

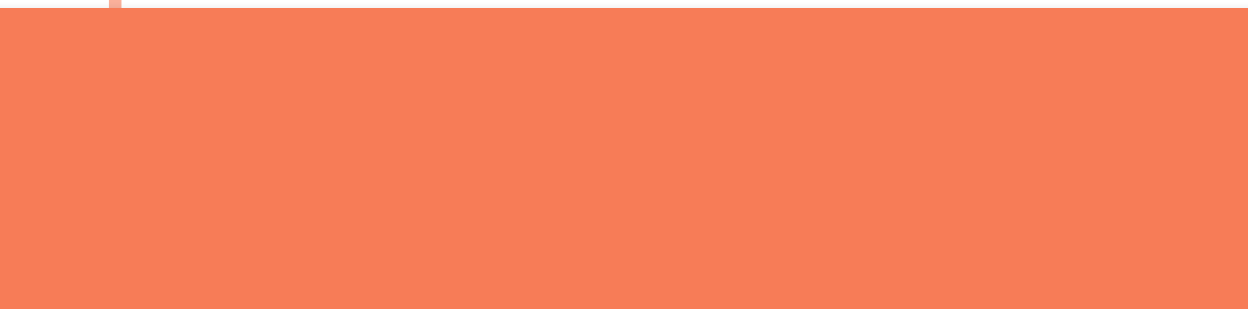


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EDITORIAL

Welcome to the first issue of volume 14 of *Annales Kinesiologiae* for the publishing year of 2023, which truly reflects the interdisciplinary scientific research and quality of life outcomes that the wider field of kinesiology research can contribute to.

The first contribution, a review article, investigates whether aerobic interval training has positive health benefits for cardiovascular patients. Based on 15 selected studies, it concludes that ten to sixteen weeks of moderate or high-intensity training two to three times per week has positive effects for elderly cardiovascular patients. These recommendations are in line with previously published guidelines, as well as very useful for planning general quality fitness programmes.

The next contribution, an original scientific article, aims to investigate whether gender differences influence gym-goers' choice of fitness trainer and can determine and explain social media exercise content. The developed questionnaire was tested on 50 gym-goers from which a myriad of complex conclusions concerning gym-clients' attitudes can be drawn. Furthermore, these results could support the planning of social media exercises and client-friendly content.

The second scientific article reports on the development and validation of a scale that reflects the decision-making by the elderly on taking part in organized physical exercise programmes. The scale was tested on 1777 people aged over 60 years and consists of four factors with 27 statements, explaining 43% of the variability. The scale will be a helpful tool assisting in the planning and promotion of organized physical activity interventions for older people.

The final contribution and second review paper investigates the best rehabilitation process for Olympic weightlifters with rotator cuff injuries, drawing recommendations from 16 research papers. As these injuries are usually quite complex, the results indicate how effective rehabilitation can be prepared based on a well-planned combination of applied physiotherapy, specific methods and duration.

In addition, our editorial team offers two reports on recent events that they were part of: the *European Association for the Sociology of Sport* held a conference in Budapest at the end of May and beginning of June; and in Piran, the *Third TwinBrain Summer School »Neuroscience of Movement – Exploring the Dynamics of the Human Brain in Motion«* was organized in June.

Altogether, the studies in this issue of *Annales Kinesiologiae* offer useful information and tools that can aid in preparing for successful lifestyle/rehabilitation interventions for various populations, including the elderly, injured and diseased persons.

Scientific collections like this are a good way for the multidisciplinary field of kinesiology to contribute to improving the quality of life, and something the editorial team certainly hopes to continue to offer in the future.

Cécil Meulenberg, PhD,
Editor

UVODNIK

Spoštovane bralke in bralci, vabimo vas k branju prve številke 14. letnika *Annales Kinesiologiae* z letnico izida 2023, vsebina katere resnično izraža interdisciplinarno znanstveno raziskovanje in rezultate na področju kakovosti življenja, h katerim lahko prispeva širše področje kinezioloških raziskav.

V prvem prispevku, preglednem članku, avtorji raziskujejo, ali aerobni intervalni trening pozitivno učinkuje na zdravje bolnikov s srčno-žilnimi obolenji. Na podlagi 15 izbranih raziskav je bilo ugotovljeno, da ima od dva- do trikrat tedenska zmerno ali visoko intenzivna vadba, ki se izvaja od deset do šestnajst tednov, pozitivne učinke na starejše srčno-žilne bolnike. Ta priporočila se večinoma skladajo s predhodno objavljenimi smernicami, prav tako so zelo koristna za načrtovanje splošnih kakovostnih programov telesne pripravljenosti.

V naslednjem prispevku, izvirnem znanstvenem članku, avtorji raziskujejo, ali razlike med spoloma vplivajo na izbiro trenerja za fitnes pri obiskovalcih telovadnic ter ali lahko določijo in pojasnijo vsebino vadbe v družbenih medijih. Vprašalnik, ustvarjen za to raziskavo, je izpolnilo 50 obiskovalcev fitnesa. Iz dobljenih rezultatov je mogoče izpeljati nešteto kompleksnih ugotovitev glede odnosa strank do fitnesa. Še bolj so ti rezultati gotovo lahko v pomoč pri načrtovanju vadbe v družbenih medijih in pri oblikovanju strankam prijaznih vsebin.

Drugi znanstveni članek poroča o razvoju in potrditvi lestvice, ki izraža odločanje starejših za udeležbo v organiziranih programih telesne vadbe. Lestvica je bila preizkušena med 1777 osebami, starejšimi od 60 let, in je sestavljena iz štirih dejavnikov s 27 trditvami, ki pojasnjujejo 43 % variabilnosti. Lestvica bo koristno orodje za pomoč pri načrtovanju in spodbujanju priporočene organizirane telesne dejavnosti za starejše osebe..

V zadnjem prispevku, ki je drugi pregledni članek v tej številki revije, poskušajo avtorji ugotoviti, kateri je najboljši rehabilitacijski postopek za olimpijske dvigalce uteži s poškodbo rotatorne manšete, pri čemer so priporočila povzeta iz 16 raziskovalnih člankov. Čeprav so te poškodbe običajno precej kompleksne, rezultati kažejo, da je učinkovito rehabilitacijo mogoče pripraviti z dobro načrtovano kombinacijo uporabne fizioterapije, specifičnih metod in njihovega trajanja.

Poleg tega je naša uredniška ekipa pripravila tudi poročili o nedavnih dogodkih, ki se jih je udeležila. Konec maja in v začetku junija je v Budimpešti potekala konferenca *Evropskega združenja za sociologijo športa* (EASS), junija pa je bila v Piranu organizirana tretja poletna šola TwinBrain »*Neuroscience of Movement – Exploring the Dynamics of the Human Brain in Motion*«.

Raziskave v tej številki revije *Annales Kinesiologiae* ponujajo koristne informacije in orodja, ki lahko pomagajo pri pripravi uspešnih posegov na področju življenjskega sloga/rehabilitacije pri različnih skupinah prebivalstva –starejših, poškodovanih in bolnih osebah.

Znanstvene vsebine, kot so predstavljene v tej številki revije, potrjujejo, da lahko multidisciplinarno področje kineziologije prispeva k boljši kakovosti življenja, uredniška ekipa pa vsekakor upa, da jih bo ponujala tudi v prihodnosti.

dr. Cécil Meulenberg,
urednik

HEALTH ASPECTS OF AEROBIC INTERVAL TRAINING IN THE REHABILITATION OF PATIENTS WITH CARDIOVASCULAR DISEASES: A SYSTEMATIC REVIEW

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ABSTRACT

Purpose: The aim of this study was to review the literature analyzing the effects of aerobic interval training in the rehabilitation of cardiovascular patients.

Methods: Research data was collected considering the inclusion and exclusion criteria of the research studies published in English. In order for the study to be included in the analysis, it had to meet the following criteria: year of publication (2004–2022), respondents were people with cardiovascular disease, and the studies included in this review must contain data on disease, training programme and outcomes. Papers without full texts available and systematic review studies were excluded. The first search identified 71 articles. In the initial assessment carried out in accordance with the inclusion and exclusion criteria, 15 articles were found suitable and were included in the study, while 20 studies were excluded for being duplicates, 28 studies excluded for not having the full text available and eight for non-compliance.

Results: The reviewed materials indicate that aerobic interval training has an impact on VO_2 max, functional abilities, VO_2 peak and functional capacity in the rehabilitation of cardiovascular diseases, especially in the elderly. The duration of the programme in most studies has a similar time range from 10 to 16 weeks. The programmes that showed the best effects are related to aerobic interval training, from 2 to 3 times per week with moderate (50–60% of VO_2 max) or high intensity (80–90% of VO_2 max).

Conclusion: *Studies indicate that properly dosed physical activity contributes to a better lifestyle for people with cardiovascular diseases. All 15 studies showed positive effects of aerobic interval training in cardiovascular disease rehabilitation.*

Keywords: *aerobic exercise, interval training, rehabilitation, cardiovascular diseases*

ZDRAVSTVENI VIDIKI AEROBNEGA INTERVALNEGA TRENINGA PRI REHABILITACIJI PACIENTOV S SRČNO-ŽILNIMI BOLEZNIMI: SISTEMATIČNI PREGLED

IZVLEČEK

Namen: Namen raziskave je pripraviti pregled literature, v kateri so analizirani učinki aerobnega intervalnega treninga na rehabilitacijo pacientov s srčno-žilnimi boleznimi.

Metode: Podatki o raziskavah so bili zbrani ob upoštevanju meril za vključitev in izključitev, in sicer za raziskave, objavljene v angleškem jeziku. V analizo so bile vključene raziskave, ki so izpolnjevale naslednja merila: objavljene so bile med letoma 2004 in 2022, anketiranci so bili ljudje s srčno-žilnimi boleznimi, poleg tega so raziskave vključevale tudi podatke o bolezni, programu treninga in rezultatih. Po drugi strani v analizo niso bili vključeni raziskave, katerih besedilo ni bilo v celoti dostopno, in sistematični pregledi raziskav. S prvim iskanjem je bilo najdenih 71 člankov. V začetno oceno je bilo v skladu z merili za vključitev in izključitev vključenih 15 člankov, medtem ko je bilo 20 raziskav izključenih, ker so bile podvojene, 28 raziskav je izključenih, ker ni bilo na voljo celotnega besedila, osem pa jih je bilo izključenih zaradi neskladnosti.

Rezultati: Pregledana gradiva kažejo, da aerobni intervalni trening vpliva na maksimalno aerobno moč (VO_{2max}), funkcionalne sposobnosti, najvišjo vrednost porabe kisika (VO_{2peak}) in funkcionalne zmogljivosti pri rehabilitaciji v primeru srčno-žilnih bolezni, zlasti pri starejših. V večini raziskav programi trajajo od 10 do 16 tednov. Tisti, ki so se izkazali za najučinkovitejše, so povezani z aerobnim intervalnim treningom in se izvajajo od 2- do 3-krat tedensko z zmerno (50–60 % vrednosti VO_{2max}) ali visoko intenzivnostjo (80–90 % vrednosti VO_{2max}).

Zaključek: Raziskave kažejo, da ustrežna količina telesne dejavnosti prispeva k boljšemu življenjskemu slogu oseb s srčno-žilnimi boleznimi. Vseh 15 raziskav je pokazalo pozitivne učinke aerobnega intervalnega treninga pri rehabilitaciji v primeru srčno-žilnih bolezni.

Ključne besede: *aerobni, intervalni trening, rehabilitacija, srčno-žilne bolezni*

INTRODUCTION

Cardiovascular disease (CVD) remains the leading cause of mortality worldwide and in Europe (Lozano et al., 2012). It is estimated that 13 million deaths worldwide are caused by CVD. In Europe, more than 80% of all CVD mortality occurs in developing countries. Both mortality and disability caused by CVD remain extremely high and thereby CVD is still the leading somatic cause of loss of productivity (Van Camp, 2014). Exercise-based cardiac rehabilitation has been established as a beneficial treatment approach for patients with cardiovascular diseases (CVDs). However, optimal exercise characteristics that elicit the most favourable effects for CVD patients are still a matter of controversy (Vanhees, Rauch, Piepoli, & van Buuren, 2012).

The “traditional” approach to prescribing exercise intensity for cardiac rehabilitation is between 60–80% of VO_2 max, resulting in an average increase of 20% of VO_2 max. Intensity appears to be a significant predictor of rehabilitation programme efficacy, as higher intensity leads to greater improvements in VO_2 max, even after adjusting for other training-related variables (Rankin, Rankin, MacIntyre, & Hillis, 2012). However, higher intensity is difficult to sustain over a longer period; therefore, Mezzani et al. (2013) suggest an interval structure that refers to shorter exercise sessions with high to severe intensity (60–95% of VO_2 max) with duration from 3 to 20 minutes.

Several studies have demonstrated the beneficial effects of physical activity in the prevention, treatment and rehabilitation of cardiovascular diseases (Scrutino, Bellotto, Lagioia, & Passantino, 2005; Secco, Paffenberger, & Lee, 2000; Šuščević et al., 2011). Physical activity was not previously recognized as having a significant impact on the prevention and rehabilitation of CVDs. However, in recent years, significant changes have occurred due to the emergence of strong evidence of the effectiveness of primary and secondary prevention (Fletcher et al., 2013). It has been established that physical activity has a powerful and beneficial effect on human health, particularly in the pathogenesis of diseases that make up metabolic syndrome, including CVDs (Ades & Coello, 2000). Physical activity is part of a multifactorial concept that, in addition to reducing risk factors, lifestyle changes and therapy, leads to a reduction in cardiovascular risk (Šuščević et al., 2011). In contrast, physical inactivity is one of the main risk factors and causes two million deaths annually (Petković-Košćal, Damjanov, Jevtović, Jovanović & Pantović, 2007).

Considering previous studies, there is a need for further and more detailed analysis of the implementation of aerobic interval training in the rehabilitation of patients with cardiovascular disease. Although there are many studies

investigating aerobic interval training in the rehabilitation of CVDs, to be able to draw a conclusion on this topic there is a need for a systematic review of studies that employ different structures, intensity and frequency of this kind of training in practice. Research in this direction will make it possible to obtain information about health aspects of aerobic interval training in the rehabilitation of CVD patients. Therefore, the aim of this study was to review the literature analyzing the effects of aerobic interval training in the rehabilitation of cardiovascular patients.

METHODS

This research was designed using the systematic review technique. Research data was collected considering the inclusion and exclusion criteria of the research published, as a result of a search made by using the keywords “aerobic, interval, training, rehabilitation, cardiovascular diseases” in English. The search string was related to aerobic interval training with the following combination of keywords used in all databases: “aerobic interval training” AND “rehabilitation” AND “cardiovascular diseases”. The search was performed on the Web of Science, Google Scholar and PubMed databases. In accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines, a systematic review of the available literature was undertaken (Moher et al., 2009) (Figure 1.). The first search identified 71 articles. In the initial assessment carried out in accordance with the inclusion and exclusion criteria, 15 articles were found suitable and were included in the study, while 56 studies were excluded. In order for a study to be included in the analysis, it had to meet the following criteria: year of publication (2004–2022), respondents were people with cardiovascular disease, and the studies included in this review must contain data on disease, the training programme and outcomes. Papers without the full text available and systematic review studies were excluded. References from all papers were reviewed in order to find more studies that deal with a topic that is interesting and related to our review paper.

