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ORIGINAL SCIENTIFIC PAPER

The Effects of Hatha Yoga and Specific Balance Exercises in Older Adults Living in Nursing Homes

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Abstract

We tested the effects of Hatha Yoga and specific balance exercises on balance function and fear of falling in older adults living in nursing homes. Twenty-six older adults underwent either Hatha Yoga or simple balance exercises practice. Before, during, and after completing the two programmes, the performance-oriented mobility assessment tool and the Italian version of the falls efficacy scale international were administered to assess participants' balance function and fear of falling. Hatha Yoga practice yielded significant differences in balance function and fear of falling associated with low falls risk and reduced fear of falling. Specific balance exercises practice yielded significant differences only on balance function but with reduced performance-oriented mobility assessment tool scores associated with a greater falls risk. Accordingly, to improve the quality of life of older adults living in nursing homes, the practice of Hatha Yoga should be encouraged.

Keywords: *awareness, balance function, fear of falling, falls risk*

Introduction

Nowadays, there is an increasing interest in balance and falls prevention programmes useful for improving older adults' quality of life (Farlie et al., 2019; Thomas et al., 2019). Exercise interventions with leg strengthening and balance training are considered the most promising (Cumming, 2002). However, there is a growing request for more research related to balance training effects in older adults living in nursing homes. Beyond falls, the fear of falling (FoF) is another common problem that adversely affects older adults' quality of life. This condition may lead to activity restrictions, reducing older adults' physical fitness and balance function (Ruggiero et al., 2009). Although FoF is often a psychological consequence of a fall, it may also affect non-fallers and people in institutional care (Jørstad et al., 2005). Thus, intervention and post-intervention evaluation of FoF may be fundamental to thoroughly assist institutionalized older adults (Dewan & MacDermid, 2014).

Regarding balance training programs, Hatha Yoga (HY) is gaining increasing attention. It is a complementary and/or alternative therapy, which commonly improves health because of its mind-body component (Rinella, Romeo, Di Corrado, & Massimino, 2017). HY encompasses breathing, meditation, and balance/posture control exercises (Tang et al., 2007; Tew, Howsam, Hardy, & Bissell, 2017). It may increase awareness and address postural stability (Ni et al., 2014) and poor balance problems (Kadachha, Soni, & Parekh, 2016).

Based on these considerations, this study aimed to determine the effects of HY and a specific balance exercises (SBE) program on balance function (balance, gait, total balance) and FoF in older adults living in nursing homes. HY exercises were adapted so that older adults could safely participate whilst still benefiting from the intervention (Tew et al., 2017). For SBE intervention, we used exercises commonly recommended by physical activity policies for ageing well (e.g., Williams, 2016). Given the stronger focus of the yogic practice on bodily awareness, we expected to observe better HY (first hypothesis) results. For the same reason, we also ex-

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pected early changes and improvements associated with HY but not with SBE (second hypothesis).

Methods

Participants

A priori power analysis (effect size=0.30, power=0.90, and α level=0.05) was conducted using G*Power (version 3.1) to determine the sample size. The resulting sample size was 26 for the mixed between-within subjects analysis of variance (ANOVA) to run. Two nursing homes took part in our project. We recruited 14 older adults in each nursing home for a total of 28 participants (women=15, men=13), aged from 78 to 82 years (Mean=79.84±1.34). Participants were recruited based on the following criteria: 1) they did not report severe impairments of cognitive functions; 2) they were not using wheelchairs for mobility; 3) they were medically certified to undertake Yoga and balance exercise practice. Participants' demographic and clinical characteristics are provided in Table 1. Each nursing home allowed us to conduct either HY or SBE practice. Therefore, we conducted a quasi-experimental design study in which participants missed random allocation. Two participants involved in the HY condition did not complete the protocol; thus, we considered 26 out of 28 participants (HY condition=12 participants; SBE condition=14 participants).

Table 1. Demographic and clinical characteristics of participants in the two conditions

	Hatha Yoga (HY)	Specific Balance Exercises (SBE)
Participants	12	14
Women	7/12	7/14
Men	5/12	7/14
Hypertension	8/12	9/14
Stroke	2/12	1/14
Dementia	1/12	2/14
Osteoporosis	8/12	7/14
Parkinson	1/12	1/14
Fallers	8/12	2/14
Age	79.66±1.55	80±1.17
Weight	58.41±9.87	57.42±13.36
Height	1.48±0.05	1.50±0.09

Legend: Dementia and Parkinson were at their early stage; the column Fallers indicate the number of participants who experienced falls in the past. Age, Weight, Height - Mean±SD

Instruments

Balance function (balance, gait, total balance) was measured using the performance-oriented mobility assessment (POMA) tool (Monti Bragadin et al., 2015; Tinetti, 1986). The total score, defined as total balance, indicates a person's chances of falling. Balance assessment is characterized by the appraisal of eight positions/position changes: sitting balance, arising from a chair, immediate and prolonged standing balance, withstanding a nudge on the sternum, balance with eyes closed, turning balance, and sitting down. The gait assessment includes the observation of eight gait components: initiation, step height, step length, step continuity, symmetry, path deviation, trunk sway, and walking stance. For each task, a score of 2 (steady), 1 (steady with adaptation), or 0 (unsteady) is given. Balance and gait are first scored separately and then combined to determine the total score. Maximum scores of 16 and 12 can be assigned to balance and gait sections, respectively, with a maximum total balance score of 28. A score below 19 indicates the highest falls risk, while a score of 19 to 24 suggests a lower falls risk. A score of 25 to 28 represents the lowest falls risk.

