Outward Bound School	Adults participating in an expedition-based program of at least 14 days	A quasi-experimental design with some courses being informed about the presence of a satellite phone and others not; all the participants filled in a post-course survey measuring wilderness experience, risk-taking, the perception of safety, and level of stress.	261
Hovelynck, 2001	Outward Bound Belgium	Outward Bound course leaders	Multiple semi-structured interviews with course leaders discussing 2-3 moments per day per program and how they were facilitated	8
Hyer et al., 1996	Pacific Crest Outward Bound School; North Carolina Outward Bound School	Vietnam War veterans with chronic PTSD participating in a five-day outdoor adventure education program	Veterans in a multi-week PTSD treatment program administered a 5-day Outward Bound program in lieu of scheduled treatment (the control group did not attend the Outward Bound program); veterans subject to a battery of surveys measuring symptom change in PTSD subjects pre-program, immediately post-program, and on exit from the multi-week treatment; the Outward Bound participants also filled in a survey and provided open-ended comments on their perception of the experience	219 (Control=111, Treatment=108)
Jirásek et al., 2016	Vacation School of Lipnice-Outward Bound Czech Republic	Adults participating in a 12-day expedition	Mixed method design including frequency charts with participants identifying close relationships in the group recorded at three points throughout the expedition, post-course reflective essays, a post-course survey on group cohesion, and mid-course and post-course mind maps exploring how participants feel about the Outward Bound course	26
Jirásek, Jirásková et al., 2017	Vacation School of Lipnice-Outward Bound Czech Republic	Adults participating in a 12-day expedition	Post-course unstructured interviews and the development of systemic constellations; content analyzed for spiritual elements of the experience	12

Authors	Program Provider	Study Population	Study Methods	Sample Size
Jirásek, Veselský et al., 2017	Vacation School of Lipnice-Outward Bound Czech Republic	Adults participating in a 12-day expedition-based program	Unstructured interviews on the spiritual aspects of the expedition paired with the Prague Spirituality Questionnaire.	12
Kalisch et al., 2011	North Carolina Outward Bound School	Individuals enrolled in expedition-based programs of 7-45 days	Participants given an open-ended survey on their perceptions of the solo experience during the last hour of the solo, responses coded for salient themes and frequency tables constructed	335
Kirwin et al., 2019	Outward Bound Canada	Individuals enrolled in an eight-day expedition-based program	Three previously developed surveys were used to measure savoring, mindfulness, and positive affect in both the control (no Outward Bound program participation) and experimental (participation in the eight-day Outward Bound mindfulness program) groups at three time periods: pre-program, immediately post-program, and three months post-program	30 (Control=16, Treatment=14)
Klein & Riordan, 2009	Expeditionary Learning Schools Outward Bound	Educators in New York City	A qualitative case study analyzing hardcopy materials like student work, classroom observations, and teacher interviews; analyzed for salient themes by both authors	8
Klein & Riordan, 2011	Expeditionary Learning Schools Outward Bound	Educators in New York City	A qualitative case study comprising interviews, site visits, and document and artifact analysis; data were coded and analyzed via analytic memos, triangulation, and member checks	8

Authors	Program Provider	Study Population	Study Methods	Sample Size
Leberman, 2007	Outward Bound New Zealand	Female offenders to be released from prison within one year participating in a 20-day outdoor adventure education course	27 semi-structured interviews at the end of the course; follow-up interviews with 14 women three months after the end of the course; field observations, instructor reports, and case officer reports were also utilized; analyzed in a phenomenological manner	27
Leberman & Martin, 2002	Outward Bound Czech Republic, Outward Bound New Zealand	International participants in the Czech Republic; female offenders in New Zealand; both participating in multi-day outdoor adventure education programs	Two separate studies analyzing comfort, risk, and the relationship these concepts have to learning; for Outward Bound Czech Republic, participants completed an open-ended questionnaire 6-months after course conclusion; for Outward Bound New Zealand, interviews conducted post-course and three months after course conclusion.	Outward Bound Czech Republic=25, Outward Bound New Zealand=27
Lowan, 2009	Outward Bound Canada	Former Giwaykiwin students, Outward Bound staff members, Aboriginal Elders, and community members involved with the program	A collaborative ethnography study consisting of interviews, field journal from researcher, collaborative examination of participants' course journals, and course artifacts	9
Martin & Legg, 2002	Outward Bound New Zealand	Individuals enrolled in nine-day and 22-day expedition-based courses	A mixed method longitudinal study, administering a multidimensional self-concept questionnaire pre-and post-program; three open-ended questions were administered pre-program, post-program, and six months after the program examining course atmosphere; questions examined course outcomes and what elements of the course contributed to them	93