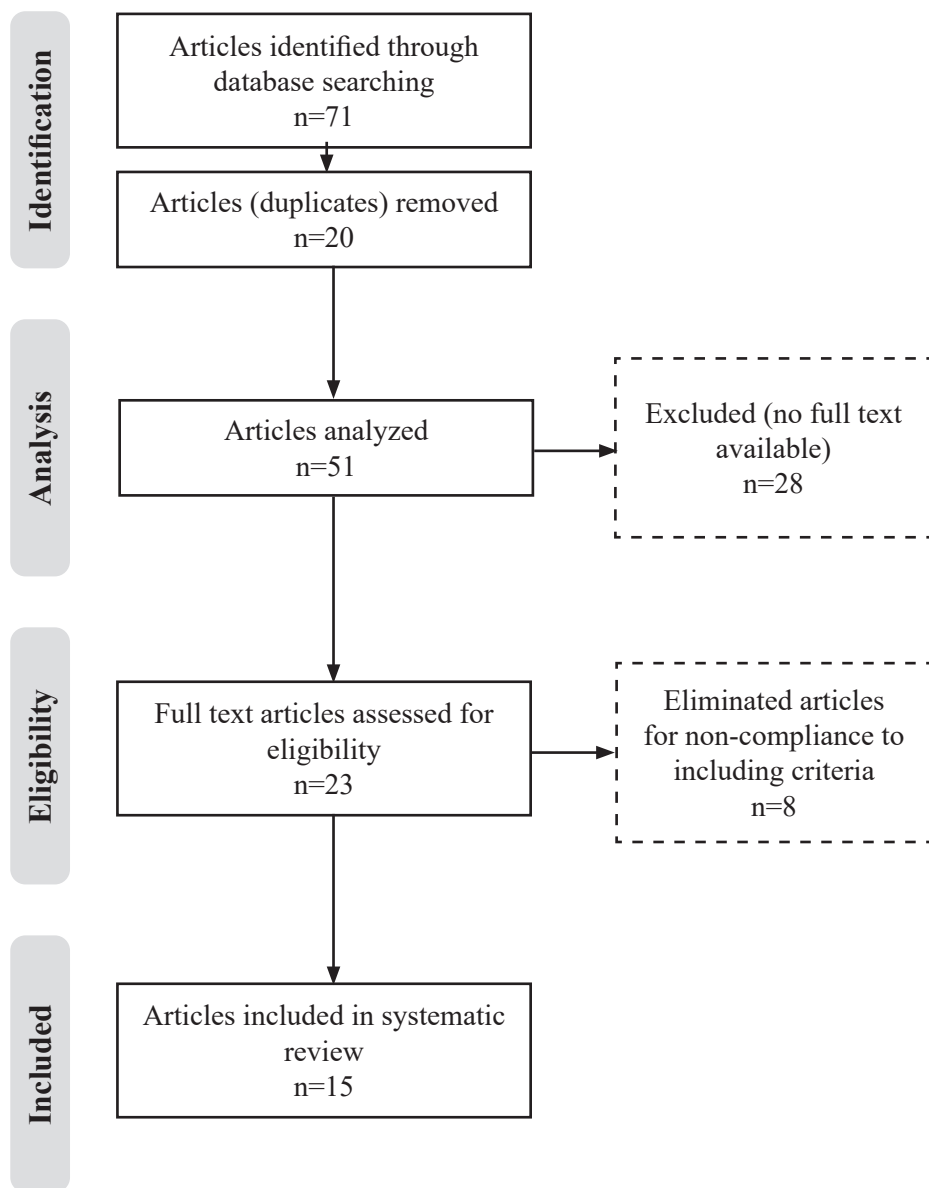


Figure 1. PRISMA flow chart of the article selection process

RESULTS

In this part, 15 original scientific studies will be presented on the topic of the influence of physical activity on the arterial blood pressure of the elderly in Table 1.

The number of respondents did not vary much from study to study, where the lowest number of respondents (21) was seen in the study (Rognmo, Hetland, Helgerud, Hoff, & Slørdahl, 2004), while the highest number of respondents (200) was seen in the study (Conraads et al., 2015). The studies had either only male or only female population, except for study (Papathanasiou et al., 2020), which contained a mixed population. The age range did not vary much in the studies (mostly between 53–65 years), while the youngest population was seen in the study of Lee, Tsai, Oh and Brooks (2018), where there were respondents aged 30. All research studies had the same goal, examination of the impact of aerobic interval training (AIT) in the rehabilitation of cardiovascular disease (CVD) patients. The reviewed materials indicate that aerobic interval training has numerous health aspects in the rehabilitation of cardiovascular diseases, especially in the elderly. The duration of the programme in most studies had a similar time range from 10 to 16 weeks, and the programmes that showed the best effects are related to aerobic interval training, from 2 to 3 times a week with moderate (50–60% of VO_2 max) or high intensity (80–90% of VO_2 max).

Table 1. Systematic review of the studies

Authors	Participants	Purpose	Type of physical activity (intensity and frequency)	Results
Rognmo et al. (2004)	n=21 (M) age 57.1±5.1 (CVD)	The influence of different intensities of AIT in the rehabilitation of CVDs.	Supervised treadmill walking was performed at high intensity (80-90% VO ₂ peak) or moderate intensity (50-60% VO ₂ peak) three times a week for 10 weeks.	VO ₂ peak 17.9% ↑ in the high-intensity group and 7.9% ↑ in the moderate-intensity group (p=0.074)
Smart & WSteele (2012)	n=23 (M) age 66±7 (Congestive heart failure)	Health aspects of AIT in the rehabilitation of congestive heart disease	The participants were divided into two groups. These groups completed 16 weeks of stationary cycling at 70% VO ₂ max three times a week for 30 minutes continuously or 60 minutes (60sec work: 60sec rest).	VO ₂ max group one: 13%↑ (p = 0.12); group two 21%↑ (p=0.03).
Rankin et al. (2012)	n=31 (F) age 63±2 (Menopause with CVD)	Examination of the health aspects of AIT in the rehabilitation of CVD in women	Supervised treadmill walking was performed at high intensity (75-85% VO ₂ peak) or moderate intensity (45-55% VO ₂ peak) three times a week for 10 weeks.	High-intensity AIT showed that VO ₂ max ↑ (12%; p=0.085)
Madssen et al. (2014)	n=36 (M) age 50-63.5 (CVD)	The effects of two types of training on the rehabilitation of coronary heart disease	AIT (intervals at ≈90% of maximum heart rate) or MCT (continuous exercise at ≈70% of maximum heart rate) were performed three times a week for 12 weeks after the implantation of an intracoronary stent.	AIT↑ 13.2% (p=0.05) MCT↑ 12.7% (p=0.05).
Kim et al. (2015)	n=28 (F) Age 61±8 (Acute myocardial infarction)	The health aspects of AIT in acute myocardial infarctions in older women	AIT at 85-95% intensity or MCT at 70-85% intensity, three days a week for six weeks in a cardiac rehabilitation clinic.	AIT VO ₂ peak↑ 22.16% (p = 0.021) MCT VO ₂ peak 8.7% (p=0.021)

Authors	Participants	Purpose	Type of physical activity (intensity and frequency)	Results
Cardozo et al. (2015)	n=71 (M) Age 56±12 (CVD)	The health aspects of AIT in the rehabilitation of CVD	EG performed 30 minutes of continuous aerobic exercise at 70-75% of maximum heart rate (HRmax), while HIIT performed 30-minute sessions divided into 2-minute alternating attacks at 60%/90% HRmax (three times a week for 16 weeks).	VO ₂ max↑ 22.5% (p<0.05)
Conraads et al. (2015)	n=200 (M) Age 58.4±9.1 (Coronary artery disease)	Examine the effects of AIT in the rehabilitation of CVD	A supervised 12-week cardiac rehabilitation programme of three weekly sessions or AIT (90-95% of peak heart rate) or MCT (70-75% of peak heart rate) on a bicycle.	VO ₂ max↑(AIT 22.7±17.6% versus MCT 20.3±15.3%). p<0.05
Jaureguizar et al. (2016)	n=72 (M) age 52-67 (Ischaemic heart disease)	Examine the health aspects of AIT in the rehabilitation of CHD	A supervised 8-week cardiac rehabilitation programme of three weekly sessions or AIT (80-90% of peak heart rate (HR)) on a bicycle.	VO ₂ max↑ 21% (p<0.05)
Ulbrich et al. (2016)	n=22 (M) Age 53.8±8 (Chronic heart disease)	Health aspects of AIT in participants with chronic heart disease	The participants underwent 12 weeks of supervised aerobic training, lasting 60 minutes, three times a week (60-70%)	AIT VO ₂ max↑ VO ₂ peak↑ 20.7% (p<0.01)
Anderson et al. (2016)	n=31 (F) Age 59.9±11.1 (Coronary artery disease)	The health aspects of HIIT were investigated in the rehabilitation of CVD in older women with coronary artery disease.	Aerobic interval training on a bicycle ergometer for 16 weeks, three times a week for 45-60 minutes, with a model of linear periodization and gradual increase every four weeks at 60-70% VO ₂ peak.	AIT VO ₂ peak↑ 20.8% (p<0.05)

Authors	Participants	Purpose	Type of physical activity (intensity and frequency)	Results
Lee et al. (2018)	n=72 Age 30-50 (CVD)	Examine the impact of AIT on CVD rehabilitation	Aerobic interval training on a stationary bicycle for 60 minutes, three times a week at 50-75% of maximum heart rate, for 10 weeks.	VO ₂ peak↑ (p<0.001); reduced the frequency of CVD by 3.13%.
Lee et al. (2019)	n=31 (F) Age 68.2±9.2 (Menopause with coronary artery disease)	Examine the impact of AIT on the rehabilitation of coronary artery disease	Four intervals of four minutes at 90-95% of maximum heart rate, three times a week + plus twice a week for 8 weeks.	VO ₂ max↑ 22.56% (p<0.05)
Silveira et al. (2020)	n=34 (F) Age 60±9 (CVD)	Investigate the benefits of HIIT in older women with CVD	A clinical trial with exercise three days a week for 12 weeks was conducted. Patients with CVD were randomly assigned to high-intensity interval training or moderate continuous training.	VO ₂ peak↑: HIIT 22% (p<0.05); MCT 11% (p<0.05).
Papathanasiou et al. (2020)	n=120 (M+F) Age 63.73±6.68 (CVD)	Examine the health aspects of HIIT in the rehabilitation of CVD in the older population	Participants were encouraged to pedal at a frequency of 65-80 revolutions per minute (rpm). The exercise ended when the pedal frequency dropped below 40 rpm and the participants were exhausted. Three times per week for 16 weeks.	HIIT↑ (p<0.001) in the rehabilitation of CVD in elderly participants
Liu et al. (2022)	n=24 (F) Age 64.2±4.2 (CVD)	Examining the health aspects of HIIT in the rehabilitation of CVD	Supervised treadmill walking was performed at high-intensity (80-90% VO ₂ peak) or moderate-intensity (50-60% VO ₂ peak) three times per week for 20 weeks.	HIIT↑VO ₂ peak (21.3%; p<0.05);

Legend: ↑ - improvement; CVD – cardiovascular diseases; AIT – aerobic interval training; HIIT – high-intensity interval training; M – male; F – female; n – number of participants; EG – experimental group.

DISCUSSION

The aim of the study was to perform a literature review of studies examining the health aspects of aerobic interval training for the rehabilitation of cardiovascular patients. The cardiorespiratory endurance of CVD patients improved in all studies that examined the effects of high- and moderate-intensity interval training, whereas high-intensity interval training produces greater cardiorespiratory adaptations, related to VO_2 max, than moderate-intensity interval training, according to the data (Table 1).

Most of the studies presented in Table 1 investigated the impact of high- and moderate-intensity aerobic interval training on CVD patients (Rognmo et al., 2004; Rankin et al., 2012; Madssen et al., 2014; Kim, Choi, & Lim, 2015; Cardozo, Oliveira, & Farinatti, 2015; Conraads et al., 2015; Donelli da Silveira et al., 2020; Liu, Liu, Ji, Dai, & Han, 2022). Some studies showed that high-intensity interval training, ranging from 80–95% HRmax, induced significant improvements in VO_2 max ranging from 13–22% after a 6- (Kim et al., 2015), 10–12- (Rognmo et al., 2004; Rankin et al., 2012; Madssen et al., 2014; Conraads et al., 2015; Donelli da Silveira et al., 2020) and 16–20- (Cardozo et al., 2015; Liu et al., 2022) week experimental programme. Since all the studies showed significant cardiorespiratory adaptations it can be noted that the intensity variable plays crucial role in achieving those adaptations. However, it is worth mentioning that the studies presented in this paragraph also compared high- and moderate-intensity exercises. Considering the cardiorespiratory adaptations of moderate-intensity groups, improvements in VO_2 max ranged from 8–20% after a 6- (Kim et al., 2015), 10–12- (Rognmo et al., 2004; Rankin et al., 2012; Madssen et al., 2014; Conraads et al., 2015; Donelli da Silveira et al., 2020) and 16–20- (Cardozo et al., 2015; Liu et al., 2022) week experimental programme. Both high- and moderate-intensity exercise programme showed significant improvements in VO_2 max, although high-intensity interval training seemed to induce a slightly higher increment in cardiorespiratory indications than moderate training in CVDs patients.

Some of the studies examined only the impact of moderate-intensity aerobic interval training on CVD patients (Smart & Steele, 2012; Ulbrich et al., 2016; Anderson et al., 2016; Lee et al., 2018; Papathanasiou et al., 2020). The intensity in most of these studies ranges from 55–75% HRmax inducing a significant impact on VO_2 max of around of 20% after 10–12 (Ulbrich et al., 2016; Lee et al., 2018) and 16 (Smart & Steele, 2012; Anderson et al., 2016; Papathanasiou et al., 2020) weeks of moderate-intensity exercise. Since all of the studies showed improvements on the health aspects of aerobic interval training, it can

be seen that moderate-intensity training can also be used in rehabilitation with CVD patients.

A few studies investigated only the effect of high-intensity aerobic interval training on CVD patients (Jaureguizar et al., 2016; Lee, Tsai, Brooks, & Oh, 2019). In these studies the intensity ranged from 80–95% of HR_{max} that affected the improvement of VO₂ max 21–22% for 8 weeks (Jaureguizar et al., 2016; Lee et al., 2019). Both of the studies showed that this type of high-intensity interval training can be used to benefiting aspects of health in the rehabilitation of CVD patients.

All of the studies, that investigated the effects of high- and moderate-intensity interval training showed positive improvements of cardiorespiratory endurance in CVD patients. However, based on the data shown (Table 1), it can be noted that high-intensity interval training has a slightly better effect on cardiorespiratory adaptations, regarding VO₂ max, compared to moderate-intensity interval training.

Limitations of the study

This study has potential limitations. Firstly, the study's inclusion and exclusion criteria, which were quite restrictive, likely reduced the amount of literature retrieved. Secondly, only articles published in English were included in this systematic review.

CONCLUSION

The aim of this study was to systematize the literature that examines the health aspects of aerobic interval training in the rehabilitation of cardiovascular patients. In conclusion, this study showed that both high- and moderate-intensity interval training are valid interventions in cardiovascular rehabilitation, positively inducing cardiorespiratory adaptations. However, when comparing the data of the analyzed studies, we concluded that high-intensity interval training contributes slightly more to the health aspects regarding cardiorespiratory adaptations than moderate-intensity training does.

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Conflict of interest

The authors declare that there is no conflict of interest.

Future research

For future research, we recommend the inclusion of a larger number of studies in the systematic review.

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ATTITUDES TOWARDS EXERCISE CONTENT ON SOCIAL MEDIA AND THE CHOICE OF FITNESS TRAINER

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ABSTRACT

The aim of this study was to: a) investigate and determine gender differences towards factors influencing gym-goers' choice of fitness trainer; and b) to identify and explain gender differences in gym-goers' attitudes towards social media exercise contents (SMEC). For this purpose, a questionnaire was created. The study was conducted on a sample of 50 gym-goers (N1=13 male and N2=37 female), all attending a gym in Split, Croatia. The variable sample consisted of five groups of variables. Test-retest overlap was performed to determine the reliability (88.20%) of the questionnaire. The results showed that the affirmative attitudes were statistically significant in contrast to the non-affirmative attitudes (Wilcoxon Matched Pairs Test, $T=250.00$, $Z=3.60$, $p<0.001$). In addition, male gym-goers generally have a significantly more affirmative attitude towards SMEC than female gym-goers (Mann-Whitney U-test, $U=119.50$, $Z=-2.68$, $p=0.007$). Furthermore, there are gender differences in choosing a fitness trainer based on their appearance; but there are no gender differences in the attitude towards the number of fitness trainers' followers on social media as an indicator of trustworthiness. As this study was specifically concerned with the attitudes of gym-goers, future studies should focus on sports professionals and their attitudes toward this topic.

Keywords: social media, attitudes, fitness trainer, exercise, gender

ODNOS DO VSEBIN V DRUŽBENIH MEDIJIH, POVEZANIH S TELESNO VADBO, IN IZBIRA TRENERJA FITNESA

IZVLEČEK

Cilj raziskave je bil: a) proučiti in opredeliti razlike med spoloma v dejavnikih, ki vplivajo na odločitev obiskovalcev fitnesa o izbiri trenerja, ter b) ugotoviti in razložiti razlike med spoloma v odnosu obiskovalcev fitnesa do vsebin v družbenih medijih, povezanih s telesno vadbo. V ta namen smo na novo zasnovali vprašalnik. Raziskavo smo izvedli na vzorcu 50 oseb ($N_1 = 13$ moških, $N_2 = 37$ žensk), ki obiskujejo fitnes v Splitu. Vzorec spremenljivk je bil sestavljen iz petih skupin spremenljivk. Izvedli smo test ponovljivosti, s katerim smo določili zanesljivost (88,20 %) vprašalnika. Rezultati so pokazali statistično pomembnost afirmativnih odnosov v nasprotju z neafirmativnimi (Wilcoxonov test ekvivalentnih parov, $T = 250,00$, $Z = 3,60$, $p < 0,001$). Poleg tega je bil odnos moških obiskovalcev fitnesa do vsebin v družbenih medijih, povezanih s telesno vadbo, veliko bolj afirmativen kot odnos obiskovalk (Mann-Whitneyjev U test, $U = 119,50$, $Z = -2,68$, $p = 0,007$). Med spoloma so bile razlike tudi pri izbiri trenerja fitnesa na podlagi njegovega videza, ni pa bilo razlik med spoloma v odnosu do števila sledilcev, ki jih ima trener v družbenih medijih, kot kazalnika njegove verodostojnosti. Ta raziskava zajema samo obiskovalce fitnesa, zato bi se morale prihodnje raziskave osredotočiti na poklicne športnike in njihov odnos do te teme.