FoF was measured using the Italian short version of the falls efficacy scale international (FES-I; Ruggiero et al., 2009). The short FES-I includes seven activities: getting dressed/undressed, taking a bath or shower, getting in or out of a chair, going up or down stairs, reaching for something above the head or on the ground, walking up or down a slope, going out to a social event (e.g., religious service). If a person is currently not doing one of the activities, this is asked to answer whether he/she would be concerned about falling when doing that activity. The possible answer options are: 1 (not at all concerned), 2 (somewhat concerned), 3 (fairly concerned), 4 (very concerned). A total score for the Short FES-I ranges from 7 (no concern about falling) to 28 (severe concern about falling) and is obtained by adding the scores on all the items together.

Intervention

Each HY lesson lasted approximately one hour with a long warm-up (~20 minutes), including breathing exercises, slow dynamic, gentle muscle and joint movements (e.g., shoulder/arm/wrist circling, neck rolling). Each lesson then included mindful walking exercises and physical postures, also known as asanas or poses (~25 minutes), followed by other breathing exercises (pranayama) and relaxation techniques (~15 minutes). As concerns poses, Chair (Utkatasana), Tree (Vrksasana) and Crescent Lunge (Alanasana) were used because of their general strengthening effect on lower-limb muscles (Hamrick, Mross, Christopher, & Smith, 2017). A complete list of the used poses is provided in Table 2.

The practice was safe enough to preserve participants' health. For example, when performing poses such as Chair, participants were instructed to perform them without jeopardizing their joints and use aids to make the exercise easier or for support in accordance with the practice proposed by Tew et al. (2017; see also Figure 1). When participants were concerned with getting up from the floor, the key elements

Table 2. Complete list of asanas (poses) used in the Hatha Yoga intervention

Asanas	Poses
Urdhva Hastasana	Arms over head
Indudalasana	Crescent side stretch
Pawanmuktasana	Knee to chest
Utkatasana	Chair
Tadasana	Mountain
Uttanasana	Forward bend
Adho Mukha Svanasana	Down dog
Garudasana	Eagle
Alanasana	Crescent lunge
Vrksasana	Tree
Natarajasana	Dancer
Virabhadrasana II	Warrior II
Utthita Trikonasana	Triangle
Savasana	Corpse

Legend: Most of the *asanas* were adapted in a seated position or using a chair as a support. When necessary, both sides were required

of traditional supine postures (e.g., Corpse Pose-Savasana) were integrated into seated postures. In the case of a forward bend, the movement was modified so that the head was never lower than the heart, protecting participants with cardiac conditions; for the same reason, breath retention was avoided (Tew et al., 2017). Classes started with participants seated and continued with the practice of a few standing postures. Finally, participants sat again to rest and breathe.

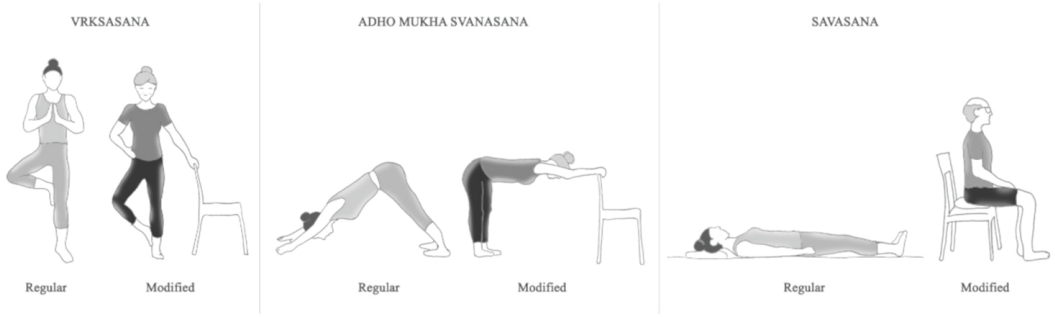

FIGURE 1. Examples of how asanas were modified

SBE practice, with lessons lasting approximately one hour each, was characterized by a warm-up encompassing slow dynamics, gentle muscle and joint movements (e.g., shoulder/arm/wrist circling, neck rolling) and gentle total body stretching exercises (~20 minutes), followed by balance exercises and different kinds of walking. Each lesson included exercises such as heel/toe rising, standing on one leg at a time, walking backwards or sideways, walking heel to toe in a straight line (~25 minutes). Gentle total body stretching exercises were practised again during the last part of the lesson (~15 minutes). A reduction of supporting aids and personal assistance was gradually suggested. Challenging changes of direction and experiences on mats of different heights were also proposed. Overall, SBE practice could challenge the visual, somatosensory, and vestibular mechanisms of balance.

Participants in both conditions could recover for a greater time than normal, especially after the most intense activities. The instructor demonstrated all the exercises.

Procedure

Participants in both HY and SBE conditions attended a 20-session programme (one hour per two sessions a week), delivered across an intervention period of three months. All sessions were medically supervised and conducted by a qualified kinesiologist and Hatha Yoga expert. In each nursing home, intervention and assessment occurred in a large but quiet and safe environment to guarantee participants' activities and comfort. The POMA tool and the short FES-I were administered the week prior to beginning (T0), 1.5 months after the beginning (T1), and one week after the conclusion (T2) of the intervention programs to assess balance function and FoF, respectively. The mid-term assessment (i.e., T1) was performed to identify early changes associated with the interventions. To avoid the overestimation of the effects of one of the interventions, we performed a blinded assessment of the outcomes; thus, the observers and participants were not aware of the purposes and hypotheses of the study. In the two conditions, the POMA tool was administered by the same qualified nurse and double-checked by a qualified therapist to guarantee the accuracy of the assessment process. Regarding POMA tool administration, see the procedure used by Abruzzese (1998). The study was conducted in accordance with the Declaration of Helsinki and approved in advance by University "G. d'Annunzio" of Chieti-Pescara (ID

richiam7px, May 16, 2019). Each participant voluntarily provided written informed consent before participating.