Authors	Program Provider	Study Population	Study Methods	Sample Size
Martin, 2011	Vacation School of Lipnice-Outward Bound Czech Republic	Self-examination and reflection	Autoethnography using participant observation with the author examining the personal meaning of the Outward Bound experience	1
Martin & Leberman, 2005	Outward Bound New Zealand	Participants who were 16 years and older participating in a variety of outdoor adventure courses	A mixed method longitudinal approach, conducting questionnaires on the first day, last day, and 12 weeks after program completion; surveys and open-ended questions examined learning around a variety of concepts such as leadership, self-confidence, and social competence	157
Martin et al., 2016	Outward Bound New Zealand	School and executive directors	A case study framework on organizational culture with primary data being collected through semi-structured interviews; findings further triangulated via analysis of Outward Bound New Zealand annual reports and researchers' firsthand knowledge of Outward Bound	14
Martin et al., 2002	Outward Bound Czech Republic, Outward Bound Australia	Individuals enrolled in 14-day expedition-based programs	Open-ended survey questions were administered to participants 6-months after all courses; secondary follow-up was distributed to two courses one year after completion and two years after completion for the third course; examined the impactful elements of Outward Bound courses utilizing a dramaturgical approach to education	70
Martin et al., 2009	Colorado Outward Bound School	7th and 8th grade students enrolled in an Expeditionary Learning Outward Bound School	Examining the influence of a watershed education unit; children's Environmental Virtue Scale survey administered pre- and post-program to participants; results compared to a convenience sample of eighth-grade students in Colorado serving as a control group	112 (Treatment=45, Control=67)

Authors	Program Provider	Study Population	Study Methods	Sample Size
Maxwell et al., 2008	Outward Bound New Zealand	Young adults facing long-term unemployment who are participating in a 21-day residential program	Analysis of Outward Bound participant data including demographics, external environmental factors, internal environmental factors, and social integration; interviews conducted with a sample of 10 program dropouts	Survey=585, Interview=10
McKenzie, 2003	Outward Bound Western Canada	Adults, youth, female survivors of abuse, and at-risk youth participating in outdoor adventure courses ranging from 7 to 36 days in length	An interpretive case study examining Outward Bound student learning processes; data collection consisted of a post-program questionnaire, interviews, researcher observation of group discussions	Survey=92, Interview=20
Millikan, 2006	Historical Analysis	N/A	Historical analysis of Outward Bound programming	N/A
Mott & Martin, 2017	Outward Bound New Zealand	Individuals enrolled in various outdoor adventure courses	A mixed methods design consisting interviews, incident report and quality control form analysis, and pre- and post-program evaluation questionnaires analyzing perceptions of risk and safety on Outward Bound New Zealand courses	Survey = 6792, Interview = 5
Neill & Dias, 2001	Outward Bound Australia	Young adults on a 22-day expedition oriented program	A quasi-experimental design; the experimental group completed a Resilience Scale for pre- and post-program measures and the Social Support Scale upon course completion; control group only completed Resilience Scale for pre- and post-program measures	72 (Treatment=41; Control=31)
Newbery, 2004	General Outward Bound programming	Female Outward Bound instructors	A qualitative design comprising semi-structured interviews conducted over 6 months between 1999-2000, individual reflective journal transcripts and a group interview.	4

Authors	Program Provider	Study Population	Study Methods	Sample Size
Pommier & Witt, 1995	Outward Bound Family in Need of Services program	Adolescent status offenders and parents participating in a multi-month support program	A longitudinal quantitative study; surveys were administered before the program start, 28 days after the program start, and four months after the program start; control group was not exposed to the Family in Need of Services program	107 (Treatment=61; Control=46)
Purdie & Neill, 1998	Outward Bound Australia	Under-achieving Japanese students participating in a 22-day outdoor adventure program in Australia, program accompanied by a language development component	Control and experimental groups completed the "About Myself" self-concept instruments at three time periods: pre-course, immediately post-course, and six weeks post-course; experimental group also completed "Evaluation of Course" instrument immediately post-course; multivariate repeated measures analysis was utilized and change scores were compared to previous findings within primarily Western populations	72 (Treatment=32; Control-42)
Scheinfeld et al., 2017	Outward Bound for Veterans	United States Veterans participating in a six-day outdoor adventure education program	A quasi-experimental study with experimental and control groups completing pre- and post-program surveys measuring demographic information, masculine role conformity, and mental health symptoms	199 (Treatment=181; Control=18)
Sibthorp et al., 2018	Outward Bound Hong Kong	Secondary and university students participating in a variety of outdoor adventure education programs	A pre- and post-course administration of the Outward Bound Hong Kong Performance Evaluation Questionnaire; survey results used to explore how course outcomes were related to course language, sense of belonging, and teacher-student relationship	2292
Tolich, 2012	Outward Bound New Zealand	Self-examination and reflection	An autoethnographic study from a researcher-participant lens on the meaning of the Outward Bound experience	1