Ključne besede: družbeni mediji, odnos, trener fitnesa, vadba, spol

INTRODUCTION

Over the last twenty years, technology has not only changed the way we live but also the way we work. This has led to a sedentary lifestyle, less physical work and the emergence of modern diseases (WHO, 2021; European Commission, 2021).

As online access to information does not require users to have any prior knowledge or knowledge of a programming language (Norman, 2012), people have easier and cheaper access than before (Chou, Hunt, Beckjord, Moser & Hesse, 2009; Hanson et al., 2011; Ralph, Berglas, Schwartz & Brindis, 2011; Selkie, Benson & Moreno, 2011; Usher, 2011). For example, statistical data indicate that 61% of American adults use the Internet to find information about sports and health every day, while 39% look for the same information on social media (Fox & Jones, 2018); 22% of healthcare professionals in Norway use Facebook as a source of health information, while 45% of healthcare professionals in Norway and Sweden use LinkedIn for the same purpose (Teodoro & Naaman, 2013); and 30% of the world's population uses social media as a medium of interaction every day (Regan, 2015).

Due to its efficiency and convenience, social media as a global phenomenon has become an indispensable means of communication today: a channel for the instant exchange of information, opinions, and attitudes shared by all generations worldwide (Ratinger, 2017; Stanojević, 2011; Akbari, Huc, Liqiangb & Chua, 2018). Even more, its use is not only a common medium to emphasize one's interests or hobbies but also a medium to share knowledge and opportunities in various fields and for various purposes in our daily lives: from its use in health and educational professions (Mani, Uma, John & Mieminen, 2023; Zaintal & Rahmat, 2020) to its impact on consumers' purchase intention, workers' creativity (Arora, Rana & Prashar, 2023; Zhang, Wang & Chen, 2023) and even as a tool to promote the career prospects of female academics in countries where women's career prospects are not as promising as men's (Sarwar, Imran, Akhtar & Fatima, 2023).

Furthermore, when browsing online profiles, people are subject to trends imposed by social media, whether consciously or unconsciously. One such trend concerns the profiles of fitness trainers and their social media exercise content (SMEC). The idea of taking care of one's health, combined with daily posts of exercises, healthy eating, and various ways to become physically active, has led to the emergence of this modern trend that has taken on an important, even invasive, role in contemporary life. In other words, Facebook and Instagram, as the most popular social media in terms of followers, have enabled fitness

trainers to publish such content and reach a large audience through pictures, videos and motivational posts (Stanojević, 2011; Kaplan & Haenlein, 2010). In addition, today's gym-goers have become more demanding and require more information and expertise than what they receive in a gym (McCall, 2015). Numerous studies have highlighted the positive impact of SMEC on its users. In addition to the ability to publish daily online exercise videos and motivational posts, fitness trainers who post on social media represent an important 'digital type of health communicator that could influence health behavior' (Durau, Diehl & Terlutter, 2022: 2). Tracking the influence of SMEC and fitness trainers on social media shows that they increase users' awareness of the importance of physical activity, healthy eating and good fitness, and increase physical activity among both men and women (Durau, Diehl & Terlutter, 2022). Social media platforms that expose SMEC provide the opportunity to reach a larger number of people in a timely manner and draw their attention to their posts and/or blogs where they disseminate information about a healthy lifestyle on a daily basis; it represents a valuable source of useful and correct information about health and sports (Adams, 2010a; Adams, 2010b); it brings profit to the influencers of social media fitness trainers as they use these platforms to promote themselves and their products in addition to all the aspects mentioned above (Grbavac & Grbavac, 2014; Teodoro & Naaman, 2013). However, some studies have also highlighted the negative aspects of SMEC use. Moorhead et al. (2013), for example, lists 12 negative aspects of SMEC. One of these is the inability to control the trustworthiness of the source of content posted on social media, highlighting the potential harm that can result from blindly following SMEC.

Given all this, and the fact that there is no way to control the accuracy of SMEC, the question arises: can users trust the SMEC they see, to what extent can they trust it, and how should they choose which influences from SMEC or fitness trainers to follow?

Based on these arguments, we hypothesize the following:

H1: Users tend to be indecisive when choosing their fitness trainer on social media;

H2: There are differences between males and females in terms of affirmative attitudes towards exercise via social media;

H3: There are statistically significant differences between males and females in terms of non-affirmative attitudes towards sports on social media.

Thus, this study aims to: a) investigate and determine gender differences towards factors influencing gym-goers' choice of fitness trainer; b) identify and explain the gender differences in gym-goers' attitudes towards SMEC.

METHODS

Procedure and participants

The sample consisted of a total of 50 gym-goers ($N_1=13$ male (26%) and $N_2=37$ female (74%)), all attending a gym in Split, Croatia (see Table 1 for a detailed description of the sample). All of the participants were annual gym members who exercised individually and not in groups programs.

As there were no previously developed and validated measurement instruments, a new measurement instrument (questionnaire with five questions) was constructed for data collection. The survey was conducted in May 2018. The questionnaire was anonymous and all participants were informed in writing that their participation was voluntary. The given time limit was ten minutes. The questionnaire was written in Croatian. It was handed out in paper.

The questionnaire consisted of five items: 1) Demographic variables (gender, age, height, weight and body mass index (BMI)); 2) Exercise habits (how often do they exercise, do they participate in any type of group workout); 3) Sources of knowledge about exercise (education, gym, social media, online articles or scientific sports literature); 4) Choice of social media platforms as a source of information about exercise (Facebook, Instagram, Twitter or YouTube); 5) 13 variables on attitudes towards SMEC (7 affirmative attitude variables, 4 non-affirmative attitude variables and 2 variables of a neutral character).

Affirmative attitudes were as follows: “I follow sports-content posts on the Internet and social media”; “Social media play an important role in the fitness industry”; “I often visit personal fitness trainers’ sites and their sports content posts on the Internet and social media”; “I trust personal fitness trainers’ posts on the Internet and social media”; “Personal fitness trainers’ posts on the Internet and social media motivate me”; “Exercising according to fitness trainers’ posts on the Internet and social media is the most practical way of exercising”; “Personal trainers’ posts on the Internet and social media have had a positive impact on the importance of exercising”. Non-affirmative attitudes were as follows: “People who cannot afford any other type of exercising, exercise using personal fitness trainers’ posts on the Internet and social media”; “One cannot exercise using personal fitness trainers’ posts on the Internet and social media without any prior knowledge”; “I have a hard time finding adequate personal fitness trainers’ posts on the Internet and social media for my exercises”; “I do not exercise using personal fitness trainers’ posts on the internet and social media, but via their posts I have enriched my knowledge on exercising”. Neutral attitudes were as follows: “I choose personal fitness trainers on the Internet and

social media according to their looks”; “The number of followers is a good quality sign of personal fitness trainers’ posts on the Internet and social media”.

All questions that could be answered quantitatively were asked on a 5-point Likert scale (1=strongly agree, 2=agree, 3=neither agree nor disagree, 4=disagree, and 5=strongly disagree).

The test-retest overlap was calculated (88.20%) to determine the reliability of the measurement instrument (questionnaire). This confirms the validity of the newly constructed questionnaire. Descriptive statistics (mean, standard deviation, minimum and maximum score, median, mode, and frequency of mode) were used to describe the variables of the sample and to determine the differences between the affirmative and non-affirmative variables. Frequency, percentage and mode were calculated for the questions describing the sample. The Wilcoxon matched-pairs test was used to determine the differences between affirmative and non-affirmative attitudes. The Mann-Whitney U test was used to determine differences in attitudes between male and female. Data were analysed using the statistical software package Statistics 14.0. (TIBCO Software Inc. (2020)).

RESULTS

Table 1 shows that non-affirmative attitudes statistically prevail ($p < 0.001$) and that male users have more affirmative attitudes than female users ($p = 0.007$).

Table 2 shows that, based on the results gained from the total sample, the majority of users exercise mostly 3 times per week or 3-5 times per week.

Table 3 shows that, based on the results gained from the total sample, gym-goers say they have gained their knowledge of exercises and fitness mostly from the gym and less from SMEC.

Table 4 shows that Instagram (46%) is the most popular platform for gaining information on exercises; Twitter (30%) is the second most popular platform, Facebook (22%) comes in third place and YouTube (2%) is the least popular platform for gaining information on exercises.

Table 5 shows the results of the gym-goers answers for each of 12 variables regarding all three attitudes. Variable 1 has the highest frequency in males, in females, and in all groups together.

Table 1: Descriptive statistical parameters (mean, standard deviation, minimal and maximal result) for sample description and affirmative and non-affirmative attitudes regarding exercising using contents published online and on social media

	All groups		Female		Male	
Variable	AS ± SD	MIN/ MAX	AS ± SD	MIN/ MAX	AS ± SD	MIN/ MAX
Age	58.44 ±8.99	17.00/ 54.00	28.62 ±9.64	17.00/ 54.00	27.92 ±7.09	19.00/ 43.00
Body height	174.72 ±6.15	165.00/ 191.00	172.11 ±4.43	165.00/ 183.00	182.15 ±3.85	178.00/ 191.00
Body weight	70.60 ±12.14	51.00/ 97.00	66.19 ±8.47	51.00/ 96.00	86.00 ±6.28	76.00/ 97.00
BMI	23.02 ±3.02	18.21/ 31.71	22.01 ±2.73	18.21/ 31.71	26.91 ±2.73	23.20/ 28.41
Affirmative	2.69 ±0.54†	1.71/ 4.43	2.55 ±0.42*	1.71/3.43	3.08 ±0.68*	1.86/ 4.43
Non-affirmative	3.30 ±0.74†	2.00/ 5.00	3.40 ±0.70	2.00/5.00	3.03 ±0.81	2.00/ 5.00

Legend: †Statistically significant difference between affirmative and non-affirmative on the total sample (Wilcoxon Matched Pairs Test, T=250.00, Z=3.60, p<0.001); *Statistically significant difference between females and males in affirmative attitudes (Mann-Whitney U test, U=119.50, Z=-2.68, p=0.007)

Table 2: Descriptive statistical parameters (frequency, percentage, and mode) for the variable 'Exercise habits of gym-goers'

All groups		
I exercise	f	%
Daily	4.00	8.00
3-5 times per weekw	21.00	42.00
3 times per week	22.00*	44.00*
2 times per week	3.00	6.00
Never	0.00	0.00

Legend: *mode; f - frequency; % - percentage

Table 3: Descriptive statistical parameters (frequency, percentage, and mode) for the variable 'Source of knowledge about exercise'

All groups		
I gained my knowledge on exercises	f	%
Throughout my education	6.00	12.00
In a gym	31.00*	62.00*
Via social media	10.00	20.00
Via online articles	2.00	4.00
From scientific sports literature	1.00	2.00

Legend: *mode; f - frequency; % - percentage

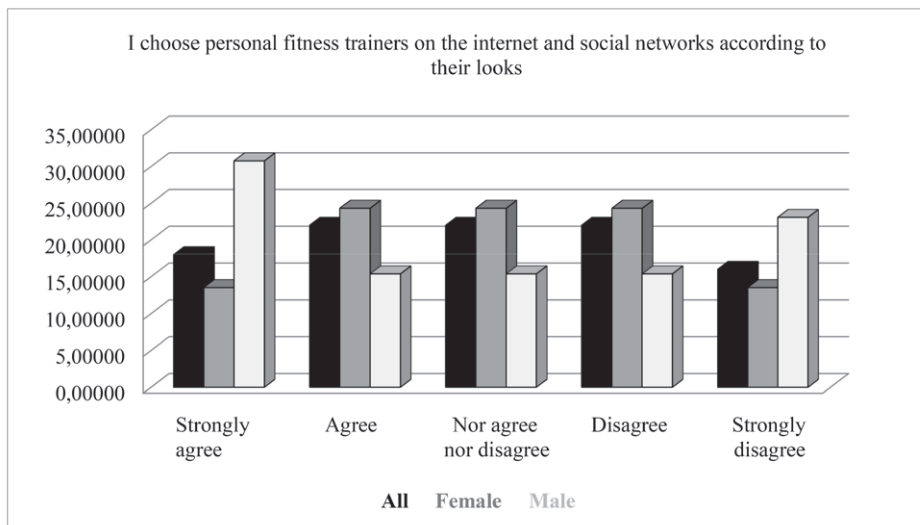
Table 4: Descriptive statistical parameters (frequency, percentage and mode) for the variable 'Choice of social media platforms as a source of information about exercising'

All groups		
As a source of information about exercising, I use:	f	%
Facebook	11.00	22.00
Instagram	23.00*	46.00*
Twitter	15.00	30.00
YouTube	1.00	2.00

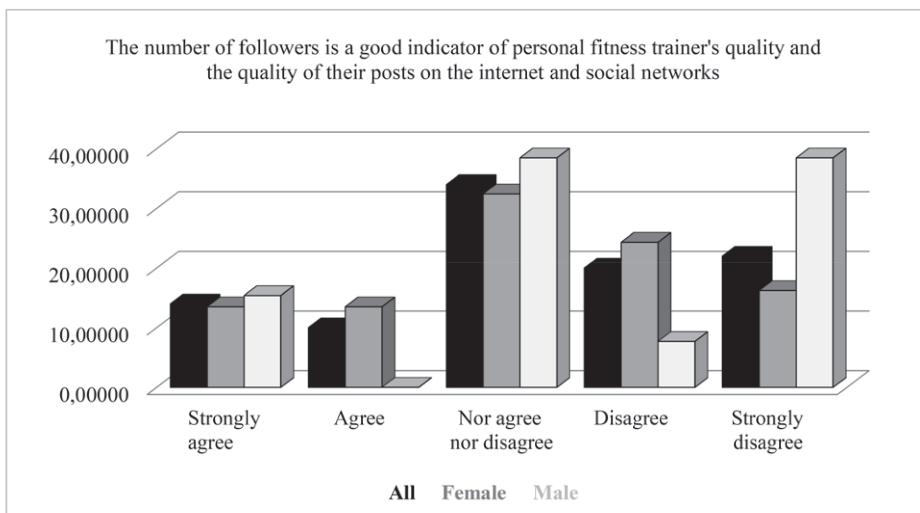
Legend: *mode; f - frequency; % - percentage

Graph 1 shows that for males the answers vary from 'Strongly agree' to 'Strongly disagree' while, for females, answers vary from 'Agree' to 'Disagree'.

Graph 2 shows that the answers 'Nor agree nor disagree' dominate; females were more likely to answer 'Disagree' than males, and males were more likely to answer 'Strongly disagree' than females.