Statistical analysis

Examination of histograms, skewness, and kurtosis of the variable scores showed no substantial deviations from a normal distribution. A series of mixed between-within subjects ANOVA 2 (condition) × 3 (time) was performed comparing HY and SBE conditions on each dependent variable (i.e., balance, gait, total balance, FoF scores), over the time (i.e., T0, T1 and T2). The least significant difference (LSD) test was used for post hoc pairwise comparisons. The sphericity assumption was evaluated using the Mauchly test, and Huyn Feldt correction for degrees of freedom was applied in the case of non-sphericity. Effect sizes were calculated using partial eta squared (ηp2; Lakens, 2013) in the analyses of variance and using Cohen's d (Cohen, 1988) in the case of multiple comparisons. The significance level was set at 0.05, and all statistical analyses were performed using the Statistica software (Version 12).

Results

Means and standard deviations of the variable scores over the time in the two conditions are provided in Table 3.

The between-within ANOVA on balance, gait, total balance and FoF scores did not reveal significant main effects either on time or condition except for a between conditions difference on FoF scores, with F(1,24)=16.055, p=0.001, ηp2=0.401, power=0.970, and HY<SBE. However, we were mainly interested in the condition × time interactions subsequently described.

Table 3. Means±SD over the time of balance, gait, total balance, and fear of falling (FoF) scores in the two conditions

		T0 (M±SD)	T1 (M±SD)	T2 (M±SD)
Balance	HY	10.91±1.92	12.41±2.23	13.41±1.92
	SBE	10.71±3.62	10.64 (3.27	10.50±3.85
Gait	HY	6.25±2.89	8.33±2.53	8.25±2.70
	SBE	6.07±3.98	4.78±3.94	4.35±3.22
Total balance	HY	17.16±4.42	20.75±4.55	21.66±4.49
	SBE	16.78±7.24)	15.42±6.83	14.85±6.61
FoF	HY	6.25±3.40	8.33±1.66	8.25±0.38
	SBE	6.07±7.18	4.78±6.85	4.35±6.39

Legend: T0 - First Assessment; T1 - Mid-Term Assessment; T2 - Last Assessment

Balance Scores

Between-within ANOVA showed a significant condition × time interaction, F(2,48)=4.658, p=0.014, ηp2=0.163, power=0.758). According to the pairwise comparison using LSD, only the participants who underwent HY showed significant differences between T0 and T1 (p=0.026, d=0.799) and between T0 and T2 (p<0.001, d=1.456) with increased scores associated with improved balance. Moreover, after the completion of the two programs (T2) there were significant differences (p=0.018, d=0.933), with HY>SBE (Figure 2).

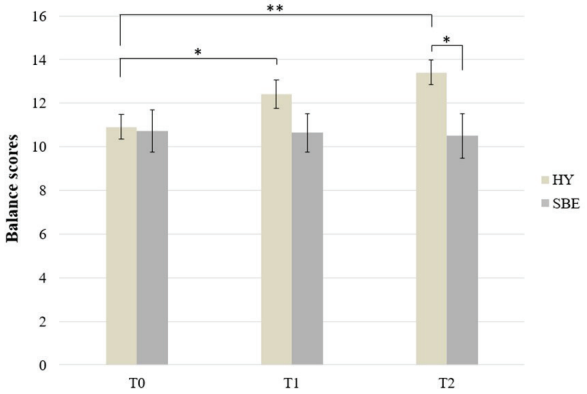

FIGURE 2. Condition (Hatha Yoga-HY, Specific Balance Exercises-SBE) × time (T0, T1, T2) interaction results for balance scores. Error bars represent standard error (*p<0.05; **p<0.001)

Gait Scores

Between-within ANOVA showed a significant condition × time interaction, F(2,48)=22.916, p<0.001, ηp2=0.488, power=1.000). According to the pairwise comparison using LSD, both conditions showed significant differences between T0 and T1, with HY: p<0.001, d=0.861, SBE: p=0.045, d=0.361, and between T0 and T2, with HY: p<0.001, d=0.798, SBE: p=0.001, d=0.519. While HY yielded increased scores associated with improved gait, the SBE condition yielded reduced scores associated with impaired gait. Moreover, there were significant differences at T1 (p=0.010, d=1.052) and T2 (p<0.001, d=1.299), with HY>SBE in both cases (Figure 3).

Total Balance Scores

Between-within ANOVA showed a significant condition × time interaction, F(2,48)=13.916, p<0.001, ηp2=0.361, power=0.957).