Authors	Program Provider	Study Population	Study Methods	Sample Size
Vernon, 2015	United States, unspecified program provider	Students from a diversity program participating in an unspecified Outward Bound program	A qualitative study consisting observations coupled with jottings, field notes, photographs, and audio recordings; interviews with students and administrators	N/A
Walker et al., 2005	Outward Bound Australia	Individuals with recent brain injury participating in an Outward Bound course embedded in a broader treatment program	Upon completion of the program, participant goals were analyzed for completion; pre- and post-measures using the Depression, Anxiety, and Stress Scales, the General Well-Being Questionnaire, and the European Brain Injury Questionnaire were all gathered; post-program efficacy scores for different program elements and the program as a whole were gathered	11
Wang et al., 2006	Outward Bound Singapore	Female secondary school students participating in a five-day outdoor adventure education program	Pre- and post-program surveys were administered to participants measuring leadership, social skills, interpersonal skills, self-esteem, motivation for participating in the program (pre-program only), and satisfaction with the experience (post-program only)	149

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REPORTS AND REVIEWS
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REPORTS AND REVIEWS/POROČILA IN OCENE, 185–195

NEUROSCIENCE OF MOVEMENT

TwinBrain Summer School 2.0, Piran, Slovenia 4-9 July 2022

In our daily lives, we do many things automatically. And although we often seem to respond without the slightest mental effort, there are a multitude of complex processes going on in our brains. We only realize how difficult a task is when we (re)learn a certain cognitive-motor task, such as keeping our balance on skis or while surfing, or even when grasping a spoon after a stroke. On the other hand, we know of several progressive neurodegenerative diseases that prevent the smooth performance of everyday tasks. James Parkinson recognized that progressive Parkinson's disease (PD) is associated with debilitating features including postural instability and gait difficulties (PIGD), such as falls and freezing of gait. PD initially causes physical symptoms but later, problems with cognitive function, including forgetfulness and difficulty concentrating, may occur. As the disease worsens over time, many people develop dementia.

Studying the dynamics of the brain during the most routine movements, such as walking, balancing or learning new motor-cognitive tasks, remains a major challenge for neuroscience. For the TwinBrain Summer School 2.0, we have invited an international team of experts to report on the latest discoveries in the field of neuroscience on movement topics and to provide insight into how brain imaging technology can contri-

bute to the understanding of brain function and disease development. Recent advances in wireless and portable technologies allow us to take experimentation a step further into real life or situations that reflect everyday experiences. Therefore, the latest developments in Mobile Brain/Body Imaging (MoBI) were presented by internationally recognized experts from Slovenia, Germany, Switzerland, Italy, Belgium, the Czech Republic, Croatia, Bosnia and Herzegovina and the USA. The TwinBrain Summer School 2.0 was held on July 4-9, 2022, in Piran, Slovenia. The next Summer School 3.0 is scheduled for June 19-24, 2023, again in Piran, Slovenia.

Uroš Marušič

REPORTS AND REVIEWS/POROČILA IN OCENE, 185–195

NEVROZNANOST GIBANJA

Poletna šola TwinBrain 2.0, Piran, Slovenija, 4. –9. julij 2022

V vsakdanjem življenju veliko stvari počnemo samodejno. In čeprav se pogosto zdi, da se odzovemo brez najmanjšega miselnega napora, v naših možganih potekajo številni kompleksni procesi. Kako težka je ta naloga, se zavemo šele, ko se (ponovno) naučimo določene kognitivno-motorične naloge, kot je ohranjanje ravnotežja na smučeh ali med deskanjem ali celo prijemanje žlice po možganski kapi. Hkrati poznamo več nevrodegenerativnih bolezni, ki napredujejo in onemogočajo nemoteno opravljanje vsakodnevnih opravil. Že James Parkinson je poročal, da je progresivna Parkinsonova bolezen (PD) povezana z izčrpavajočimi značilnostmi, kot so posturalna nestabilnost in težave pri hoji (PIGD) ter tudi padci in zamrznitev hoje. PD na začetku povzroči telesne simptome. Pozneje se lahko pojavijo tudi težave s kognitivnimi funkcijami, vključno s pozabljivostjo in nezmožnostjo koncentracije. Ko se bolezen sčasoma poslabša, veliko ljudi razvije demenco.