Graph 1: Percentages of answers to the neutral attitude: 'I choose personal fitness trainers on the Internet and social networks according to their looks'



Graph 2: Percentages of individual responses to the neutral attitude: 'The number of followers is a good indicator of a fitness trainer's quality as well as the quality of their posts on the Internet and social networks'

Table 5: Descriptive statistical parameters (median, mode, and frequency of mode-F mode) for 12 variables on the positive and negative attitudes

Variable	All groups				Female			Male		
	Median	Mode	F mode		Median	Mode	F mode	Median	Mode	F mode
Affirmative attitudes	1	strongly agree	strongly agree	40	strongly agree	strongly agree	30	strongly agree	strongly agree	10
	2	neither agree nor disagree	neither agree nor disagree	19	agree	neither agree nor disagree	17	disagree	disagree	4
	3	neither agree nor disagree	neither agree nor disagree	19	neither agree nor disagree	neither agree nor disagree	13	neither agree nor disagree	neither agree nor disagree	6
	4	neither agree nor disagree	neither agree nor disagree	16	neither agree nor disagree	neither agree nor disagree	13	disagree	strongly disagree	5
	5	neither agree nor disagree	neither agree nor disagree	19	neither agree nor disagree	neither agree nor disagree	12	neither agree nor disagree	neither agree nor disagree	7
Non-affirmative attitudes	6	agree	agree	19	agree	agree	16	neither agree nor disagree	strongly disagree	4
	7	disagree	disagree	20	agree	strongly disagree	15	disagree	disagree	7
	8	neither agree nor disagree	agree	14	neither agree nor disagree	neither agree nor disagree	12	strongly agree	strongly agree	7
	9	neither agree nor disagree	neither agree nor disagree	15	neither agree nor disagree	neither agree nor disagree	13	neither agree nor disagree	strongly agree	5
	10	agree	agree	17	agree	agree	12	agree	agree	5

All groups				Female			Male			
Variable	Median	Mode	F mode	Median	Mode	F mode	Median	Mode	F mode	
Neutral attitudes	11	neither agree nor disagree	Multiple	11	neither agree nor disagree	Multiple	9	neither agree nor disagree	strongly agree	4
	12	neither agree nor disagree	neither agree nor disagree	17	neither agree nor disagree	neither agree nor disagree	12	neither agree nor disagree	Multiple	5

Legend: Median; mode; f mode-frequency
Variables: 1-‘Social media play an important role in the fitness industry’; 2-‘I often visit personal fitness trainers’ sites and their sports content posts on the Internet and social media’; 3-‘I trust personal fitness trainers’ posts on the Internet and social media’; 4-‘Personal fitness trainers’ posts on the Internet and social media motivate me’; 5-‘Exercising thanks to fitness trainers’ posts on the Internet and social media is the most practical way of exercising’; 6-‘Personal trainers’ posts on the Internet and social media have had a positive impact on the importance of exercising’; 7-‘People who cannot afford any other type of exercising, exercise using personal fitness trainers’ posts on the Internet and social media’; 8-‘One cannot exercise using personal fitness trainers’ posts on the Internet and social media without any prior knowledge’; 9-‘I have a hard time finding adequate personal fitness trainers’ posts on the Internet and social media for my exercising’; 10-‘I do not exercise using personal fitness trainers’ posts on the Internet and social media but via their posts I have enriched my knowledge on exercising’; 11-‘I prefer choosing personal fitness trainers on the Internet and social media according to their looks’; 12-‘The number of followers is a good quality sign of personal fitness trainers’ posts on the Internet and social media’

DISCUSSION

Firstly, based on the obtained results, we can confirm that non-affirmative attitudes towards SMEC dominate (Affirmative 2.69 ± 0.54 ; Non-affirmative 3.30 ± 0.74). There can be many reasons for this. For example, you do not need to have any license or diploma to post any type of content related to exercise; there is no form of control or review of the content published on the Internet; it seems that people can post whatever they want as long as the content is not pornographic or discriminatory. On the one hand, it is necessary to protect children and young people, but, on the other hand, it encroaches on freedom of speech (Ružić, 2008). Furthermore, if we compare the results regarding gender differences, we notice that male users are significantly more affirmative than female. A higher percentage of males play sports, so we can assume that they have more knowledge on this topic, i.e. it would be logical for males to be more critical of the content.

Secondly, although the gym-goers say that most of their gained knowledge comes from the gym, probably from fitness trainers working at the gym, still, when using social media as their source of information, users prefer using Instagram. It comes as no surprise that Instagram is the platform that is currently the trendiest and, as such, the most used by athletes as a platform to post their content. Research has shown that females in elite sports are more likely to post pictures on Instagram, but that males get more attention and comments (Geurin-Eagleman & Burch, 2016). Instagram is a network used by athletes for self-promotion (Smith & Sanderson, 2015; Li, Scott, Naraine & Ruibley, 2021), while social networks are used a lot in sports and by the sports industry and fans, in general (Shahzad, Bajwa, Hussain & Naz, 2021; Anagnostopoulos, Parganas, Chadwick & Fenton, 2018; Calvio, 2013).

In addition, studies show that everyday exposure to social media awakens an individual's creativity and innovation making its user's profile a reflection of their identity (Kušić, 2010). In other words, if we have acknowledged the impact of social media on and in our daily lives, as well as the fact that we use and buy many of the products advertised online, then the issues regarding a fitness trainer's appearance as a determining factor and the number of their followers as an indicator of their trustworthiness, comes as no surprise.

The results indicate that for males, a fitness trainers' appearance is not the prime reason for following them. The same goes for females who, based on their answers that varied from 'Agree' to 'Disagree', also state that the appearance does not have the expected impact on the determining choice of fitness trainer. This may be, as Soekmawati et al. (2022) explain in their research, in

direct relationship between gym-users' age and gender. In other words, they confirmed that the gym-users who said they were influenced by appearance and weight management motives were more likely to identify with physically attractive fitness trainers. Based on the age of our sample (young adults), we believe that extrinsic motives, such as physical appearance, do not seem to motivate them (at least as our small sample is concerned). This is rather a surprise since we know that today a lot of young people spend a lot of time trying to look physically attractive and more like some famous social media persona (Jiotsa, Naccache, Duval, Rocher & Grall-Bronnec, 2021; Fardouly, Pinkus & Vartanian 2017; Choukas-Bradley, Nesi, Widman & Higgins, 2019). The second statement, based on the prevailing answers, 'Nor agree nor disagree', informs us that the number of fitness trainer followers and the quality of their posts do not stand as an indicator of their quality and trustworthiness. The reason might be that gym-goers are aware of the complexity of fitness coaching as a profession, i.e. they might believe that, in addition to theoretical and practical knowledge, fitness trainers should master several other professional, scientific and teaching skills (Marković, Marković & Metikoš, 2006). Or, since it has not yet been regulated anywhere, we cannot avoid the question regarding the type of competencies needed for an individual who posts or owns such SMEC.

Limitations of the study

The fundamental limitation of this study is the rather small and unbalanced sample. The inclusion of a larger sample, perhaps consisting of professional athletes, would complement the available data and provide a more complete picture of the attitudes towards the issues addressed. As the data analysis was conducted in a local gym, further research is needed to generalise the current findings on a more national and international level. Finally, it would be interesting if the future studies would do a qualitative research based on which we would get direct answers regarding the issue.

CONCLUSION

Social media platforms in general have become the most popular means for users to create, share, and receive all kinds of information/content on a daily basis. In this context, many social media users share content about physical

activity, nutrition, fitness activities and sports, consciously or unconsciously influencing the attitudes of a large number of their users.

Based on the results of this case study, we can confirm hypothesis H1, which states that respondents are statistically significantly more likely to be non-affirmative towards SMEC. We can also confirm hypothesis H2, according to which there are statistically significant differences between males and females in affirmative attitudes towards exercising via the Internet and social media. Finally, we can reject hypothesis H3, as there were no confirmed statistically significant differences between males and females in non-affirmative attitudes towards exercise via the Internet and social networks. In conclusion, we can summarise that females tend to choose a fitness trainer based on their appearance more often than males and that the number of followers does not play a role in the decision to follow a fitness trainer's social media profile.

We, therefore, conclude that this study contributes to a better understanding of how gender differentiated users can be motivated to engage in physical activity by fitness trainers on social media, i.e. it provides insights into how the use of social media related to sports and fitness can influence users' attitudes towards choosing specific SMEC. Also, we believe that repeating the same study, after the COVID-19 pandemic, would show significantly stronger results in favour of using SMEC precisely due to the type of exercise and physical contact that was (not) allowed during the pandemic.

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DEVELOPMENT AND PRELIMINARY VALIDATION OF THE SCALE OF FACTORS WHICH INFLUENCE DECISION-MAKING OF THE ELDERLY TO TAKE PART IN PHYSICAL EXERCISE PROGRAMS

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ABSTRACT

Regular physical activity and exercise are beneficial for both physical and mental health. However, in the elderly, the level of physical activity they partake in is consistently inadequate. Recognizing the need to enhance the participation of the elderly in organized physical exercise and understanding the factors which influence their decision-making becomes pivotal. The purpose of this study was to develop a measurement instrument, specifically a scale, to identify these factors and evaluate its psychometric properties. First, the statements were formulated, which was followed by content assessment by a panel of experts. In the process of scale validation, its internal consistency, stability, correlations between the variables, and factor structure were also evaluated. The scale was tested on a sample of 1777 participants engaged in guided physical exercise at the School of Health Association (društvo Šola zdravja), all aged 60 years or more. The exploratory factor analysis yielded a four-factor model with 27 statements which explained 42.9% of variability. The results indicated weak, but statistically significant correlations between the factors and an acceptable level of internal consistency and stability of the entire scale. This scale, developed to establish the factors that influence the decision-making of the elderly to take part in organized physical exercise, represents a valid and reliable measurement instrument, which can be beneficial in the planning and promotion of organized physical exercise programs for the elderly.

Keywords: physical exercise, quantitative methodology, elderly, social gerontology

RAZVOJ IN PRELIMINARNO PREVERJANJE LESTVICE DEJAVNIKOV PRI ODLOČANJU STAREJŠIH ZA VADBO

IZVLEČEK

Redna gibalna dejavnost in vadba koristita fizičnemu in duševnemu zdravju, vendar so starejši večinoma premalo gibalno dejavni. Za povečanje deleža starejših pri organiziranih gibalnih vadbah je ključno poznavanje dejavnikov, ki vplivajo na njihovo odločitev za vključitev v vadbo. Namen raziskave je bil razviti merski instrument – lestvico za ugotavljanje dejavnikov, ki vplivajo na odločitev starejših za vključitev v organizirano gibalno vadbo – in oceniti njegove psihometrične lastnosti. Najprej so bile oblikovane trditve, ki so jih vsebinsko ocenili strokovnjaki ekspertnega panela. V procesu validacije lestvice so se preverjale tudi notranja konsistentnost, stabilnost, povezanost spremenljivk in struktura dejavnikov. Lestvica je bila testirana pri 1777 udeležencih vadbe v društvu Šola zdravja, starih 60 let ali več. Eksploratorna analiza dejavnikov je podala model s štirimi dejavniki (27 trditvami), ki pojasnjujejo 42,9 % variabilnosti. Rezultati kažejo tudi šibke, toda statistično značilne povezanosti med dejavniki ter sprejemljivo notranjo konsistentnost in stabilnost celotne lestvice. Ustvarjena lestvica za ugotavljanje dejavnikov, ki vplivajo na odločitev starejših za vključitev v organizirano gibalno vadbo, je veljaven in zanesljiv merski instrument, ki je lahko koristen pri načrtovanju in promociji programov organiziranih gibalnih vadb za starejše.

Ključne besede: gibalna vadba, kvantitativna metodologija, starejši, socialna gerontologija

INTRODUCTION

The global population is aging and, in the coming decades, many countries including Slovenia will face serious challenges in the fields of public healthcare systems, pensions, and social security (Zubiashvil & Zubiashvil, 2021). In 2022, 21.1% of the population of Slovenia were aged 65 years or more, and according to data from the EUROPOP2023 population projections, this percentage is expected to increase to 30.2% by 2050 (Statistical Office of the Republic of Slovenia, 2023). This shifting age structure forces countries to conduct research on how to preserve and enhance the health and well-being of the elderly, ultimately prolonging their independence and reducing the costs associated with healthcare and social services (van Baal, Hoogendoorn & Fischer, 2016; Wang et al., 2019).

To maintain health and prevent premature morbidity and mortality, regular physical activity and exercise are of particular importance (Langhammer, Bergland & Rydwik, 2018; Winett & Ogletree, 2019). Their benefits have been well-documented in the prevention and management of chronic diseases, such as cardiovascular diseases (Coats et al., 2017; Tonet et al., 2018; Singam, Fine & Fleg, 2020; Ciumărnean et al., 2022; Vilela de Sousa et al., 2023), type 2 diabetes (Colberg et al., 2016; Pan et al., 2018) and some cancers (Ahn et al., 2020; Sanchez-Bayona et al., 2021; Trinh et al., 2021). Additionally, regular physical activity and exercise have been associated with improvements in emotional, psychological, and social well-being, as well as mental health, and cognitive functions (Lee et al., 2015; Langhammer et al., 2018; Yamasaki, 2023).

Despite compelling evidence that regular physical activity and exercise significantly contribute to maintaining independence and improving quality of life in old age (Langhammer et al., 2018; Wang et al., 2019), there exists a notable shortfall in the percentage of elderly individuals who meet the recommended guidelines of at least 150 minutes of moderate physical activity per week (Vargas, 2020). Therefore, the promotion of physical activity among the elderly constitutes an important public health objective, which should receive greater attention (Nielsen et al., 2014; Langhammer et al., 2018).

In the pursuit of formulating effective measures to increase the level of physical activity among the elderly, an in-depth understanding of the factors influencing their decision-making to engage in physical activity is crucial (Nielsen et al., 2014; Chen, While & Hicks, 2015). Nevertheless, the results of studies conducted among the elderly across various cultures cannot be indiscriminately generalized. The factors influencing their decision-making to engage in physical activity within the context of a specific cultural and social community

necessitate focused investigation (Buman, Daphna Yasova & Giacobbi, 2010; Apaydin Kaya et al., 2013; Capalb, O'Halloran & Liamputtong, 2014; Dèdelè, Chebotarova & Miškinytė, 2022). Since there are no well-established tools in Slovenia to identify such factors, the primary objective of the article was to introduce a measurement instrument designed to assess the factors influencing elderly individuals' decisions to participate in organized physical exercise, and to validate its psychometric properties.

METHODS

This study was part of a larger quantitative study of the factors which influenced the decision-making of elderly inhabitants of Slovenia to participate in regularly scheduled organized physical exercise throughout an entire year. The study's objective was in compliance with the recommendations of the World Health Organization, which suggest at least 150 minutes of moderate-intensity exercise a week for the elderly to maintain their health (World Health Organization, 2010). Several psychometric tests were employed to assess the instrument's validity and reliability.

Process for developing a measurement instrument

Drawing upon an extensive review of prior research into the factors influencing the decision-making of the elderly to engage in physical activity (Stathi, McKenna & Fox, 2010; Lee & Hung, 2011; Sims-Gould, Miran-Khan, Haggis & Liu-Ambrose, 2012; Capalb et al., 2014; Nielsen et al., 2014; Chen et al., 2015; de Guzman, Jatulan & Jimenez, 2015; Yamakita, Kanamori, Kondo & Kondo, 2015) and a smaller qualitative study done among the members of the Ljubljana-Dravljje and Ljubljana-Vič groups of the School of Health Association, a set of 36 statements was created to establish the factors which influence the participation of the elderly in organized physical exercise. Assessment of these statements was based on a 5-point Likert scale, with responses ranging from 5 (I completely agree) to 1 (I completely disagree).

Evaluating the content validity of the scale

To determine the suitability of the scale designed to identify the factors influencing the decision-making of elderly individuals to participate in organized physical exercise, a panel of experts from the field assessed the formulated statements. To assess content validity, members of the expert panel rated the statements on two dimensions: (1) relevance, using the following scale 4 – very relevant, 3 – somewhat relevant, 2 – revision is essential, and 1 – irrelevant; and (2) clarity, using the following scale 1 – not clear, 2 – needs some revision, and 3 – very clear.

When evaluating the content validity index, the number of experts who rated each statement as 3 (somewhat relevant) or 4 (very relevant) was divided by the total number of experts in the panel. This ratio, which was calculated for each individual statement, represents its content validity according to the method described by Polit and Beck (2006). The same two authors also stated that an individual statement is acceptable if its sum total is at least 0.83 for six to eight experts, reflecting good content validity.

Furthermore, the Fleiss Kappa (κ) coefficient was calculated, which determines the level of agreement above random chance. Values of the Fleiss Kappa coefficient above 0.74 are considered excellent, those between 0.60 and 0.74 are good, and those between 0.40 and 0.59 are fair (Tang, Hu, Zhang, Wu & He, 2015).

Evaluation of the construct validity of the scale

Construct validity was evaluated using exploratory factor analysis which enables the condensation of extensive data into a more manageable and comprehensible datasets (Tavakol & Wetzel, 2020). Exploratory factor analysis is used to collate interdependent variables into descriptive categories and to classify profiles into types with similar properties. In addition, factor analysis can be used to simplify the complexity of correlations between the variables and to predict correlations (Field, 2009). The suitability of data for factor analysis was evaluated using the Kaiser-Meyer-Olkin (KMO) index and Bartlett's test of sphericity. Data is deemed suitable if the KMO index is at least 0.5. If Bartlett's test of sphericity does not show statistical significance ($p \geq 0.05$), this means that the correlation matrix does not show a satisfactory correlation between the variables measuring an individual construct (Field, 2009). In the data analysis,

only variables with an eigenvalue of communalities (percentage of total variance in the variable) greater than 0.4 were considered relevant.

Evaluation of reliability of the scale

The reliability of the scale was assessed by analyzing its internal consistency and stability. Internal consistency was assessed using the Cronbach's alpha coefficient (α), whereby 0.60 was used as the threshold value. While this value is considered suboptimal, it remains acceptable (Morgan, Cleave-Hogg, DeSousa & Tarshis, 2004; Kachooei et al., 2015). The threshold value of 0.60 was also applied when evaluating reliability with the split-half method for analyzing the stability of the variables using Guttman's coefficient and Spearman-Brown's coefficient.

Sample description

The expert panel tasked with evaluating the content validity of the scale's statements consisted of six experts, five women and one man between the ages of 40 and 75, and having a master's degree or doctorate of science. The panel's diverse expertise included social gerontology, sociology and extensive experience in healthcare education. Their collective experience provided a comprehensive understanding of the various aspects of social activities relevant to the focus of the scale.