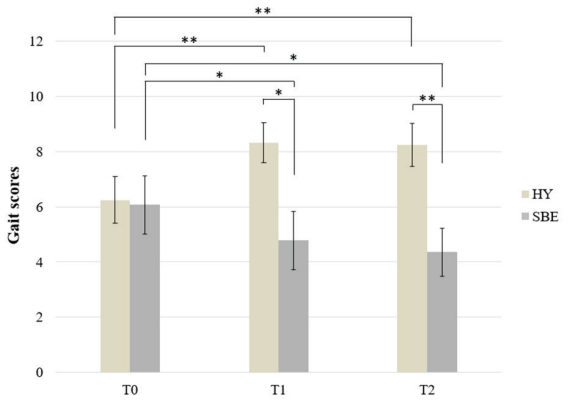

FIGURE 3. Condition (Hatha Yoga-HY, Specific Balance Exercises-SBE) × time (T0, T1, T2) interaction results for gait scores

According to the pairwise comparison using LSD, the participants who underwent HY showed significant differences between T0 and T1 (p<0.001, d=0.890) and between T0 and T2 (p<0.001, d=1.129) with increased total balance scores associated with low falls risk. The participants who underwent SBE yielded significant differences between T0 and T2 (p=0.033, d=0.310) with reduced total balance scores associated with higher falls risk. Moreover, there were significant differences at T1 (p=0.029, d=0.902) and T2 (p=0.033, d=1.185), with HY>SBE in both cases (Figure 4).

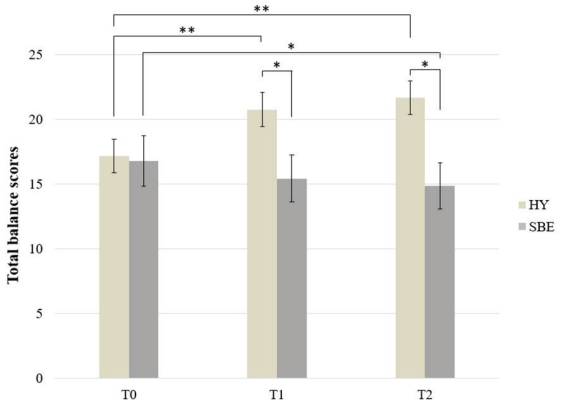

FIGURE 4. Condition (Hatha Yoga-HY, Specific Balance Exercises-SBE) × time (T0, T1, T2) interaction results for total balance scores

FoF Scores

Between-within ANOVA showed a significant condition × time interaction, F(1.852,44.453)=7.845, p=0.002, ηp2=0.246, power=0.926). According to the pairwise comparison using LSD, only the participants who underwent HY showed significant differences between T0 and T1 (p=0.006, d=0.911) and between T0 and T2 (p<0.001, d=1.149) with reduced FoF scores associated with lower concern about falling. Moreover, there were differences at T0 (p= 0.009, d=0.994), T1 (p<0.001, d=1.607) and T2 (p<0.001, d=2.103) with HY<SBE in all cases (Figure 5).

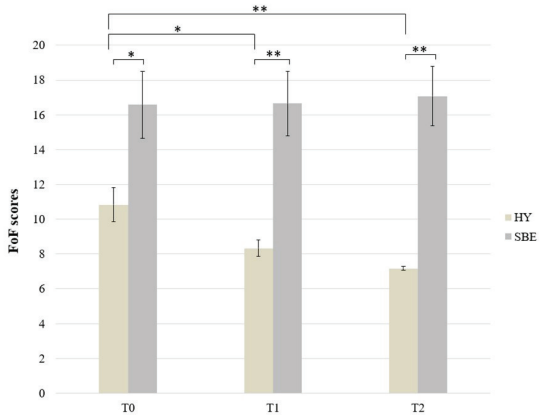

FIGURE 5. Condition (Hatha Yoga-HY, Specific Balance Exercises-SBE) × time (T0, T1, T2) interaction results for FoF - fear of falling - scores

Discussion

The current study aimed to explore the effects over the time of HY and SBE practice on balance function (balance, gait, total balance) and concern about falling in institutionalized older adults. Only HY practice significantly improved balance scores between the first (T0) and the mid-term assessment (T1) and between the first (T0) and the last assessment (T2). This is in line with the literature (e.g., Cuevas-Trisan, 2017) and could be ascribed to the focus of HY practise on physical isometric postures, strengthening muscles that account for the retention and enhancement of balance function. The pre-post intervention improvement of balance scores is also consistent with the study of Schmid, Van Puymbroeck, and Koceja (2010), who observed balance enhancement in older adults after a 12-week single-armed yoga intervention. The last assessment revealed a clear difference between HY and SBE practice, and no significant improvements were observed by means of SBE practice (see Figure 2). This could be due to the low strengthening effect of SBE in general, echoing the notion that strength is a crucial element for balance, even in the geriatric population (Cuevas-Trisan, 2017; Hamrick et al., 2017).

While HY yielded a significant improvement, SBE practice yielded a significant pre-post intervention impairment of gait function (see Figure 3). Findings corroborate that yoga programs tailored to older adults may offer an effective means of preventing or reducing age-related changes in gait function (Di Benedetto et al., 2005). The mindful approach that characterized the walking exercises of each HY session likely influenced gait function and walking tasks of the POMA tool, improving participants' awareness (Schmid et al., 2010). The most intense and/or difficult exercises of SBE practise (e.g., changes of direction, walking backwards), along with the lack of a mindful approach, might have contributed to the significant impairment of gait function. Such findings suggest that exercise intensity is an important factor in balance exercise prescription for the elderly and that challenging activities should be administered with caution (Farlie et al., 2019).

Similar results patterns were observed for the total balance (see Figure 4). While a significant pre-post intervention improvement was observed for HY, SBE practice impaired total balance. After completing the intervention, participants who practised HY could be considered at a lower falls risk compared to the pre-intervention phase. This finding is in line with the study of Hamrick and colleagues (2017), who proved that short yoga classes were associated with reduced self-reported falls. Moreover, balance improvements after HY interventions could be due to the integration of postures with attention, awareness, meditation, and pranayama exercises (Nick, Petramfar, Ghodsbin, Keshavarzi, & Jahanbin, 2016). These exercises contribute to the "sustenance" of the core stability essential for balance function (Ryba, 2006). SBE practice effects on total balance in contrast to the results of Ni and colleagues (2010), who found balance exercises effective in a geriatric population. This finding could be interpreted considering the slightly older population we involved and concurs with the importance of combining mind and body training to achieve better health (Tang et al., 2020).