Proučevanje dinamike možganov med večino rutinskih gibov, kot so hoja, ravnotežje ali učenje novih motorično-kognitivnih nalog, ostaja velik izziv za nevroznanost. Na poletno šolo TwinBrain 2.0 smo povabili mednarodno ekipo strokovnjakov, da bi

poročali o najnovejših odkritjih na področju nevroznanosti gibanja in zagotovili vpogled v to, kako lahko tehnologija slikanja možganov prispeva k razumevanju delovanja teh in razvoja bolezni. Novejši napredek na področju brezžičnih in prenosljivih tehnologij nam omogoča, da gremo korak naprej pri eksperimentiranju in sicer v resnično življenje oz. okoliščine, ki odsevajo vsakodnevne izkušnje. Zato so najnovejše dosežke na področju Mobile Brain/Body Imaging (MoBI) predstavili mednarodno priznani strokovnjaki iz Slovenije, Nemčije, Švice, Italije, Belgije, Češke, Hrvaške, Bosne in Hercegovine in ZDA. Poletna šola TwinBrain 2.0 je potekala od 4. do 9. julija 2022 v Piranu. Naslednja Poletna šola 3.0 bo predvidoma organizirana od 19. do 24. junija 2023, ponovno v Piranu.

Uroš Marušič

REPORTS AND REVIEWS/POROČILA IN OCENE, 185–195

CONFERENCE REPORT – 4TH INTERNATIONAL CONFERENCE ON TECHNOLOGY INNOVATIONS FOR HEALTHCARE (ICDHT)

Magdeburg, Germany, 14th–16th September 2022

The Otto von Guericke University hosted the 4th ICDHT conference in Magdeburg, Germany. Lectures were held in the Lukas Klause building and in the main building of the college.

The two-day conference featured a comprehensive scientific program addressing the latest developments in research and technology for digital health with clinical and technical perspectives. The conference focused on future P4 medicine (predictive, preventive, personalized and participatory) and on supporting performance in all sports through information technology tools. The program featured 8 keynote speakers and 27 oral presentations. Among the participants, colleagues from the Institute for Kinesiology Research ZRS Koper presented their work; Prof Dr Rado Pišot (Digital Technology – from an Obstacle to an Incentive for a Healthy and Active Lifestyle), Prof Dr Boštjan Šimunič (The Decomposition of Tensiomyography Using Advanced Mathematics) and Prof Dr Uroš Marušič (Wearables and Wireless Technology for Training and Tele-Rehabilitation Services) were the keynote speakers and Dr Saša Pišot and Kaja Teraž gave their oral presentation.

The issued "Book of Abstracts" contains 27 abstracts of scientific papers with current research results in the field of digital health technology.

The rich historical background of the city of Magdeburg, the hospitality of the organizers and the interesting social program allowed us to exchange professional thoughts and ideas related to this field, which will experience many innovations in the future.

Kaja Teraž

REPORTS AND REVIEWS/POROČILA IN OCENE, 185–195

POROČILO S 4. MEDNARODNE KONFERENCE O TEHNOLOŠKIH NOVOSTIH V ZDRAVSTVU (ICDHT)

Magdeburg, Nemčija, 14.–16. september 2022

Univerza Otto von Guericke je gostila 4. konferenco ICDHT, ki je potekala v Magdeburgu v Nemčiji. Predavanja so potekala v stavbi Lukas Klause in glavni stavbi univerze.

Dvodnevna konferenca je vključevala obsežen znanstveni program, v okviru katerega so bili obravnavani najnovejši dosežki na področju raziskav in tehnologije za digitalno zdravje z njegovimi kliničnimi in tehničnimi vidiki. Konferenca se je osredinila na obetavno P4 medicino (prediktivna, preventivna, personalizirana in participativna medicina) in podporo športnim dosežkom v vseh športih s pomočjo orodij informacijske tehnologije. V okviru programa je sodelovalo osem vabljenih govornikov, predstavljenih pa je bilo 27 povzetkov prispevkov. Med vsemi udeleženci so svoje delo predstavili tudi kolegi z Inštituta za kineziološke raziskave ZRS Koper, in sicer prof. dr. Rado Pišot (Digitalna tehnologija – od ovire do spodbude za zdrav in aktiven življenjski slog), prof. dr. Boštjan Šimunič (Dekompozicija tenziomiografije z uporabo napredne matematike) in prof. dr. Uroš Marušič (Nosljiva in brezžična tehnologija za usposabljanje in storitve rehabilitacije na daljavo) kot osrednji govorci, dr. Saša Pišot in Kaja Teraž pa sta predstavili svoj povzetek prispeveka.