Evaluation of validity and reliability based on the expert ratings was performed on a sample of participants retrieved from the physical exercise program organized by the School of Health Association of Slovenia. This program comprises 30 minutes of morning exercise done in accordance with the "1000 movements" method (Grishin, 2012). It is led by trained volunteers who are members of the association and is available free of charge every day (except Sundays and holidays) in open air public areas. The research data were obtained on a sample of 1777 respondents between 60 and 92 years of age. The average age of the respondents was 69.5 years ($SD = 6.2$). In terms of gender structure, women prevailed in the sample (88.7%), while based on their residence the respondents were mostly from urban areas (65.1%). The respondents came from all statistical regions of Slovenia, except the Pomurje and Zasavje regions. The levels of education ranged from unfinished primary school to doctorate of science, and most of them had a secondary school level of education (39.4%). In

terms of household income, most respondents stated that they were just getting by with their income (50.3%), 8.4% of the respondents found it difficult or extremely difficult to survive on their income, and the rest of them stated that they were able to live comfortably on their income.

Data collection and processing

Data collection was done in line with the Helsinki Declaration and took place from June to October 2017. Formal approval from the ethics committee was not sought as the research method did not involve any interventions or sensitive personal data. The participants were thoroughly informed about the study and their voluntary participation. In addition, the study was conducted in accordance with general ethical principles, including anonymity and confidentiality, as well as respect for the autonomy and dignity of all participants.

The first author joined several training groups and upon completing the exercises she invited the participants to join the study, guaranteeing anonymity and protection of the collected data. Since it was not possible to visit all of the groups, some of the participants were recruited by the group leaders using the same approach described above. The participants were given the questionnaires and asked to fill them out at home and return them back to the group leader. All of the leaders then forwarded the collected questionnaires to the first author by mail using envelopes equipped with stamps and properly addressed.

Data were analyzed using the IBM SPSS software, Version 29.0 (SPSS Inc., Chicago, IL, US). To determine the psychometric properties of the scale to establish the factors influencing the decision-making of the elderly to take part in organized physical exercise, the following statistical analyses were done: descriptive statistics (frequency distribution, the lowest and highest data values, the mean and standard deviations), Cronbach's alpha coefficient to establish internal consistency, Guttman's and Spearman-Brown's coefficients for analyzing the stability of the variables, exploratory factor analysis for evaluating the factor structure and Pearson's correlation coefficient to determine the correlation between the variables.

RESULTS

A total of 2579 questionnaires were distributed and 1966 of those were returned, which means that the response rate was 76.2%. Questionnaires of the participants younger than 60 years of age and of those who did not provide the year of birth were excluded from further analysis. The statistical analysis thus comprised 1777 or 68.9% of all distributed questionnaires.

Content validity of the scale

The expert panel members assessed all 36 formulated statements of the scale as relevant and clear. Therefore, no statement was excluded on the basis of content validity analysis. The content validity indices for the statements were satisfactory and rated between 0.83 and 1.00 for relevance, and between 0.83 and 1.00 for clarity. To reduce the possibility of random agreement between the expert panel's members, the level of their agreement was calculated using the Fleiss Kappa coefficient. The value of this coefficient showed a good agreement between expert assessments ($\kappa = 0.71$; 95% confidence interval from 2.98 to 4.08; $p < 0.001$). The results for the Fleiss Kappa coefficient for individual statements of the scale ranged between 0.67 and 1.00.

Construct validity of the scale

The evaluation of the scale's validity to establish the factors that affect the decision-making of the elderly to take part in organized physical exercise was done on the basis of an exploratory factor analysis. The suitability of data for factor analysis was first verified using the KMO index and Bartlett's test of sphericity. Analysis of the interdependence between the variables showed that the use of factor analysis was reasonable, which was confirmed by the KMO index and Bartlett's test of sphericity (KMO = 0.702; Bartlett's test of sphericity $\chi^2 = 5165.895$, $df = 496$, $p < 0.001$). It follows from the obtained results that the correlation matrix demonstrated satisfactory correlations between the variables measuring individual constructs. In the data analysis, we used those variables which had an eigenvalue of communality higher than 0.4. For this reason, 9 statements were excluded from further analysis because they did not meet the inclusion criteria. The final scale for determining the factors that influence

the decision-making of the elderly to participate in organized physical exercise thus consisted of 27 statements.

Table 1 shows these 27 statements and the respective factor loadings which range from 0.402 to 0.791. Factor 1, Exercise Characteristics, was comprised of 8 statements with factor loadings ranging from 0.498 to 0.647. Factor 2, Social Aspect, was comprised of 4 statements with factor loadings ranging from 0.603 to 0.788. Factor 3, Health Problems, was comprised of 7 statements with factor loadings ranging from 0.483 to 0.785, and Factor 4, Improvement in Psychophysical Well-Being, was comprised of 8 statements with factor loadings ranging from 0.402 to 0.791. Using this four-factor model, 42.9% of variability can be explained. Factor 1 had the highest eigenvalue of variability of 14.3 %, followed by Factor 2 with 10.7%, Factor 3 with 9.6%, and Factor 4 with 8.3%.

Table 1 also shows the content validity index of individual statements from the viewpoint of relevance. Regarding clarity, all expert panel members assessed all of the 27 statements of the final scale to establish the factors that influence the decision-making of the elderly to participate in organized physical exercise as very clear (1.00).

A quartile-based scoring system was also determined. Using the scale, the respondents were able to achieve between 27 and 135 points. Considering the factors that influence the participation of the elderly in organized physical exercise, scoring was done as follows: low influence (from 27 to 53 points), moderately low influence (from 54 to 81 points), moderately high influence (from 82 to 108 points), and high influence (from 109 to 135 points). The sum of all results leading to the final score on the scale was quite low among the respondents and indicated a moderately low influence of the factors on the decision-making of the elderly to participate in organized physical exercise ($\bar{x} = 65.00$; $SD = 12.189$; 95% confidence interval [64.43; 65.57]; $p < 0.001$) (Table 2).

As part of validating the measurement model, the correlation coefficients between the factors were also stated. The results showed that the correlations between the factors were low/weak, as they ranged from 0.216 to 0.300. All correlations were statistically significant at $p < 0.001$ (Table 3).

Table 1: Assessment scale to establish the factors which influence the participation of the elderly in organized physical exercise

	Statements	Factor loadings	Mean score (SD)	I-CVI (R)
Factor 1	I chose to exercise at the School of Health Association because it is done in a standing position.	0.647	2.16 (1.592)	0.83
	I chose to exercise at the School of Health Association because it lasts only 30 minutes.	0.627	2.31 (1.689)	1.00
	I chose to exercise at the School of Health Association because it takes place in the mornings.	0.625	3.43 (1.646)	1.00
	I chose to exercise at the School of Health Association because it is available several times a week.	0.582	2.85 (1.812)	1.00
	I chose to exercise at the School of Health Association because it is performed in a group.	0.534	2.93 (1.899)	1.00
	I chose to exercise at the School of Health Association because it takes place in the open air.	0.508	3.92 (1.496)	0.83
	I chose to exercise at the School of Health Association because it is close to my home.	0.499	3.74 (1.549)	0.83
	I chose to exercise at the School of Health Association because it does not require any special sports equipment.	0.498	2.39 (1.655)	0.83
Factor 2	I chose to attend the exercising activities at the School of Health Association because I miss the company of other people.	0.788	1.72 (1.438)	0.83
	I chose to exercise at the School of Health Association to feel less lonely.	0.764	1.82 (1.552)	0.83
	I chose to exercise at the School of Health Association because I am depressed.	0.617	1.35 (0.753)	1.00
	I chose to exercise at the School of Health Association to feel less sad.	0.603	1.25 (0.907)	0.83

	Statements	Factor loadings	Mean score (SD)	I-CVI (R)
Factor 3	I chose to exercise at the School of Health Association because I have elevated cholesterol levels.	0.785	2.33 (1.734)	1.00
	I chose to exercise at the School of Health Association because I have diabetes.	0.759	1.39 (1.118)	1.00
	I chose to exercise at the School of Health Association because I have breathing problems.	0.678	1.59 (1.186)	0.83
	I chose to exercise at the School of Health Association because I have a cardiovascular disease.	0.512	1.98 (1.532)	0.83
	I chose to exercise at the School of Health Association because I have stomach problems or indigestion.	0.506	1.69 (1.292)	0.83
Factor 4	I chose to exercise at the School of Health Association because I have cancer.	0.497	1.19 (0.738)	1.00
	I chose to exercise at the School of Health Association because I have osteoporosis.	0.483	1.80 (1.390)	0.83
	I chose to exercise at the School of Health Association to improve my mobility.	0.791	4.27 (1.508)	1.00
	I chose to exercise at the School of Health Association for greater well-being.	0.620	4.44 (0.649)	1.00
	I chose to exercise at the School of Health Association for better physical fitness.	0.473	3.88 (1.463)	0.83
	I chose to exercise at the School of Health Association to improve my balance.	0.461	2.44 (1.882)	1.00
	I chose to exercise at the School of Health Association because I have pain in my muscles or joints.	0.458	2.46 (1.888)	0.83
	I chose to exercise at the School of Health Association to improve my sleep.	0.443	1.37 (1.110)	1.00
	I chose to exercise at the School of Health Association to lose weight.	0.405	1.32 (1.044)	0.83
	I chose to exercise at the School of Health Association to maintain my health.	0.402	3.35 (1.893)	1.00

Legend: Factor 1 – Exercise Characteristics; Factor 2 – Social Aspect; Factor 3 – Health Problems; Factor 4 – Improvement in Psychophysical Well-Being; SD – standard deviation; Scores based on level of agreement: From 5 – Completely agree to 1 – Completely disagree; I-CVI (R) – Statements Content Validity Index (Relevance)

Table 2: Scores on the scale to establish the factors which influence the participation of the elderly in organized physical exercise

Factors	\bar{x}	SD	95% confidence interval		p value
			Lower limit	Upper limit	
Exercise Characteristics	21.89	6.788	21.58	22.21	< 0.001
Social Aspect	6.14	3.025	6.00	6.28	< 0.001
Health Problems	11.98	4.016	11.79	12.16	< 0.001
Improvement in Psychophysical Well-Being	23.18	4.844	22.96	23.41	< 0.001
Assessment scale to establish the factors which influence the decision-making of the elderly to participate in organized physical exercise	65.00	12.189	64.43	65.57	< 0.001

Legend: \bar{x} – mean value; SD – standard deviation

Table 3: Correlation matrix for factors of the scale – Pearson's correlation coefficient

Factors	1	2	3	4
Exercise Characteristics	-	0.216**	0.266**	0.300**
Social Aspect	0.216**	-	0.256**	0.243**
Health Problems	0.266**	0.256**	-	0.288**
Improvement in Psychophysical Well-Being	0.300**	0.243**	0.288**	-

Legend: ** Correlation is statistically significant at 0.01

Evaluation of reliability of the scale

The reliability evaluation to establish the factors that influence the decision-making of the elderly to enroll in organized physical exercise was done using reliability and stability testing. Cronbach's alpha coefficient, Guttman's split-half coefficient, and Spearman-Brown's coefficient were calculated for the scale as a whole (Table 4). The results showed reliability and stability along the entire scale (> 0.600).

Table 4: Reliability evaluation of the scale to establish the factors which influence the participation of the elderly in organized physical exercise

Construct	n	Cronbach's α coefficient	Guttman's split-half coefficient	Spearman-Brown's coefficient
Assessment scale to establish the factors which influence the participation of the elderly in organized physical exercise	27	0.642	0.670	0.649

Legend: n – total number of statements within the scale

DISCUSSION

The purpose of the study was to develop a scale comprising of factors that influence the decision-making of the elderly to enroll in organized physical exercise lasting 30 minutes per session five or six days a week, and to perform its psychometric validation.

The retention of all 36 initial statements after expert validation emphasizes their relevance and appropriateness in capturing the different aspects of decision-making in this population. This comprehensive inclusion, which meets the content validity criteria of Polit and Beck (2006), emphasizes the depth and breadth of the factors considered in our study.

The exploratory factor analysis, which was crucial for refining the scale, revealed interesting findings. The exclusion of 9 statements due to their insufficient variability suggests that certain anticipated factors may not play as significant a

role in the decision-making process as originally assumed. This refinement resulted in a more focused four-factor model that reveals the complexity and multidimensionality of the decision-making process in the elderly in relation to physical exercise. The weak but statistically significant correlations between these factors suggest a nuanced interplay rather than strong, direct relationships. This subtlety in the relationships between the different factors provides a more complex understanding of how the elderly weigh up different considerations when deciding to participate in organized physical exercise programs.

The scale to establish the factors that influence the decision-making of the elderly to enroll in organized physical exercise clearly identified four main factors that are crucial for planning organized physical exercise for the elderly in Slovenia. The first factor refers to the Exercise Characteristics and is related to the way the exercises are done, the duration of exercise, the timing of exercise, the frequency of exercise, the form of exercise, the place of exercise, and the need to use sports equipment. Other authors have also reported that the characteristics of organized physical exercise, such as access to the exercise area, the time and place of exercise, the intensity and form of exercise, and the prices of exercise programs, are important for the elderly when deciding to participate in a physical exercise program (Bethancourt, Rosenberg, Beatty & Arterburn, 2014; de Guzman et al., 2015; Levasseur et al., 2015; Shaikh & Dandekar, 2019).

The second factor, i.e. Social Aspect, is related to the enrolment of the elderly in organized physical exercise programs as a means to counteract feelings of loneliness, depression, and sadness. Aging encompasses not only biological changes, but also important psychological and social shifts (Cannon, 2015). These are often associated with alterations in socio-economic status, loss of employment, spouse or friends, and an increasing dependence on the assistance of others. Moreover, cognitive and mental capacities tend to decline with age (Johnson, Barrera & Yochim, 2018; June & Marty, 2018; Woodhead, 2018). Given these multifaceted challenges, it becomes advantageous for the elderly to have access to and participate in organized group physical exercise programs. The results of studies have shown that the elderly do not take part in such programs solely to maintain or improve their physical health, but also to socialize with other people of similar age (Devereux-Fitzgerald, Powell, Dewhurst & French, 2016; Pels & Kleinert, 2016; Franke, Sims-Gould, Nettlefold, Ottoni & McKay, 2021). There is also an increasing amount of evidence in support of the mental and cognitive benefits for the elderly derived from participating in programs involving regular physical exercise (Windle, 2014; Lee et al., 2015; Yamasaki, 2023).

The third factor, i.e. Health Problems, comprises statements on various health problems reported by the respondents. This factor is particularly complex as there are different views in the literature on how health perceptions influence physical activity in the elderly. On the one hand, some studies have found that poor health can actually motivate the elderly to increase the level of their physical activity (Stathi et al., 2010; Patel, Schofield, Kolt & Keogh, 2013; Midlöv, Leijon, Sundquist, Sundquist & Johansson, 2014). These authors suggest that health problems may serve as a wake-up call that prompts the elderly to exercise more in order to manage or alleviate their health problems. On the other hand, a number of studies argue that negative self-rated health tends to be associated with lower levels of physical activity in the elderly (Moschny, Platen, Klaaßen-Mielke, Trampisch & Hinrichs, 2011; Chen et al., 2015; Yamakita et al., 2015; Aro, Agbo & Omole, 2018). This perspective implies that the elderly who perceive their health to be poor are less likely to engage in physical activity, possibly out of concern about exacerbating their health problems or a general sense of incapacity. When designing exercise programs, it is advisable to consider the health problems and diseases of the elderly. Awareness of these conditions is crucial as the etiology of such health problems may necessitate adaptations in the exercise program.

The last factor of the scale to establish the factors that influence the decision-making of the elderly to participate in organized physical exercise combines statements that refer to improvement in psychophysical well-being. This is demonstrated by improvements in mobility, overall well-being, fitness levels, balance, pain reduction, sleep quality, loss of excess weight, and maintenance of health. Our findings are consistent with other studies (Bethancourt et al., 2014; Capalb et al., 2014; Nielsen et al., 2014; Tumanova, 2019; Yarmohammadi, Saadati, Ghaffari & Ramezankhani, 2019; Pedersen, Hansen & Elmoose-Østerlund, 2021). When designing physical exercise programs, it is important to understand the reasons that motivate the elderly to participate in the organized physical exercise program. With this knowledge, exercises programs might become better tailored to the needs of the elderly. Aligning physical exercise programs with the values and needs of the elderly enhances the likelihood of their sustained commitment to the organized physical exercise program.

In addition to substantiating the validity of the scale in elucidating the factors influencing the decision-making of the elderly to participate in organized physical exercise, the study also verified its commendable reliability and stability.