We observed a reduction of FoF scores only by means of the yogic practice (see Figure 5). This finding is in accordance with the study by Keay and colleagues (2018), who determined Yoga to be an important falls prevention strategy and as an effective means to increase self-awareness in older adults in India. The self-awareness achieved was also evident in the last filling in of FES-I (Hamrick et al., 2017). Participants who underwent HY indeed took more time to complete the scale and answered the questions in a more conscious way. Instead, FoF in participants who underwent SBE practice remained stable and high. As mentioned above and suggested in the literature (Farlie et al., 2019), this finding is likely due to the intense and quite challenging exercises that were proposed. Overall, our first hypothesis is confirmed.

As also hypothesized, early changes and improvements were only associated with HY, which is likely due to the completeness of the yogic practice (Nick et al., 2016; Rinella et al., 2017). Instead, the lack of significant differences between the mid-term and the last assessment is related to the fact that both groups of participants had not previously practised HY or SBE. Thus, in accordance with motor learning principles, changes and improvements were only initially observed, but longer times are necessary for obtaining further results (Schmidt & Wrisberg, 2008). Future research should envisage longer protocols and follow up that permit better examining the late changes related to yogic or balance practice in older adults. Although our hypotheses were confirmed, more studies are necessary to explore the characteristics of yogic practice further. For example, a comparison of HY with brand new methods, such as the use of rhythmic auditory stimulation to ameliorate gait function (e.g., footsteps sound; Murgia et al., 2018), should be considered.

Furthermore, it could be interesting to investigate psychophysiological parameters and psycho-biosocial states (di Fronso et al., 2017; Robazza et al., 2017). Finally, future studies should envisage randomized trials and larger samples of participants to attain more generalizable findings.

In conclusion, the use of (an adapted programme of) HY should be encouraged for older adults living in nursing homes. This practice could improve balance function and reduce the risk of falls and fear of falling, thereby improving older adults' quality of life. Additionally, it represents an attempt to provide a kind of adapted physical activity that benefits the mind and the body in a context in which the holistic approach to the patient should be adopted and/or reinforced.

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Conflict of interest

The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Attitudes and Preferences of Students in Sports Science Concerning the Use of E-Learning and Social Media at the University of Novi Sad

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Abstract

Using e-learning and social media has become a common part of students' academic lives in many sciences, including sport sciences. The purpose of this research study was to identify attitudes and preferences of students in sports science concerning the use of e-learning and social media at the University of Novi Sad. The present study was included respondents (N=297) from the Faculty of Sport and Physical Education at the University of Novi Sad from all levels of studies. The attitudes and preferences of the use of e-learning and social media were measured with three separate parts: (1) General information (8 items); (2) use of different genres of social media in teaching (28 items); (3) e-learning in the field of sports studies (13 items), and descriptive statistics (frequencies) were used to describe the basic features of the data. The results showed that participants mostly use Facebook (44.4% of students), Viber (66%), and WhatsApp (56.6%) to contact peer students for study in the context of learning purposes. In comparison, they do not use LinkedIn (1.3%), Twitter (0.3%) or Skype (4%). From another side, the students mostly share their messages via Viber and WhatsApp in the form of various questions (67% via Viber; 62.6% via WhatsApp), video messages (20.5%; 25.3%), screenshots of their screen (21.2%; 27.6%), various links (23.2%; 25.3%), comments on a current topic (22.2%; 22.2%). In the participants' opinion (81.5%), the teaching process has been set back by the coronavirus pandemic. In contrast, the students experienced the pandemic's positive effect as an improvement in e-learning (51.2% of students). They shared the opinion that virtual teaching is not as effective as traditional teaching (85.2%). The theoretical and practical applications of these results are discussed.

Keywords: *higher education, blended learning, digital technology, social networks, students*

Introduction

University education in sports sciences provides students with the opportunity to be active in research and innovation throughout their studies (especially at higher levels of study) and, thus, have a direct opportunity to, together with their teachers, contribute to the development of sports technologies and physical education methods, as well as to improve sports diagnostics and prevention.

Parallel to the development of the World Wide Web (WWW), digitally supported media in teaching and learning (e-learning) have taken a very important place in many fields of studies (Ruiz, Mintzer, & Leipzig, 2006; Isidori, Frias, & Echazarreta, 2015; Liu, Huang, & Hsu, 2015). However, in the field of sports sciences, resistance to the application of new technologies has long been evident, especially because the teaching in this academic field was frequently conducted in gyms and students and teachers preferred the "manual way" of learning and teaching (Kinchin & Bryant, 2015). However,

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over time, the situation has changed, especially as new technological possibilities have emerged that have significantly improved both theoretical and practical teaching (Manca & Ranieri, 2016).

Today, digitally supported media in teaching and learning (e-learning), in addition to face-to-face lectures, are used as "blended learning", one of the most innovative methodologies in education (Al Awamleh, 2020). For this reason, approaches to learning and teaching are changing rapidly, and universities around the world are now implementing and investing in a virtual learning environment that paves the way for blended learning to take a leading role in higher education management systems, which is not surprising because students in all academic fields highly value e-learning as a modern way of education. For sports sciences, e-learning has proven to be an important support for the transfer of knowledge about certain theoretical and practical knowledge, based, for example, on on-line learning management platforms for better supply and distribution of digital tools (Olesov, Sergin, Alekseev, Nikiforov, & Baishev, 2020).