Izdan zbornik vsebuje 27 povzetkov znanstvenih prispevkov z aktualnimi rezultati raziskav na področju digitalne zdravstvene tehnologije

Bogato zgodovinsko ozadje mesta Magdeburg, gostoljubnost organizatorjev in zanimiv družabni program so nam omogočili izmenjavo številnih strokovnih misli in idej o omenjenem področju, ki bo v prihodnosti doživelo številne novosti.

Kaja Teraž

REPORTS AND REVIEWS/POROČILA IN OCENE, 185–195

"KNOWLEDGE FOR HEALTH": INTEGRATED HEALTH CARE

Koper, Slovenia, 1 October 2022

The annual "Knowledge for Health" event was held on 1 October, International Day of Older Persons. The United Nations General Assembly proclaimed this day to highlight the often overlooked role and position of this population group in society, despite the fact that the proportion of older people in the population is increasing. Experts from various fields participated in the event, which was aimed at a broad audience and was intended to highlight the issue of holistic health at the intersection of muscular, cognitive and cardiovascular health.

Talking about the consequences of an inappropriate lifestyle and how to take care of one's health in a holistic way that is also accessible to the general public remains the main goal of the initiators of the "Knowledge for Health" event, held for the eleventh consecutive year in collaboration with the Institute for Kinesiological Research of the Scientific Research Centre (ZRS) Koper and the Izola General Hospital. During this period, numerous meetings and discussions were held and thousands of measurements of physical and functional fitness and risk factors were performed. Numerous public lectures were held with top experts who have time and again offered new insights for health.

This year's event took place in the morning at Taverna in Koper, Slovenia, and included measurements of physical characteristics, functional abilities and health risk

factors. Participants had the opportunity to assess their cardiovascular, muscular and cognitive health through simple but relevant tests.

On the occasion of the International Day of Older Persons, the organizers of the event emphasized the importance of monitoring sarcopenia for general health. They identified severe sarcopenia in 9% of those measured and urged them to change their lifestyle for better health. Sarcopenia can have very serious consequences, such as insufficient muscle strength, decreased metabolic capacity, decreased aerobic capacity, leading to physical limitations, immobility, poorer quality of life, more fragile bones, cognitive decline, cardiovascular disease and ultimately premature death. This is mainly due to the excessive loss of muscle fibers and the reduction of the remaining fibers. What causes this is not yet entirely clear, and the answer is certainly very broad, which is why it is a syndrome rather than a disease. However, we can confirm with certainty that one of the causes is a lack of proper exercise with sufficient intensity to stimulate the repair and growth of muscle fibers. In addition to proper exercise, adequate protein intake is also important to support muscle repair after exercise.

The testing of participants at the "Knowledge for Health" event is an example of knowledge transfer to the general public, as it comes directly from the research work of colleagues from the Institute for Kinesiology Research, ZRS Koper. The irreversibility of the processes of muscle deterioration in the elderly motivated Prof. Dr Boštjan Šimunić to obtain two new national research projects. The "Validation of a muscle-quality marker for the diagnosis of sarcopenia (ARRS J7-2605)" project will develop a method that will enable the early detection of changes in muscle properties and performance during ageing, before they become visible with standard clinical instruments. The goal is to allow early intervention before sarcopenia actually sets in. The "Neuromuscular decline after physical inactivity: a comparison of younger and older adults (ARRS J5-4593)" project aims to investigate the mechanisms and temporal patterns of muscle mass and performance decline in younger and older adults, which is critical for understanding the processes of decline and for developing preventive and curative interventions/guidelines. The central nervous system controls muscle function and has been shown to be a key determinant of muscle performance. Under the leadership of Assoc. Prof. Dr Uroš Marušič, the researchers have been awarded the "TWINning the BRAIN with machine learning for neuromuscular efficiency – TwinBrain" international project, which investigates brain function during movement, during execution of various movements, and during motor learning with and without skeletal movement.

With the completion of the testing in Taverna in Koper, each participant received a ticket to the afternoon part of the event, which took place at Koper Theatre, where a panel of experts spoke about the importance and role of monitored characteristics in health. Too often we want to "measure health", compare ourselves to the norms without knowing more about the parameters and indicators of (un)healthiness that are being measured. High-profile speakers and top experts tried to find answers to the question of what holistic health is and how muscular, cognitive and cardiovascular health form a whole. Prim. Dorjan Marušič, MD, PhD, spoke about cardiovascular health, Bojan

Rojc, MD, PhD, spoke about neuromuscular health and Uroš Marušič, PhD, Associate Professor, spoke about cognitive health.