The study was conducted on a representative sample of the elderly taking part in physical exercises at the School of Health Association, although the use of stratified random sampling instead of convenience sampling should be con-

sidered in future studies. Limitations of the study may arise from unequal gender representation and omission of certain statistical regions of Slovenia. Some limitations might also be associated with the subjective nature of participants' personal experiences.

While the four-factor model exhibited satisfactory psychometric properties, it might not have comprehensively addressed the entire scope of the factors influencing the participation of the elderly in organized physical exercise. Therefore, a suggestion for future studies is to expand the scale's statements, perform confirmatory factor analysis and test-retest analysis on a new sample of respondents. Furthermore, assessing the cultural sensitivity of the scale and performing intercultural adjustment would contribute to a better understanding of the factors influencing the decision-making of the elderly to take part in organized physical exercise.

CONCLUSION

This study focused on the development and initial psychometric validation of a scale. It identified factors that influence decision-making of the elderly to take part in organized physical exercise programs. The resulting novel measurement instrument comprises four factors and 27 statements. It can help professionals, public and non-governmental institutions, organizations and associations in the planning and promotion of organized physical exercise programs for the elderly.

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PHYSICAL THERAPY OF ROTATOR CUFF INJURIES OF OLYMPIC WEIGHTLIFTERS – A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

From an injury-rate standpoint, Olympic weightlifting is a relatively safe sport. Despite that, a large number of repetitions, the ballistic nature of the lifts and the high forces sustained by the shoulder joint during their execution can lead to shoulder injuries, specifically rotator cuff injuries. The purpose of this paper was to investigate the scientifically proven physiotherapy methods and what their indications are when dealing with rotator cuff injuries of Olympic weightlifters.

A qualitative literature review method was used, and the following online databases were included: PubMed, Scopus, Wiley, and PEDro in ResearchGate. The keywords in the literature search were: rotator cuff, shoulder, injury, physiotherapy, sport, weightlifting and Olympic weightlifting. The final analysis included fully published and accessible research papers in English from 2012 onwards, focusing on the physiotherapy of rotator cuff injuries.

In total, 16 research papers were included in the final review. Management of rotator cuff injuries is a complex process, especially in sports with overhead movements. We found that the success and effectiveness of the physiotherapy process can be improved through a proper combination of kinesiotherapy, physical agent modalities, manual methods and other forms of therapy.

The choice of the specific methods and their duration depends on the pathology of the individual injury. Further research focusing on Olympic weightlifting is needed to

create precise and conclusive guidelines for rehabilitation, especially for sport specific phases occurring later in the rehabilitation process.

Keywords: *Olympic weightlifting, rotator cuff, rehabilitation, injuries, physiotherapy.*

FIZIOTERAPIJA PO POŠKODBAH ROTATORNE MANŠETE PRI OLIMPIJSKIH DVIGALCIH UTEŽI – SISTEMATIČNI PREGLED LITERATURE

POVZETEK

Olimpijsko dviganje uteži je z vidika pogostnosti poškodb relativno varen šport. Kljub temu veliko število ponovitev, balistična narava športa in visoka sila na ramenski sklep lahko povzročijo poškodbe ramena, še posebej rotatorne manšete. Namen tega dela je s pregledom literature raziskati, katere fizioterapevtske metode so dokazano učinkovite in kakšne so njihove indikacije za obravnavo posameznih tipov poškodb rotatorne manšete pri olimpijskih dvigalcih uteži.

V kvalitativni pregled literature so bile vključene te podatkovne baze: PubMed, Scopus, Wiley, PEDro in ResearchGate. Ključne besede pri iskanju literature so bile: »Rotator cuff«, »Shoulder«, »Injury«, »Physiotherapy«, »Sport«, »Weightlifting« in »Olympic Weightlifting«. V končno raziskavo smo vključili v celoti objavljene in dostopne raziskave v angleškem jeziku, ki so bile objavljene od leta 2012 in neposredno raziskujejo fizioterapevtsko rehabilitacijo poškodb rotatorne manšete.

V končno analizo je bilo vključenih 16 raziskav. Obravnavo poškodb rotatorne manšete je kompleksen proces, še posebej kadar gre za športe z aktivnostmi nad glavo. Ugotovili smo, da je izboljšanje uspešnosti rehabilitacije omenjenih poškodb mogoče doseči s pravilno kombinacijo kinezioterapije, fizičnih dejavnikov, manualnih in drugih metod obravnave.

Izbira posameznih metod in njihovo trajanje sta odvisna od patologije posamezne poškodbe. Jasno je, da so za izoblikovanje natančnih smernic celotne rehabilitacije, predvsem v poznejših športno specifičnih fazah, potrebne raziskave usmerjene samo v dvigalce uteži.

Ključne besede: *olimpijsko dviganje uteži, rotatorna manšeta, rehabilitacija, poškodbe, fizioterapija.*

INTRODUCTION

Olympic weightlifting is often misinterpreted as a very dangerous sport. While it is true that athletes in this sport are constantly lifting relatively heavy weights, this alone cannot be the reason to label a sport as dangerous. This is clear if we consider that the execution, volume and intensity of the sessions and movements in this sport can be often tracked and managed better than for example in team sports. Aasa, Svartholm, Andersson and Berglund (2017) concluded that the injury rate in weightlifting is between 2.4 to 3.3 injuries/1000 hours of training. We can compare this to American football where the injury rate is much higher at 9.3 injuries/1000 hours of training or even 35.9 injuries/1000 hours of competition (Hootman, Dick & Agel, 2007). Even when comparing these numbers to the injury rate of 3.57 injuries/1000 hours of exposure to non-contact sports like track and field (Jacobsson et al., 2013), Olympic weightlifting is a relatively safe sport.

Researchers found that the most injured anatomical regions within weightlifting were the lower back, shoulder and knee joints (Calhoun & Fry, 1999; Raske & Norlin, 2002). In terms of the severity and nature of those injuries, we found conflicting results. Calhoun and Fry (1999) found that most of the injuries to the mentioned regions required less than one day of missed training, suggesting that most of the injuries and associated pain were minor. On the other hand, Raske and Norlin (2002) reported the injuries to be more severe, requiring more than one month to recover. For comparison, the majority of track and field injuries were severe, requiring more than three weeks of missed training (Jacobsson et al., 2013). The most common diagnosis was tendinitis, muscle spasms, muscle tears and ligament tears (Calhoun & Fry, 1999).

Since Olympic weightlifting includes ballistic movements with weight overhead, athletes can be expected to be at a higher risk for subacromial impingement (Page, 2011; Escalante, 2016). This is in line with claims that repetitive lifting overhead presents a certain risk for soft tissue shoulder injuries (Van der Wall et al., 1999; Raske & Norlin, 2002; Bedi, 2011). Escalante (2016) and Gross, Brenner, Esformes and Sonzogni (1993) claim that the primary reason for risk with those movements is increased stress on the inferior glenohumeral ligament while the upper extremity is abducted and externally rotated. The required catch and stabilization of the weight overhead in the end shoulder range of motion and the involvement of shoulder musculature practically throughout the whole Olympic lifts are also important risk factors to consider (Serano, 2020).

During the lift-off, the first pull and transition phases of snatch and clean shoulder muscles are contracting primarily isometrically. During the explosive second pull and turnover phases, they are contracting concentrically, as they do during the drive phase of the jerk. Lastly, the greatest shoulder musculature isometric force requirements are present during the catch phase of the snatch and jerk. The required dynamic glenohumeral stability and humeral head centralization during those phases depend primarily on the rotator cuff muscles and the long head of the *musculus biceps brachii* (Serrano, 2020). Any limitations or deficiencies in shoulder range of motion and passive or active stability may compromise the technical execution of the lifts and contribute to or lead to injuries (Henoch, 2017).

When assessing a patient with shoulder pain, the first goal should be to determine the underlying cause of the pain. This is usually performed through a combination of an interview, palpation, diagnostic imaging, pain-provoking and range of motion tests. Treatment plans and physiotherapeutic methods should be based on that information (Ristori et al., 2018; Serrano, 2020). One of the primary goals of diagnostics is determining whether the pain is specific or non-specific and if surgical treatment is needed. Additional assessments of shoulder stability, thoracic mobility and scapula movement all provide physiotherapists with additional crucial information that should be used to guide interventions (Moser 2014; Panagiotopoulos & Crowther, 2019)

When dealing with the majority of specific rotator cuff injuries, researchers suggest starting with conservative treatment and opting for surgery only when conservative treatment fails (Ryösä et al., 2017; Nazari, MacDermid, Bryant & Athwal, 2019; Millett, Wilcox, O'Holleran & Warner, 2006). Ristori et al. (2018) suggested that both diagnostic imaging and pain-provoking tests should be interpreted only in association with functional activity and pain. The main reasons for this are the often large discrepancies found between diagnostic results, actual functional limitations and pain.

In the past authors proposed similar models of rotator cuff rehabilitation. The main difference between the 3-phase post-operative (Sgroi & Cilenti, 2018) model proposed for the general population and the 4-phase (Millett et al., 2006) or 5-phase (Serrano, 2020) models for athletes, is that the latter two usually last longer as they define sport specific phases. Cools et al. (2021) emphasized the importance of a comprehensive return to sports protocol for athletes, which should be able to detect and correct possible asymmetries in shoulder range of motion, stability and strength.

Today we have a good amount of clinical research on effective physiotherapeutic modalities for rotator cuff treatment. There is however virtually no cli-

nical research specifically done on Olympic weightlifters. The 5-phase model proposed by Serrano (2020) is a rare work that focuses on collecting existing research and knowledge on rotator cuff injuries and forming rehabilitation guidelines specifically for Olympic weightlifters.

The goal of our work was to focus primarily on the role of the physiotherapist in the process of the aforementioned rehabilitation. We wanted to highlight clinically proven effective physiotherapeutic interventions and how they could be used specifically for the rehabilitation of Olympic weightlifters with rotator cuff injuries.

METHODS

We systematically reviewed the literature using a systematic qualitative literature review method. Data was extracted from the online databases PubMed, Scopus, Wiley, PEDro, and ReserchGate during the period between 25 May 2022 and 3 June 2022. In conjunction with the operator AND and/or OR, the following keywords were used: rotator cuff, shoulder, injury, physiotherapy, sport, weightlifting and Olympic weightlifting.

Articles were first evaluated based on title, followed by the abstract, then a quick full-text overview and lastly based on the inclusion and exclusion criteria. The inclusion criteria were: i) fully accessible clinical studies, ii) fully written in the English language, iii) published after 2012, and iv) investigating physiotherapeutic interventions during the rehabilitation of rotator cuffs. The exclusion criteria were: i) meta-analysis, systematic literature reviews and case studies, ii) studies investigating the efficiency of pharmaceutical interventions, iii) choosing between operative and conservative treatment, iv) entirely home-based unsupervised kinesiotherapy, v) research in which all subjects were older than 50 years or the average age was higher than 55 years were also excluded.

Microsoft Office Excel 2016 (Microsoft Corporation, New York, USA) was used to collect and present the summary of the results with tables. The search process and the final selection of articles were performed using the PRISMA 2020 guidelines (Page et al., 2021).

Additionally, we used additional filters when searching the databases as shown in Table 1.

Table 1: Additional search filters applied in the online databases

Database	Search filters
PubMed	Articles published between 2012 and 2022, randomized control studies and clinical trials
Scopus	English articles published between 2012 and 2022
Wiley	Articles published between 2012 and 2022
PEDro	PEDro grade at least 5/10 and articles published after 2012
ReserchGate	Not able to choose additional search filters within the database

RESULTS

The initial search in databases returned 1302 hits. After applying additional search parameters from Table 1, the search results included 248 hits. Next, after reviewing the titles and abstracts we narrowed our search to 49 studies. Lastly, we eliminated duplicates and read the full articles. After reviewing the content, we eliminated an additional 33 articles and thus analyzed 16 relevant studies. The systematic review process is presented in Figure 1.

A total of 724 individuals with rotator cuff injuries were included in the analyzed studies. Out of the 16 studies, 14 provided information on participants' gender, with women representing a slightly larger share (54%). The duration of the studies varied from one week up to a year. Most of the studies, their eligibility requirements and the period between checkups were in line with the following differentiation based on the length of the symptoms (Koç et al., 2020):

- Acute pain: symptoms lasting less than 6 weeks
- Sub-acute pain: symptoms lasting between 6–12 weeks
- Chronic pain: symptoms lasting more than 12 weeks

Chronic injuries were the most researched within our sample. Seven studies investigated exclusively chronic rotator cuff injuries, while six other studies also included them among others. Sub-acute injuries were exclusively investigated within one study while they were included among others in eight other studies. There was no research focusing exclusively on acute injuries, but they were part of six mixed studies. Only one of the studies specifically defined that all of the patients underwent surgical intervention.

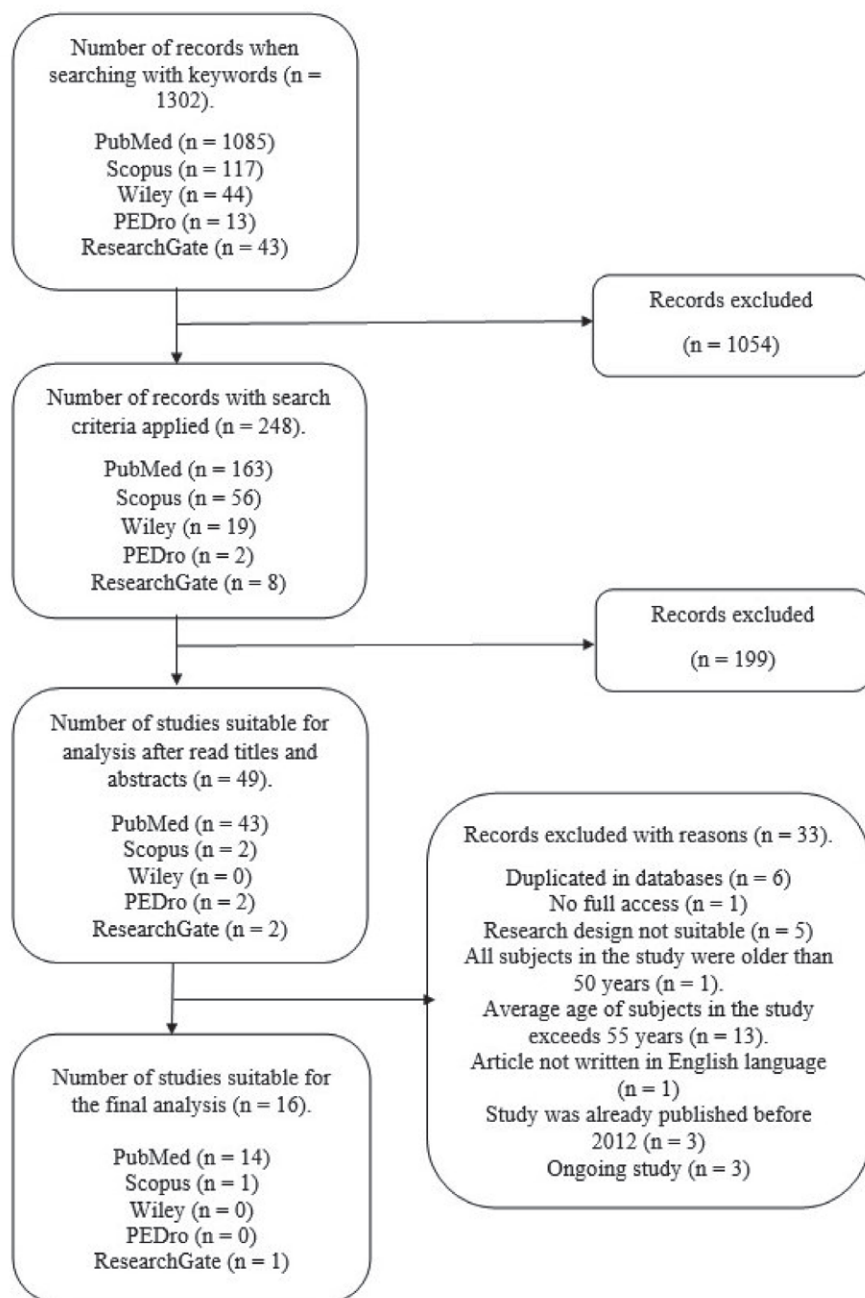


Figure 1: Systematic review process

Table 2: Summary of the included articles and results

Author(s) and year of publ.	Article title	Research sample	Article type	Results
De Oliveira et al. (2020)	Kinesiotaping for the Rehabilitation of Rotator Cuff-Related Shoulder Pain	52 people (22 females and 30 males) with pain, restricted range of motion, and function as a result of a rotator cuff pathology.	Randomized clinical trial	Both in the medium- and long-term, the addition of kinesiotaping to 6-week-long kinesiotherapy did not result in a statistically significant effect on reducing pain and improving ROM in the shoulder joint.
Parle et al. (2017)	Acute rotator cuff tendinopathy: does ice, low load isometric exercise, or a combination of the two produce an analgaesic effect?	20 people (13 females and 7 males) with unilateral shoulder pain persisting less than 12 weeks. All subjects had ultrasound-confirmed rotator cuff tendinosis or bursitis.	Randomized clinical trial	A statistically significant short-term effect on reducing pain and improving function of the shoulder joint. The combination of both methods was not found advantageous.
Boudreau et al. (2019)	The Addition of Glenohumeral Adductor Coactivation to a Rotator Cuff Exercise Program for Rotator Cuff Tendinopathy	42 people (22 females and 20 males) with confirmed rotator cuff tendinopathy and symptoms persisting longer than a month. Painful arc, pain with resisted isometric external rotation and abduction.	Randomized clinical trial	No statistically significant improvement in shoulder function and pain reduction after 6 weeks of additional glenohumeral adductor coactivation.
Guan et al. 2020	Decreased Synovial Fluid Biomarkers Levels Are Associated with Rehabilitation of Function and Pain in Rotator Cuff Tear Patients Following Electroacupuncture Therapy	54 people (38 females and 16 males) with a small to medium-sized rotator cuff rupture and at least 6 months of conservative treatment.	Randomized clinical trial	Synovial fluid biomarkers levels are reliable indicators of a successful rehabilitation. Electroacupuncture therapy is an effective conservative method delivering a reduction of inflammatory cytokines, pain and improving shoulder function.