Although students in sports sciences were slightly behind their colleagues in technical and natural sciences if the level of use is measured in front of the mentioned tools, due to the lower level of technical knowledge but also due to traditional aversion to it, the new circumstances caused by the pandemic led them to adapt and adopt new knowledge and skills (Olesov et al., 2020; Vukovic et al., 2021). Therefore, further research analysis is needed to adequately monitor the development of this area within the aforementioned population, mostly because few scientific publications have published recent research in this context. Furthermore, another form of digital tools has also entered the academic world in recent years, with the use of social media for educational purposes (Kinchin & Bryant, 2015; Rigamonti et al., 2020).

There is a wide variety of studies reporting on the use of tools among students and teachers for communication and teaching purposes by integrating these tools into different course settings (cited in Rigamonti et al., 2020), and this research study has specifically addressed this issue in sports sciences, especially (as previously stated) because there are certain assumptions that there may be certain deviations in the aforementioned area from other areas of education.

The sport sciences span a range of subjects in research and education, involving many issues that impact various areas that are central to contemporary societies (Popovic, Matic, Bjelica, & Maksimovic, 2020). For this reason, they may profit from new forms of communications and distribution of knowledge by the use of contemporary digital media (Matic, Popovic, Maksimovic, Bjelica, & Vukovic, 2020). Knowing about social media and digital learning preferences can be valuable when planning to promote international educational courses in sports sciences or academic collaborations, as preferences for using certain digital tools may differ between nations and cultures (Rigamonti et al., 2020).

As few scientific publications could be found in this context, the purpose of this research study was to identify attitudes and preferences of students in sports science concerning the use of e-learning (with a special focus on the professional development of staff in technology-enhanced learning) and social media at the University of Novi Sad (with a special focus on different genres, especially focusing on social media writing).

Methods

The data were collected from 297 respondents (174 male (58.6%) and 123 female (41.4%)) from the Faculty of Sport and Physical Education at the University of Novi Sad. Most of the students were the students at the bachelor level (271 students (91.2%)), while the rest were at the master (12 students (4.0%)) and doctoral levels (14 students (4.7%)). It is also worth adding that the majority of respondents pointed out that they have constant access to the Internet (279 students (93.9%)); however, it is surprising that as many as 6.1% of respondents do not have constant internet access, which, perhaps, the faculty could provide. When asked which of the following devices they own or have easy access to, 90.9% of students said they own a smartphone, 74.1% of students said they have a laptop, 27.9% of students said they have a desktop computer, while only 9.8% of students stated that they own a tablet.

The data collection was conducted using a survey questionnaire. The focus content areas for the questionnaire were identified with a search on the Web of Science site. Guidelines for improving the quality of on-line surveys and empirical research methods were considered, and the preliminary questionnaire was sent to an independent researcher for peer review control and to selected students for validation of the questions. Their suggestions were integrated into the final version of the questionnaire, which was prepared in the local language (Serbian) and made in an on-line version (Google Forms). The questionnaire (a modified Survey of Social Media and e-Learning in Sport Science and Sport Medicine, created by Rigamonti et al. (2020)) was designed to collect the data (49 items) that to test proposed hypotheses and identify attitudes and preferences of students in sports science concerning the use of e-learning (with a special focus on the professional development of staff in the technology-enhanced learning) and social media at the University of Novi Sad (with a focus on different genres, especially focusing on social media writing). The questionnaire contained three separate parts: (1) general information (8 items); (2) use of different genres of social media in teaching (28 items); and (3) e-learning in the field of sports studies (13 items). The second part of the questionnaire contained five different sections: (1) social networking sites; (2) image sharing & messaging sites; (3) video sharing sites; (4) social blogging; and (5) social community and discussion sites, while the third part of the questionnaire has contained two sections: one that investigates the general issues and one that investigated the issues caused by the coronavirus pandemic and professional development of staff in technology-enhanced learning. The questionnaire was distributed to students at all levels of study (bachelor, master and doctoral).

Descriptive statistics (frequencies) were used to describe the basic features of the data, providing simple summaries about the measures to identify the attitudes and preferences of students in sports science concerning the use of e-learning and social media at the University of Novi Sad.

Results and discussion

In the first place, empirical research was conducted to identify students' attitudes and preferences in sports science concerning social media use at the University of Novi Sad, focusing on different genres, especially focusing on social media writing. The second part of this section presented the results

related to identifying students' attitudes and preferences in sports science concerning the use of e-learning with a special focus on the professional development of staff in technology-enhanced learning.

With regards to the use of different genres of social media, it is worth noting that the research study identified the attitudes and preferences of students of five different genres, namely: (1) social networking sites; (2) image sharing and messaging sites; (3) video sharing sites; (4) social blogging; and (5) social community and discussion sites (Barnhart, 2017).

Regarding social networking sites, students answered the question of whether they use Facebook, LinkedIn, Twitter, Viber, WhatsApp and Skype in the curriculum of their study programme, including any information, data or acquisition of knowledge, which is not organizational only (Table 1); as well as what type of messages they most often share via each aforementioned social networking sites (Table 2). It is interesting that students from the Faculty of Sport and Physical Education at the University of Novi Sad mostly use Facebook (44.4% of students), Viber (66%) and WhatsApp (56.6%) to contact peer students for study-related learning purposes, much more than they use other media, such as LinkedIn (1.3%), Twitter (0.3%), and Skype (4%), which is in line with previous studies (cited in Rigamonti et al., 2020). However, the students do not use most social networking sites to contact teachers for study-related learning purposes; just 9.4% of students use Viber and all other media significantly less.