The discussion was moderated by the founding fathers of the meeting, Prof. Dr Rado Pišot and Assoc. Prof. Dr Mladen Gasparini. The event was another in the series of events that brought together Koper Theatre, ZRS Koper and Izola General Hospital in an effort to contribute to the health and quality of life of our citizens, and was therefore once again supported by the Koper City Council.

Boštjan Šimunić, Nika Štravs, Matej Kleva, Peter Čerče

REPORTS AND REVIEWS/POROČILA IN OCENE, 185–195

»ZNANJE ZA ZDRAVJE«: CELOSTNA SKRB ZA ZDRAVJE

Koper, Slovenija, 1. oktober 2022

Vsakoletni dogodek »Znanje za zdravje« je tokrat potekal 1. oktobra, ob mednarodnem dnevu starejših. Generalna skupščina Združenih narodov je ta dan razglasila zaradi pogosto spregledane vloge in položaja, ki ga ima ta skupina prebivalstva v družbi, čeprav se delež starejše populacije povečuje. Strokovnjaki z različnih področji so na dogodku, ki je namenjen najširši zainteresirani javnosti, poskušali osvetliti problem celostnega zdravja v preseku med mišičnim, kognitivnim in srčno-žilnim zdravjem.

Spregovoriti o posledicah neustreznega življenjskega sloga in kako celostno poskrbeti za svoje zdravje na način, ki je dostopen najširši javnosti, tudi sicer ostaja glavno vodilo pobudnikov dogodka »Znanje za zdravje«, ki je že enajsto leto zapored potekal v sodelovanju Inštituta za kineziološke raziskave Znanstveno-raziskovalnega središča (ZRS) Koper in Splošne bolnišnice (SB) Izola. V tem času so izvedli številna srečanja in pogovore, več tisoč meritev telesne in funkcionalne pripravljenosti ter dejavnikov tveganja. Organizirali so številna javna predavanja z vrhunskimi strokovnjaki, ki so vedno znova ponudili nova znanja za zdravje.

Na letošnji prireditvi so v koprski Taverni v dopoldanskem času potekale meritve telesnih značilnosti, funkcionalnih sposobnosti in dejavnikov tveganja za zdravje. Udeleženci so imeli možnost na osnovi preprostih, vendar relevantnih meritev preveriti svoje srčno-žilno, mišično in kognitivno zdravje.

Ob svetovnem dnevu starejših so organizatorji dogodka posebej poudarili pomen spremljanja sarkopenije za celostno zdravje. Pri kar 9 % izmerjenih so odkrili hudo obliko sarkopenije in jih opozorili, naj spremenijo svoj življenjski slog za kakovostnejše zdravje. Sarkopenija lahko privede do zelo hudih posledic, kot so premajhna mišična

moč, manjše presnovne sposobnosti in manjše aerobne sposobnosti, vse to pa vodi v gibalne omejitve, nemobilnost, slabšo kakovost življenja, krhkejše kosti, kognitivni upad, srčno-žilne bolezni in v skrajni posledici v prezgodnjo smrt. Razlog je predvsem v preveliki izgubi mišičnih vlaken in zmanjšanju tistih, ki še ostanejo. Kateri so vzroki, ki privedejo do tega, še ni popolnoma jasno, in odgovor je gotovo zelo širok, zato je to tudi sindrom, bolj kot bolezen. Prav gotovo pa lahko kot enega od vzrokov potrdimo pomanjkanje primerne, dovolj intenzivne gibalne vadbe, ki spodbuja obnovo in rast mišičnih vlaken. Ob pravilni vadbi je pomemben tudi zadosten vnos beljakovin, ki podpirajo obnovo mišic po vadbi.