Author(s) and year of publ.	Article title	Research sample	Article type	Results
Muth et al. 2012	The effects of thoracic spine manipulation in subjects with signs of rotator cuff tendinopathy	30 people (14 females and 16 males) with signs of rotator tendinopathy and symptoms which lasted on average for 4,2 months. Primarily high-level athletes from disciplines involving overhead movements.	Laboratory controlled trial	No statistically significant effect on scapular kinematics, with the exception of slightly smaller scapular lateral rotation. Statistically significant higher activation of the middle <i>musculus trapezius</i> , pain reduction, and improving the function 7-10 days after the manipulation.
Zhang et al. 2020	Influence of Scapula Training Exercises on Shoulder Joint Function After Surgery for Rotator Cuff Injury	46 people (20 females and 26 males) after the arthroscopic surgery of partial or full thickness tear of the rotator cuff.	Randomized clinical trial	A combination of traditional physiotherapy and specific scapular exercises is effective in reducing the dysfunctions after the surgery. After 6 weeks specific scapular exercises have a statistically significant effect on reducing shoulder pain, improving ROM and function. After 12 weeks the positive effect of those exercises is also seen on muscle strength testing.
Menek, Tarakci, & Algun 2019	The effect of Mulligan mobilization on pain and life quality of patients with Rotator cuff syndrome	30 people (12 females and 18 males) with partial rotator cuff rupture, acute symptoms, and without surgical treatment.	Randomized clinical trial	6-week-long treatment protocol with Mulligan mobilization results in a statistically significant pain reduction, improving function and ROM.
Frassanito et al. 2018	Effectiveness of Extracorporeal Shock Wave Therapy and kinesio taping in calcific tendinopathy of the shoulder	42 people (26 females and 16 males) with diagnosed calcific rotator cuff tendinopathy, and functional issues persisting at least 2 weeks.	Randomized clinical trial	The addition of kinesiointaping to extracorporeal shock wave therapy adds to pain and inflammation reduction in the short term. This addition thus potentially helps to reduce the rehabilitation time.

Author(s) and year of publ.	Article title	Research sample	Article type	Results
Akbaba et al. 2019	The effectiveness of trigger point treatment in rotator cuff pathology	41 people with diagnosed partial rotator cuff tear, at least 3 active shoulder trigger-points, and symptoms persisting at least 3 months.	Randomized clinical trial	Additional trigger-point treatment does not result in statistically significant improvement of rehabilitation outcomes.
Klüter et al. 2018	Electromagnetic transduction therapy and shockwave therapy in 86 patients with rotator cuff tendinopathy	86 people (45 females and 41 males) with diagnosed rotator cuff tendinopathy, symptoms lasting at least 3 months, pain graded at least 5 on a VAS scale, and failed previous conservative treatment.	Randomized clinical trial	A combination of electromagnetic transduction therapy and shockwave therapy has a statistically significant superior effect on pain reduction and improving function than shockwave therapy only. This was the case 6, 12, and 24 weeks after the last therapy.
Li et al. 2021	Effectiveness of Focused Shockwave Therapy versus Radial Shockwave Therapy for Noncalcific Rotator Cuff Tendinopathies	46 people (25 females in 19 males) with MRI-diagnosed non-calcific rotator cuff tendinopathy without rupture. Subjects had symptoms lasting at least 3 months, restricted ROM, pain with overhead movements and graded their pain with at least 5 on a VAS scale.	Randomized clinical trial	No statistically significant difference in pain reduction within 24 weeks of the intervention between focused and radial shockwave therapy. Focused shockwave therapy results in superior longer-term pain reduction.
Koç et al. 2020	Does balneotherapy provide additive effects to physical therapy in patients with subacute supraspinatus tendinopathy?	90 people (53 females and 37 males) with MRI diagnosed unilateral sub-acute unilateral tendinopathy of musculus Supraspinatus, at least one positive pain-provocative test and full ROM.	Randomized clinical trial	A statistically significant improvement of shoulder ROM, function, grip strength, quality of life and pain reduction with the addition of balneotherapy to the traditional physiotherapy protocol.

Author(s) and year of publ.	Article title	Research sample	Article type	Results
Elsodany et al. 2018	Long-Term Effect of Pulsed Nd:YAG Laser in the Treatment of Patients with Rotator Cuff Tendinopathy	60 people with diagnosed rotator cuff tendinopathy, pain persisting for over 3 months, and positive pain provocative tests that indicate rotator cuff pathology. Subjects were also dealing with impaired shoulder abduction, internal and external rotation ROM.	Randomized clinical trial	Rehabilitation program combining HILT and exercise intervention program was more effective in restoring shoulder function, ROM, and reducing pain than exercise intervention program alone.
Carlisi et al. 2018	Focused extracorporeal shock wave therapy combined with supervised eccentric training for supraspinatus calcific tendinopathy	22 people (14 females and 8 males) with shoulder pain persisting for more than 6 weeks, clinical signs of sub-acromial impingement, and full passive ROM. All of the subjects also had a confirmed calcific tendinopathy of the supraspinatus tendon.	Randomized clinical trial	Focused extracorporeal shock wave therapy is an effective method for reducing shoulder pain and improving function. Additional shoulder abductor eccentric exercise protocol does not provide statistically significant improvement in treatment outcomes compared to focused extracorporeal shock wave therapy alone.
Chou et al. 2018	Comparative outcomes of extracorporeal shockwave therapy for shoulder tendinitis or partial tears of the rotator cuff in athletes and non-athletes	35 people (19 females and 16 males). 13 professional athletes and 22 non-athletes, diagnosed and symptomatic chronic rotator cuff tendinitis, with or without rupture, and previously failed conservative treatment.	Retrospective study	Extracorporeal shockwave therapy is effective both for athletes and non-athletes. Its use should be considered for athletes with long-lasting tendinitis or partially torn rotator cuff before opting for arthroscopy.
Coskun et al. 2018	Effectiveness of Kinesiology Tape Application in Rotator Cuff Injuries	30 people (13 females and 17 males) with rotator cuff injury, either tendinitis or acute injury with persistent pain, reduced ROM and associated reduced life quality.	Randomized clinical trial	The addition of kinesiointaping to traditional physiotherapy methods results in superior pain, inflammation and rehabilitation time reduction. It also enables better improvements in ROM and shoulder function compared to only traditional physiotherapy interventions.

DISCUSSION

Evaluation and diagnostics

Reviewed studies analyzed symptoms differently both at the beginning and during check-ups. This indicates that there is a lack of consensus on how to screen patients with potential rotator cuff pathology (Ristori et al., 2018). Despite that, all of the researchers used a combination of different questionnaires about the pain and function of the shoulder joint. Eleven studies used the Visual Analogue Scale (VAS), while the Numeric Rating Scale (NRC) was the second most commonly used. Concerning functional assessment, the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire was the most common, with a full version in seven pieces of research and a shortened version used within two more. The second most commonly used was the Constant-Murley Score (CMS).

Nine out of sixteen included studies used different physiotherapeutic assessments to test the active and passive range of motion (ROM), muscle strength and function. Among those, the passive range of motion assessment was the most commonly used in six studies. Half of the studies also used pain-provoking tests to confirm rotator cuff pathology, but only one study used those tests during control check-ups. Half of the research also included at least one diagnostic imaging method, with magnetic resonance imaging (MRI) used within seven, ultrasound within six and X-ray within three studies.

We believe that the basic assessment of injured Olympic weightlifters should not be significantly different than that of the general population and should focus on diagnosing the underlying mechanisms of pain. This includes the interview with the athlete, diagnostic imaging, pain-provoking testing, passive and/or active ROM assessment, and function and pain assessment. Based on that information the therapist should be able to determine if the pain is the result of the rotator cuff symptomatic and what would be the appropriate course of action. A physiotherapist has to consider how long and how severe is the pain, and especially how it affects the function and performance. It is crucial to look at an individual's training load and plan to identify possible injury-contributing factors. Physiotherapists must thus collaborate closely with the coach and athlete to modify both training load and activities to ensure alignment with the rehabilitation plan.

Physical Agent Modalities

Some authors have included similar physical agent modalities in the “traditional physiotherapy” for rotator cuff injuries (Zhang et al., 2020; Menek, Tarakci & Algun 2019; Koç et al., 2020; Coşkun et al., 2018). Those models consisted of ultrasound, cryotherapy or thermotherapy and transcutaneous electrical nerve stimulation (TENS). Cryotherapy as a modality seems to be primarily suitable for acute and subacute injuries. Parle, Riddiford-Harland, Howitt & Lewis (2017) found that cryopak is an effective method for reducing pain sensation and improving the function of the shoulder joint when dealing with non-traumatic acute or subacute pain. Zhang et al. (2020) found that a combination of 5 to 20 minutes of cryotherapy within the first four weeks after the operation and 5 to 10 minutes of moving method ultrasound therapy with the dosage of 1.5–2.5 W/cm² between the 4th and 12th week is effective in reducing the pain and improving the function of the shoulder joint after the arthroscopic surgery. Similarly, Menek et al. (2019) observed significant improvements in function and reduction of pain after 6 weeks of using a combination of cryotherapy, 6-minute ultrasound therapy at a frequency of 1.5 MHz and TENS at a frequency of 100 Hz after partial rotator cuff tears. Koç et al. (2020), using the same parameters for the ultrasound and 20-minute TENS at a frequency of 60–80 Hz for three weeks also demonstrated pain reduction and improved function in patients suffering from subacute supraspinatus tendinopathy. A similar protocol with a 20-minute TENS and 10-minute ultrasound therapy at 1.5 MHz frequency was also successfully used for a week by Coşkun et al. (2018) with patients dealing with various rotator cuff injuries. Interventions in all of the mentioned studies were carried out at least five times per week. We should emphasize that the “traditional physiotherapy” model always included some form of kinesiotherapy. Most of the studies also indicate that even though the improvements with “traditional physiotherapy” are significant, it can be expected that combining those methods with other physiotherapeutic modalities leads to superior patient outcomes.

Elsodany, Alayat, Ali & Khaprani (2018) found that for the treatment of rotator cuff tendinopathy high-intensity laser therapy (HILT) combined with exercises provides superior results in terms of pain reduction, increasing shoulder ROM and function compared to performing exercises alone. Chou et al. (2018) found that one to two sessions of extracorporeal shockwave therapy (ESWT) enabled all 13 included overhead athletes to return to a competitive level within 3 months after the intervention. 3000 impulses of the shockwave at 0.32 mJ/mm² energy flux density were applied to the affected shoulder under ultrasonographic

guidance during the sessions. The inclusion criteria in this study were an at least three-month-long unsuccessful conservative treatment. The recurrence rate was quite high at 62% though, much higher than the 18% observed in the non-athlete group, which shows the importance of comprehensive sport-specific phases of rehabilitation. Carlisi et al. (2018) found that three focused ESWT sessions with 1-week breaks in between were effective in terms of reducing shoulder pain and improving joint function in individuals dealing with sub-acute or chronic pain resulting from supraspinatus calcific tendinopathy. The amount of energy influx during a single therapy was lower, 0.15 mJ/mm^2 applied with 1700 impulses. Four sessions with focused ESWT, 3000 impulses at $0.09 \pm 0.018 \text{ mJ/mm}^2$ energy flux density applied, and a 5-to-9-day break between them, have been proven more successful in the treatment of non-calcific supraspinatus tendinopathy than a protocol with radial ESWT (Li et al., 2021). Three ESWT sessions with 2000 impulses at 0.32 mJ/mm^2 energy flux density within two weeks also resulted in shoulder pain reduction and function improvements within a group of patients with non-calcific rotator cuff tendinopathy.

Combining ESWT therapy with 8 sessions of electromagnetic transduction therapy within 4 weeks resulted in superior results. Each electromagnetic transduction therapy treatment lasted 20 minutes at 80 mT, with an impulse frequency of 3 Hz and a discharge voltage of 30 KV (Klüter et al., 2018). Chou et al. (2018) and Klüter et al. (2018) also monitored long-term ESWT results and both concluded that the improvements are greater in the long-term.

Manual methods

Adding 12 sessions of rotator cuff myofascial trigger-point release to standard conservative treatment does not significantly improve outcomes of the patients with symptomatic rotator cuff ruptures (Akbaba et al., 2019). The addition of Mulligan mobilization to all 30 sessions of “traditional physiotherapy” within six weeks results in superior outcomes. Menek et al. (2019) observed both pain reduction, an increase in shoulder ROM and an improvement of shoulder function after the described addition of an approximately 20-minute-long protocol of Mulligan mobilization. Muth, Barbe, Lauer and McClure (2012) found that a single intervention of thoracic spine and cervicothoracic junction manipulation is effective for reducing pain and improving shoulder function in patients with chronic rotator cuff pathology. Manipulation resulted in improvements both immediately after and 7–10 days after the intervention.

Exercise interventions

Different combinations of passive, active, actively assisted and range of motion exercises were used. The addition of scapular mobilization, stabilization and surrounding musculature strengthening to the standard physiotherapeutic protocol results in superior outcomes 12 weeks after the surgical repair of partial rotator cuff tears (Zhang et al., 2020). In this study, active exercises for surrounding joints and corresponding musculature were applied to all patients a day after the operation, while Codman pendulum exercises were introduced after a week. Four weeks after the surgery, actively-assisted exercises were introduced and after six weeks exercises in a closed kinetic chain. Similar exercise protocols including pendulum exercises, actively-assisted exercises, strengthening and ROM exercises were used in other included studies emphasizing conservative treatment (Menek et al., 2019; Elsodany et al., 2018). Both of those studies concluded that another physiotherapy method, specifically Mulligan mobilization or HILT, results in additional improvements in shoulder function and pain reduction for patients with rotator cuff tendinopathy. De Oliveira, de Fontenay, Bouyer Desmeule, and Roy (2020) concluded that individualized six-week kinesiotherapy with an emphasis on sensorimotor control, strengthening and education significantly improves ROM, and function and reduces pain associated with the symptomatic rotator cuff. This was evident not only in the short- and mid-term, but also in the long-term.

Some studies also defined the number of sets and repetitions executed in the respected protocols. All used three sets of 10 repetitions (Carlisi et al., 2018; Menek et al., 2019; Boudreau, Gaudreault, Roy, Bédard & Balg, 2019), while Carlisi et al. (2018) additionally defined a progressive number of sets and repetitions at the initial two weeks. Carlisi et al. (2018) and Boudreau et al. (2019) stated that mild pain (<4 on the VAS scale) was allowed during the performance of the exercises.

Parle et al. (2017) found that isometric exercises (10–20 second holds in three to five series, executed daily) are a viable and effective short-term option to reduce acute or subacute shoulder pain as a result of rotator cuff tendinopathy. Boudreau et al. (2019) found a 6-week-long intervention of strengthening exercises focusing on *m. serratus anterior*, *m. trapezius* and rotator cuff muscles result in reduced movement pain, while the pain at rest and shoulder function do not improve significantly. Additional strengthening of glenohumeral adductors in this study also did not contribute to better outcomes. Carlisi et al. (2018) also found no benefits with the addition of eccentric shoulder ab-

ductor training for calcific supraspinatus tendinopathy during a 9-week-long treatment protocol combined with ESWT.

Other physiotherapeutic interventions and methods

The addition of balneotherapy to the “traditional physiotherapy” model is effective for patients with subacute supraspinatus tendinopathy. Koç et al. (2020) found it improves ROM, pain reduction, and shoulder function. Guan et al. (2020) found improvements in shoulder function and reduced inflammation with the addition of Electroacupuncture Therapy to “traditional physiotherapy” twice per week. The 6-week, 3-day-per-week intervention was carried out on a population with full-thickness rotator cuff tears, with failed six months of conservative treatment.