In contrast, the students use Viber and WhatsApp more than other social networking sites to post knowledge contents (e.g., statements, links, materials) (12.1% - Viber; 13.1% - WhatsApp) and to discuss study-related knowledge contents (actively) (19.9% - Viber; 18.9% - WhatsApp), while the usage of Facebook is connected to Viber and WhatsApp and much higher in comparison to other social networking sites when the students receive knowledge contents (e.g., expert information, links, materials) (21.9% - Facebook; 12.1% - Viber; 15.8% - WhatsApp) and when following discussions about knowledge contents (passively) (12.8% - Facebook; 13.8% - Viber; 11.1% - WhatsApp). It is surprising that not more than 10% of the students pointed out that they would appreciate if their teachers used social networking sites as teaching aid or tool (where appropriate), while a huge percentage of the students do not use social networking sites at all (or at least not at all for learning purposes): Facebook (45.5% of students do not use it), LinkedIn (97%), Twitter (99%), Viber (29%), WhatsApp (38.7%) and Skype (94.6%).

Therefore, the obtained results in this paper are in line with those of Henderson (2015) and revealed that students' use of digital technologies is conventional. This way of using technologies supports the everyday routine academic activities in student life, such as time-saving, sharing the information among groups of students, remote access to the course and library, and similar.

Table 1. Attitudes and preferences of students concerning the use of social media with a focus on different genres

	Facebook	LinkedIn	Twitter	Viber	WhatsApp	Skype
	(in %)					
I use this social networking site to contact peer students for study-related learning purposes	44.4	1.3	0.3	66.0	56.6	4.0
I use this social networking site to contact teachers for study-related learning purposes	6.1	0.7	0.3	9.4	5.4	2.4
I use this social networking site to post knowledge contents (e.g., statements, links, materials)	4.0	1.0	0.0	12.1	13.1	1.3
I use this social networking site to receive knowledge contents (e.g., expert information, links, materials)	21.9	0.7	0.3	12.1	15.8	1.3
I use this social networking site to discuss study related knowledge contents (actively)	5.4	0.3	0.0	19.9	18.9	2.0
I use this social networking site to follow discussions about knowledge contents (passively)	12.8	0.7	0.7	13.8	11.1	1.7
I would appreciate it if my teachers used this social networking site as a teaching aid or tool (where appropriate)	4.0	0.7	0.3	8.4	6.1	2.0
I do not use this social networking site (or at least not at all for learning purposes)	45.4	97.0	99.0	29.0	38.7	94.6

Regarding the type of messages the students share via social networking sites, it is important to highlight that social media writing within student populations is the most connected to Viber and WhatsApp. The students mostly share their messages via Viber and WhatsApp in the form of various questions (67% via Viber; 62.6% via WhatsApp), video messages (20.5%; 25.3%), screenshots (21.2%; 27.6%), various links (23.2%; 25.3%), comments on a current topic (22.2%; 22.2%), while Facebook is close to the two aforementioned social networking sites in the form of various questions (30%) and various links (12.5%); all other questions regarding this issue, including slide shows, visual quotes, and polls, did not reach more than 10% of the student responses. It is also interesting to mention that a huge percentage of students said he/she does not share messages at all via (Facebook: 57% of the students; LinkedIn: 94.6%; Twitter: 94.6%; Viber: 27.6%; WhatsApp: 35%; Skype: 93.3%). WhatsApp's primacy as the most commonly used application for academic purposes was confirmed by Ashour (2019) in an exploratory study of using digital technologies of students in the United Arab Emirates.

Table 2. Attitudes and preferences of students concerning the use of social media with a focus on social media writing

	Facebook	LinkedIn	Twitter	Viber	WhatsApp	Skype
			(in %)			
Various questions	30.0	1.7	0.7	67.0	62.6	3.7
Visual quotes	3.4	0.7	0.0	7.7	7.7	0.3
Video messages	8.4	0.3	0.3	20.5	25.3	2.0
Screenshots of your screen	9.4	0.3	0.0	21.2	27.6	0.3
Slide shows	1.7	0.3	0.0	9.4	8.8	0.7
Polls	4.0	1.0	0.3	6.1	5.7	0.3
Various links	12.5	1.7	0.3	23.2	25.3	2.0
Comments on a current topic	8.4	0.3	1.7	22.2	22.2	1.0
I don't share messages at all	57.2	94.6	94.9	27.6	35.0	93.3

The results of the present study and Ashour (2020) also overlapping the results about Facebook as the least used social media platform for academic purposes.

Regarding image-sharing and messaging sites (Instagram and Snapchat), students answered the same questions and showed us they use Instagram much more than Snapchat that 91.6% of students do not use at all (or at least not at all for learning purposes). Although 48.2% of student do not use Instagram, it is interesting to highlight that the students use it mostly to contact peer students for study-related learning purposes (46.5%), while social media writing within student populations is the most connected to the various questions (50.2%), as well as video messages (26.3%) and screenshots of their screen (27.3%).

Regarding video-sharing sites (YouTube and Vimeo), students answered the same questions and revealed that while they use YouTube much more than Vimeo, 97.3% of students do not use these sites at all (or at least not at all for learning purposes). Although 53.2% of student do not use YouTube, it is interesting to highlight that the students use it mostly (32%) to receive knowledge contents (e.g., expert information, links, materials), while 82.2% said they do not share messages via this network. This is not in line with the facts determined by other studies that highlighted the students' preferences for videos as learning tools (Hampton, Pearce, & Moser, 2017), especially in sport sciences, due to the necessity of better visualization of motions sequences or tactical aspects of performance.