Na dogodku »Znanje za zdravje« izvedene meritve udeležencev so primer prenosa znanja v širšo javnost, saj izhajajo neposredno iz raziskovalnega dela sodelavk in sodelavcev Inštituta za kineziološke raziskave ZRS Koper. Ireverzibilnost procesov upada mišične mase pri starejših je namreč motivirala prof. dr. Boštjana Šimuniča k pridobitvi dveh novih nacionalnih raziskovalnih projektov. V sklopu projekta Validacija markerja mišične kakovosti za diagnosticiranje sarkopenije (ARRS J7-2605) razvijajo metodo, ki bo omogočala zgodnjo zaznavo sprememb v mišičnih značilnostih in zmogljivostih med staranjem, še preden bo ta vidna s standardnimi kliničnimi orodji. Cilj je zagotoviti še pravočasno ukrepanje pred dejanskim nastopom sarkopenije. V sklopu projekta »Upad živčno-mišičnega sistema po gibalni neaktivnosti: primerjava mlajših in starejših odraslih (ARRS J5-4593)« pa nameravajo proučiti mehanizme in časovne zakonitosti upada mišične mase in zmogljivosti pri mlajših in starejših, kar je ključno za razumevanje procesov upada ter oblikovanje preventivnih in kurativnih ukrepov/smernic. Centralni živčni sistem nadzoruje delovanje mišic in je bil prepoznan za ključni dejavnik mišične zmogljivosti. Pod vodstvom izr. prof. dr. Uroša Marušiča so raziskovalci pridobili mednarodni projekt TWINning the BRAIN with machine learning for neuromuscular efficiency – TwinBrain, v sklopu katerega proučujejo delovanje možganov med gibanjem, v procesu izvedbe različnih gibov, med motoričnim učenjem s premikanjem skeleta in brez premikanja.

Z opravljeno meritvijo v koprski Taverni je vsak udeleženec pridobil vstopnico za popoldanski del dogodka, ki je potekal v Gledališču Koper. Na njem so strokovnjaki spregovorili o pomenu in vlogi spremljanih značilnosti za zdravje. Prevečkrat si namreč želimo »izmeriti zdravje«, se primerjati z veljavnimi normami, ne da bi hkrati o merjenih parametrih in kazalnikih (ne)zdravja vedeli kaj več. Eminentni predavatelji, vrhunski strokovnjaki, so poskušali poiskati odgovore na vprašanja, kaj sploh je celostno zdravje ter kako mišično, kognitivno in srčno-žilno zdravje tvorijo celoto. Prim. mag. Dorjan Marušič, dr. med., je tako spregovoril o srčno-žilnem zdravju, doc. dr. Bojan Rojc o nevromišičnem zdravju, izr. prof. dr. Uroš Marušič pa o kognitivnem zdravju.

Pogovor sta povezovala idejna očeta srečanja prof. dr. Rado Pišot in doc. dr. Mladen Gasparini. Dogodek je ponovno združil Gledališče Koper, ZRS Koper in SB Izola v želji, da bi prispevali h kakovosti zdravja in življenja naših občanov, zato ga je tudi tokrat podprla Mestna občina Koper.

Boštjan Šimunić, Nika Štravs, Matej Kleva, Peter Čerče

GUIDELINES FOR AUTHORS

1. Aim and scope of the journal:

Annales Kinesiologiae is an international interdisciplinary journal covering kinesiology and its related areas. It combines fields and topics directed towards the study and research of human movement, physical activity, exercise and sport in the context of human life style and influences of specific environments. The journal publishes original scientific articles, review articles, technical notes and reports.

2. General policy of Annales Kinesiologiae

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d) The **title page** should include the title of the article (no more than 85 characters, including spaces), full names of the author(s) and affiliations (institution name and address) of each author; linked to each author using superscript numbers, as well as the corresponding author's full name, telephone, and e-mail address.

e) The authors are obliged to prepare two **abstracts** – one short abstract in English and one (translated) in Slovene language. For foreign authors translation of the abstract into Slovene will be provided. The content of the abstract should be structured into the following sections: purpose, methods, results, and conclusions. It should only contain the information that appears in the main text, and should not contain reference to figures, tables and citations published in the main text. The abstract is limited to 250 words.

f) Under the abstract a maximum of 6 appropriate **Keywords** shall be given in English and in Slovene. For foreign authors the translation of the key words into Slovene will be provided.

g) The **main text** should include the following sections: Introduction, Methods, Results, Discussion, Conclusions, Acknowledgement (optional), and References. Individual parts of the text can form sub-sections.

h) Each **table** should be submitted on a separate page in a Word document after the Reference section. Tables should be double-spaced. Each table shall have a brief caption; explanatory matter should be in the footnotes below the table. Abbreviations used in the tables must be consistent with those used in the main text and figures. Definitions of symbols should be listed in the order of appearance, determined by reading horizontally across the table and should be identified by standard symbols. All tables should be numbered consecutively Table 1, etc. The preferred location of the table in the main text should be indicated preferably in a style as follows: *** Table 1 somewhere here ***.