Kinesiotaping is also a potentially applicable method for symptomatic rotator cuff injury treatment. A 1-week-long addition of kinesiology tape results in improved function and pain reduction compared to “traditional physiotherapy” only (Coşkun et al., 2018). The authors of this study pointed to enhanced sensorimotor and proprioceptor effects as the likely mechanisms for those improvements. Frassanito, Cavalieri, Maestri and Felicetti (2018) found that the addition of kinesiotaping reduces the required rotator cuff calcific tendinopathy treatment response time compared to when using only ESWT. The improvements of kinesiology tape addition were seen both in short- and medium-term outcome results. During their 6-week long study, De Oliveira et al. (2020) found that adding kinesiotaping to the established rehabilitation program with an emphasis on sensorimotor training does not provide superior medium- or long-term outcomes for individuals with rotator cuff-related shoulder pain. The study identified the greater influence of exercise and the absence of a more detailed diagnosis as possible reasons for those results.

Guidelines for rotator cuff injury treatment for Olympic Weightlifters

While we can conclude that “traditional physiotherapy” is suitable for addressing the majority of rotator cuff injuries, physiotherapists should use additional methods to improve outcomes. This is vital with Olympic weightlifters, whose primary goal is usually to return to training as soon as possible after sustaining an injury.

Kinesiotaping and thoracic spine mobilization are two easily applied methods that may improve treatment outcomes of a wide range of rotator cuff pathologies. Mulligan mobilization can be added if the individual is dealing with a partial rotator cuff tear, while electroacupuncture may be more suitable for small to medium full-thickness tears.

ESWT seems to be a very effective method for addressing sub-acute and especially chronic rotator cuff tendinopathies, and its effectiveness can be enhanced with the addition of electromagnetic transduction therapy. HILT and balneotherapy are other methods that can be utilized for chronic pathologies if ESWT is not available.

We believe that comprehensive exercise intervention is an essential part of any shoulder rotator cuff injury rehabilitation, but is especially crucial for Olympic weightlifters. A suitable exercise program should be based on the results of the initial diagnostic testing which should provide information about shoulder ROM, stability and both periscapular and rotator cuff muscle strength imbalances and deficits. Even minimal, 1–2 millimetres of uncontrolled shoulder joint translation can result in pain and shoulder symptomatic (Horsley & Ashworth, 2016). Addressing found deficits should thus be the physiotherapist's priority along with methods for reducing pain, inflammation and swelling (Weiss, Wang, Hendel, Buzzerio & Rodeo, 2018).

Any possible exercise technique flaws that may be connected with the symptoms should also be identified and addressed in collaboration with coaches, while the activities that cause the pain should be discontinued or at least modified (Escalante, 2016). Additionally, an examination of possible spikes in weightlifters' training loads should also be performed as those correlate with injury incidence (Jones, Griffiths & Mellalieu, 2017).

If the shoulder pain is severe and accompanied by any kind of functional impairment or if the primary interventions failed to solve the issues within a short period, more detailed imaging diagnostics should be prioritized. It is crucial to assess if the pain is associated with structural rotator cuff damage, which would warrant a larger modification of the training plan. Determining if the continuation of the specific overhead activities presents a risk for further complications or more severe injury is also warranted. Based on the diagnosis, utilizing the appropriate combination of the aforementioned physiotherapeutic methods is vital for the most effective rehabilitation.

Lastly, if surgical treatment is chosen to treat the rotator cuff injury, physiotherapists can improve functional outcomes by adding scapular training exercises to "traditional physiotherapy" protocols within the first 12 weeks after the injury (Zhang et al., 2020). Based on multiple sources, Serrano (2020) recom-

mends introducing basic overhead activities approximately 16–20 weeks and more weightlifting-specific activities approximately 20–26 weeks after the surgery. It should be emphasized that the exact timeline for these activities should be tailored to each individual's progression and capabilities.

CONCLUSIONS

With appropriate diagnostic tests and an optimal combination of physiotherapeutic methods, the rehabilitation effects of acute, sub-acute, and chronic rotator cuff injuries can be improved. While “traditional physiotherapy” involving kinesiotherapy coupled with ultrasound, TENS and cryotherapy or thermotherapy is effective, the addition of ESWT or Mulligan mobilization results in superior outcomes for chronic and sub-acute rotator cuff pathologies. Furthermore, combining ESWT with electromagnetic transduction therapy and kinesiotaping seems to provide additional benefits. Early-stage shoulder injury rehabilitation of Olympic weightlifters may not be significantly different from that for the general population. Shoulder ROM, rotator cuff and periscapular musculature strengthening are all critical for later more sport-specific stages of rehabilitation, during which gradual exercise and training load progression are crucial for returning to full weightlifting training.

The main limitation of this work is that practical research on physical therapy protocols specifically for Olympic weightlifters dealing with rotator cuff injuries is very limited. This must be considered especially when interpreting the results and deciding on optimal physiotherapeutic interventions in later, more sport-specific stages of the rehabilitation process.

We believe that future research on rotator cuff injury rehabilitation in Olympic weightlifting should focus on effective sport-specific late-rehabilitation stage protocols and long-term post-operative rehabilitation protocols. Lastly, defining a unified approach with comprehensive diagnostic testing, both for guiding the progressions through phases of rehabilitation and identifying sport-specific issues and pain within the shoulder joint is essential. This enables practitioners and coaches to better understand and identify the rotator cuff injury risk factors that may originate from the training process itself.

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REPORTS AND REVIEWS
POROČILA IN OCENE

19th CONFERENCE OF THE EUROPEAN ASSOCIATION FOR SOCIOLOGY OF SPORT “TRANSITIONING SPORT – TRANSITIONING EUROPEAN SOCIETIES”

Budapest, Hungary, 29 May–2 June 2023

The 2023 EASS conference was held in the picturesque city of Budapest and at the Hungarian University of Sport Science with over 120 participants and 110 conference papers. Presentations in 32 parallel sessions, with more than a hundred contributions from delegates, focused on a range of different topics, with an emphasis on diversity and health. Several sessions focused on specific social groups, analysis of sport and gender, and many presentations yet explored and assessed the effects of Covid-19 on various aspects of sport.

Two keynote speakers presented recent findings on social media and the mediatization of doping. On Wednesday, we heard Prof. Dunja Antunović from the University of Minnesota present “What is Still ‘New’ about Social Media? The Importance of Sociology of Sport in Research on Mediatization.” The other keynote was by Prof. Andrea Petroczi, who brought a critical and interdisciplinary perspective to her own research in the field of doping, outlining how this very problem arises from the modern sports landscape, where a wide range of factors and stakeholders in elite sports keep the solution to the doping problem opaque. At the end of the week, the Young Researcher Award was given to Federico Genovesi from Ulster University for his paper entitled “Spaces of football and belonging for people seeking asylum: Resisting policy-imposed liminality in Italy”. There was also an honourable mention for the paper “Listening to boxing hearts and beats: Analysing boxing (through) soundscapes” by Kristina Orszaghova.

While the days were filled with presentations and talks, the afternoons were spent in social activities. A wide range of cultural activities provided opportunities to relax, connect with colleagues, and learn about the history of Budapest and Hungary.

To summarize, it is clear that new interdisciplinary and multimodal thinking is needed to address a problem that is so embedded and entrenched in the sports system. In line with this message, we are looking forward to the next EASS conference in Spain, hosted by the European University of Madrid.

Saša Pišot

19. KONFERENCA EVROPSKEGA ZDRUŽENJA ZA SOCIOLOGIJO ŠPORTA (EASS) »ŠPORT NA PREHODU – EVROPSKE DRUŽBE NA PREHODU«

Budimpešta, Madžarska, 29. maj–2. junij 2023

Konferenca EASS 2023 je potekala v slikoviti Budimpešti in na madžarski univerzi za vede o športu. Sodelovalo je več kot 120 udeležencev, ki so predstavili 110 konferenčnih prispevkov. Predstavitve so potekale v 32 vzporednih sekcijah, udeleženci pa so v prispevkih obravnavali različne teme s poudarkom na raznolikosti in zdravju. Več sekcij je bilo posvečenih posebnim družbenim skupinam, analizi športa in spola, številni prispevki pa so še vedno predstavljali raziskave o covidu-19 in učinkih tega na šport.

Na dveh plenarnih predstavitvah smo se seznanili z najnovejšimi ugotovitvami o družbenih medijih in mediatizaciji dopinga. V sredo smo prisluhnili profesorici Dunji Antunović z univerze v Minnesoti, ki je predstavila prispevek Kaj je še »novega« v družbenih medijih? Pomen sociologije športa pri raziskovanju mediatizacije. Drugo predavanje je imela prof. Andrea Petroczi, ki je v predstavitvi svojega področja raziskovanja vnesla kritično in interdisciplinarno perspektivo problema dopinga v sodobnem športnem okolju, kjer zaradi številnih dejavnikov in deležnikov v vrhunskem športu, rešitev problema še vedno ostaja nerazjasnjena.

Ob koncu tedna je nagrado za mlade raziskovalce prejel Federico Genovesi z univerze Ulster za prispevek Prostori nogometa in pripadnosti v Italiji: odpor prosilcev za azil proti liminaliteti z udeležbo v solidarnostnem množičnem športu (nogometu). Častno pohvalo je prejel tudi prispevek Kristine Orszaghove Poslušanje src in utripov boksa: Analiza boksa (skozi) zvočne pokrajine.

Medtem ko so bili dnevi napolnjeni s predstavitvami in predavanji, so bili popoldnevi in večeri namenjeni družabnim dejavnostim. Številne kulturne prireditve so ponudile priložnosti za sprostitev, povezovanje s kolegi ter spoznavanje zgodovine Budimpešte in Madžarske.

Če povzamem, je jasno, da bo v prihodnje potrebno interdisciplinarno in multimodalno razmišljanje za reševanje problemov, ki so tako močno zasidrani in zakoreninjeni v športnem sistemu. Zato se tudi veselimo naslednje konference EASS v Španiji, ki jo bo gostila evropska univerza v Madridu.

Saša Pišot

NEUROSCIENCE OF MOVEMENT – EXPLORING THE DYNAMICS OF THE HUMAN BRAIN IN MOTION

TwinBrain Summer School 3.0,
Piran, Slovenia 19–24 June 2023

Our daily lives are filled with automatic actions, and although we often respond effortlessly, our brains are engaged in numerous intricate processes. It is only when we (re)learn certain cognitive-motor tasks, such as maintaining balance while skiing or surfing, or even grasping a spoon after a stroke, that we realize the true difficulty involved. Conversely, we are aware of various progressive neurodegenerative diseases that hinder the smooth execution of everyday tasks. The study of brain dynamics during routine movements, such as walking, balancing or acquiring new motor-cognitive skills, poses a significant challenge for neuroscience.

The TwinBrain Summer School 3.0 hosted an international team of experts who shared the latest neuroscience discoveries in movement-related topics and explored how brain imaging technology contributes to understanding brain function and disease development. Advancements in wireless and portable technologies have extended experimentation into real-life scenarios, reflecting everyday experiences. The distinguished experts from Slovenia, Germany, Belgium, Italy, Luxembourg, the Netherlands, France, Switzerland and the USA presented cutting-edge developments in Mobile Brain/Body Imaging (MoBI).

Professor Dr Nico Bohnen, MD, a renowned radiology and neurology expert from the University of Michigan, delivered the keynote speech for this year's summer school. With a dedicated career focused on Parkinson's disease research and treatment, which affects over 8.5 million people worldwide, Prof. Dr Bohnen strives to discover innovative approaches that enhance the independence and quality life of individuals with Parkinson's disease and the elderly population. His lecture, held on Tuesday, 20 June 2023, at the town hall of the Municipality of Piran, revolved around the neurobiological basis of walking and balance problems in Parkinson's disease. Utilizing positron emission tomography (PET) to explore metabolic and biochemical brain processes, he presented the mechanisms underlying the disease's development and progression, along with novel treatment approaches for more effective and holistic patient care.

The final instalment of the TwinBrain Summer School series, known as TwinBrain Summer School 3.0, was held in Piran, Slovenia, from 19–24 June 2023. This event was the culmination of the TwinBrain H2020 project:

TwinBrain – TWINning the BRAIN with machine learning for neuro-muscular efficiency

European Commission: HORIZON 2020. WIDESPREAD-05-2020 – Twinning

Grant agreement ID: 952401

The Community Research and Development Information Service (CORDIS): <https://cordis.europa.eu/project/id/952401>

TwinBrain partner institutions: Znanstveno-raziskovalno središče Koper (Slovenia), Technische Universität Berlin (Germany), Université de Genève (Switzerland), Università degli Studi di Trieste (Italy)

Principal Investigator: Uroš Marušič, PhD

Project duration: 1 November 2020 – 31 October 2023

Overall budget: €900k

Uroš Marušič, Tisa Hodnik, Manca Peskar

NEUROSCIENCE OF MOVEMENT – EXPLORING THE DYNAMICS OF THE HUMAN BRAIN IN MOTION

Poletna šola TwinBrain 3.0,
Piran, Slovenija, 19.–24. junij 2023

Naš vsakdan je napolnjen z avtomatiziranimi dejanji, in čeprav se nanje pogosto odzovemo, ne da bi ob tem občutili napor, so naši možgani neprestano vpeti v številne zapletene procese. Šele ko se (ponovno) naučimo določenih kognitivno-motoričnih nalog, kot je ohranjanje ravnotežja med smučanjem ali surfanjem ali držanje žlice po možganski kapi, spoznamo resnično zahtevnost izvajanja takih nalog. Kljub temu se zavedamo, da številne progresivne nevrodegenerativne bolezni neprestano ovirajo nemoteno opravljanje vsakdanjih nalog. Raziskovanje možganskega delovanja med rutinskimi opravili, kot so hoja, ohranjanje ravnotežja in pridobivanje novih kognitivno-motoričnih veščin, je pomemben izziv za nevroznanost.

Poletna šola TwinBrain 3.0 je gostila mednarodno ekipo strokovnjakov, ki je delila najnovejša odkritja s področja nevroznanosti s poudarkom na temah, povezanih z gibanjem, ter raziskovala, kako tehnologija slikanja možganov prispeva k razumevanju delovanja teh in razvoju bolezni. Napredki v brezžični in prenosni tehnologiji so omogočili eksperimentiranje v dejanskih okoliščinah, ki izražajo vsakodnevne izkušnje. Izjemni strokovnjaki iz Slovenije, Nemčije, Belgije, Italije, Luksemburga, Nizozemske, Francije, Švice in ZDA so predstavili najnovejše dosežke na področju mobilnega slikanja možganov in telesa (Mobile Brain/Body Imaging – MoBI).

Slavnostni govornik letošnje poletne šole je bil profesor dr. Nico Bohnen, dr. med., priznan strokovnjak za radiologijo in nevrologijo z univerze v Michiganu. V svoji dolgoletni karieri se predano posveča raziskovanju in zdravljenju Parkinsonove bolezni, ki prizadene več kot 8,5 milijona ljudi po vsem svetu. Prizadeva si odkriti inovativne pristope, ki izboljšujejo neodvisnost in kakovost življenja posameznikov s Parkinsonovo boleznijo in starejše populacije. Njegovo predavanje, ki je potekalo v torek, 20. junija 2023, v mestni hiši Občine Piran, je osvetljevalo nevrobiološke osnove težav pri hoji in ravnotežju pri Parkinsonovi bolezni. Predstavljene mehanizme, ki sovpadajo z razvojem in napredovanjem bolezni, ter nove pristope k zdravljenju za bolj učinkovito in celostno oskrbo pacientov odkriva s pomočjo pozitronske emisijske tomografije (PET).

Tretja in zadnja izmed poletnih šol TwinBrain, znana kot TwinBrain Summer School 3.0, je potekala v Piranu v Sloveniji med 19. in 24. junijem 2023. Ta dogodek je bil vrhunec projekta TwinBrain H2020:

TwinBrain – TWINning the BRAIN with machine learning for neuro-muscular efficiency

European Commission: HORIZON 2020. WIDESPREAD-05-2020 – Twinning

Grant agreement ID: 952401

The Community Research and Development Information Service (CORDIS): <https://cordis.europa.eu/project/id/952401>

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Principal Investigator: Uroš Marušič, PhD

Project duration: November 1, 2020 – October 31, 2023

Overall budget: 900k €

Uroš Marušič, Tisa Hodnik, Manca Peskar

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.

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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“.

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Examples of reference citation in the text

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Examples of reference list:

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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/jappphysiol.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.

4. Manuscript submission

The article should be submitted via online Open Journal Systems application, which is open source journal management and publishing software at <http://ojs.zrs-kp.si/index.php/AK/about/submissions>. All the communication process with authors proceeds via Open Journal System and e-mail.

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