i). Captions are required for all **figures** and shall appear on a separate manuscript page, under the table captions. Each figure should be saved as a separate file without captions and named as Figure 1, etc. Files should be submitted in *.tif or *.jpg format. The minimum figure dimensions should be 17x20 cm and a resolution of at least 300 dpi. Combinations of photo and line art should be saved at 600–900 dpi. Text (symbols, letters, and numbers) should be between 8 and 12 points, with consistent spacing and alignment. Font type may be Serif (Times Roman) or Sans Serif (Arial). Any extra white or black space surrounding the image should be cropped. Ensure that participant-identifying information (i.e., faces, names, or any other identifying features) should be omitted. Each figure should be saved as a separate file without captions and named as Figure 1, etc. The preferred location of the figure in the main text should be indicated preferably in a style as follows: *** Figure 1 somewhere here ***.

j) References

The journal uses the Harvard reference system (Publication Manual of the American Psychological Association, 6th ed., 2010), see also: https://www.apastyle.org). The list of references should only include work cited in the main text and being published or accepted for publication. Personal communications and unpublished works should only be mentioned in the text. References should be complete and contain up to seven authors. If the author is unknown, start with the title of the work. If you are citing work that is in print but has not yet been published, state all the data and instead of the publication year write „in print".

Reference list entries should be alphabetized by the last name of the first author of each work. Titles of references written in languages other than English should be additionally translated into English and enclosed within square brackets. Full titles of journals are required (no abbreviations).

Where available, DOI numbers should be provided in the form of a resolvable URL https://doi.org/10.1037/rmh0000008.

Examples of reference citation in the text

One author: This research spans many disciplines (Enoka, 1994) or Enoka (1994) had concluded...

Two authors: This result was later contradicted (Greene & Roberts, 2005) or Greene and Roberts (2005) pointed out...

Three to six authors:
a) first citation: Šimunič, Pišot and Rittweger (2009) had found... or (Šimunič, Pišot & Rittweger, 2009)
b) Second citation: Šimunič et al. (2009) or (Šimunič et al., 2009)

Seven or more authors:
Only the first author is cited: Di Prampero et al. (2008) or (Di Prampero et al., 2008).
Several authors for the same statement with separation by using a semicolon: (Biolo et al., 2008; Plazar & Pišot, 2009)

Examples of reference list*:*
The style of referencing should follow the examples below:

Books
Latash, M. L. (2008). Neurophysiologic basis of movement. Campaign (USA): Human Kinetic.

Journal articles
Marušič, U., Meeusen, R., Pišot, R., & Kavcic, V. (2014). The brain in micro- and hypergravity : the effects of changing gravity on the brain electrocortical activity. European journal of sport science, 14(8), 813–822. https://doi.org/10.1080/17461391.2014.908959

Šimunič, B., Koren, K., Rittweger, J., Lazzer, S., Reggiani, C., Rejc, E., … Degens, H. (2019). Tensiomyography detects early hallmarks of bed-rest-induced atrophy before changes in muscle architecture. Journal of applied physiology, 126(4), 815–822. https://doi.org/10.1152/japplphysiol.00880.2018

Book chapters

Šimunič, B., Pišot, R., Mekjavić, I. B., Kounalakis, S. N. & Eiken, O. (2008). Orthostatic intolerance after microgravity exposures. In R. Pišot, I. B. Mekjavić, & B. Šimunič (Eds.), The effects of simulated weightlessness on the human organism (pp. 71–78). Koper: University of Primorska, Scientific and research centre of Koper, Publishing house Annales.

Rossi, T., & Cassidy, T. (in press). Teachers' knowledge and knowledgeable teachers in physical education. In C. Hardy, & M. Mawer (Eds.), Learning and teaching in physical education. London (UK): Falmer Press.

Conference proceeding contributions

Volmut, T., Dolenc, P., Šetina, T., Pišot, R. & Šimunič, B. (2008). Objectively measures physical activity in girls and boys before and after long summer vacations. In V. Štemberger, R. Pišot, & K. Rupret (Eds.) Proceedings of 5th International Symposium A Child in Motion "The physical education related to the qualitative education" (pp. 496–501). Koper: University of Primorska, Faculty of Education Koper, Science and research centre of Koper; Ljubljana: University of Ljubljana, Faculty of Education.

Škof, B., Cecić Erpić, S., Zabukovec, V., & Boben, D. (2002). Pupils' attitudes toward endurance sports activities. In D. Prot, & F. Prot (Eds.), Kinesiology – new perspectives, 3rd International scientific conference (pp. 137–140), Opatija: University of Zagreb, Faculty of Kinesiology.

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5. For additional information regarding article publication, please do not hesitate to contact the secretary of Annales Kinesiologiae.


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