Regarding social blogging (Medium and Tumblr), students answered the same questions and let us know that they seldom use Medium and Tumblr, which is also the case with social community and discussion sites (Reddit and Quora).

Regarding the use of e-learning, it is worth noting that the present study investigates the issues caused by the coronavirus pandemic and the professional development of staff in technology-enhanced learning. It is important to highlight that 96% of students confirmed they use e-learning contents (i.e., any kind of on-line learning/teaching/knowledge materials) for their studies (39.7% more than once a week; 32.3% at least once a week; 15.5% less than once a week but not less once a month; 8.4% less than once a month); however, it is interesting that more than half of students (54.5%) did not know which learning management system (LMS) their institution uses. Om contrast, they knew which modules available on their LMS platform that they mostly use in the teaching process (e-literature; multimedia content, video conferencing et cetera), as well as which on-line sources they mostly use to acquire knowledge or scientific information for their studies (Wikipedia, YouTube, etc.). Furthermore, it is interesting to examine the issue that referred to the question of whether their institution offered free access to all e-learning materials that are necessary for their study: 63% of students confirmed this fact, while 23.9% of students use some additional materials that are available somewhere else for free and 4% has to pay. The rest, 13.8% of the students, do not use e-learning; 22.2% of students would appreciate it if their institution offered more e-learning materials for their studies.

Lastly, it is important to conclude this manuscript with some very important facts. It is an alarming fact that 81.5% of students think that the pandemic caused by the SARS-CoV-2 virus has set back the teaching process in a general sense, but 51.2% of student shared the opinion that the pandemic has had a positive impact on the improvement of e-learning in the field of sports studies and professional development of staff in technology-enhanced learning. A total of 61.2% of students believe that their institution has adequately responded to the challenges posed by the pandemic. With regards to the question of whether the students think that virtual teaching is as effective as traditional teaching and that it can replace it adequately in the future, 85.2% disagreed, while 41.8% agreed on the condition that traditional and virtual teaching methods combined in the future, but the rest of the students also disagreed with this idea. This research is in line with the findings of Ashour (2019) that traditional teaching methods are still preferred by students more than virtual teaching methods in the academic education process.

Conclusions

In conclusion, it is worth noting that the results of this research showed the diverse use of social media and not very significant e-learning tools by students in sports sciences to improve and support their studies, and it can have extremely significant theoretical and practical applications. Namely, students' attitudes and preferences in sports science concerning the use of e-learning and social media at the University of Novi Sad were identified, and the teaching activities can be precisely guided in the right direction. The students prefer using some e-learning, and social media also express their potential in situations in which teachers consider such a thing to be possibly useful. Noteworthy and meaningful results have been achieved, and a cross-section has been made that will be a springboard for further practical activities and scientific research in this area.

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Conflict of Interest

The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Research on Exercises to Improve the Physical Strength of Male Athletes on High School Karate-do Teams

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Abstract

The present study suggests suitable physical exercises for male athletes on high school karate-do teams to improve their physical strength. Coaches can use these exercises and related training methods for karate-do athletes in high schools in Vietnam. As a result of six months of training with these exercises, the professional achievements of athletes in all tests have made good progress. In particular, the test of alternately straight punching in kiba-dachi in 10 seconds results in the highest growth rate of w = 20.23%, while the outcome of the test of repeatedly jerking hands in 30 seconds is the lowest at w = 11.01%.

Keywords: *physical education, high school, karate-do, strength*

Introduction

Physical education (PE) is a critical subject in the school curriculum, contributing to students' comprehensive development (Bailey et al., 2009; Meyer et al., 2013; Wallhead, Garn, & Vidoni, 2013; Harvey, Kirk & O'Donovan, 2014; Evans, 2013). Physical exercises requiring significant efforts naturally foster good qualities, such as courage, willpower, determination, confidence, patience, self-discipline, team spirit, among others. They also enrich social and cultural life, help fight social problems and, in particular, build up trust and healthy lifestyles in the youth.

Karate-do is a martial art that originated in Japan. Due to its practicality and sportsmanship, karate-do quickly spread worldwide. In high schools in Vietnam, it is welcomed by many students as it is suitable for the training and physical conditions of Vietnamese people. However, the achievements of many male karate-do teams in high schools are inadequate. The main reason is poor physical strength. Meanwhile, exercises to enhance physical strength are non-systematic and inappropriate, mostly based on coaches' experiences. Therefore, it is vital to study exercises of strength enhancement for male karate-do athletes.

Macovei, E. A. Lambu, and I. S. Lambu (2013) researched the relationship between reaction time and achievements in karate-do. Their study results provide an important database for training athletes to improve their performance and achievements. Chaabene, Hachana, Franchini, Mkaouer, and Chamari (2012) assessed the physical and physiological condition of excellent male athletes and its impact on their performance. They concluded that while many factors affect the achievements, reaction time is the major one. Chan (2018) pointed out that karate-do can potentially become an effective strategy for the well-being of male youth. This research is also useful for educators, PE teachers and school administrators who deploy karate-do in high schools. To the best of our knowledge, while the have been several studies on karate-do (Bonotto et al., 2016; Jorga, Mastrappas, & Damigos, 2018; Takahata, Shiraki, Sakane, & Takebayashi, 2004; Masciotra, Ackermann, & Roth, 2001), no research on applying exercises to improve the physical strength of male karate-do athletes, especially at the high school level, has been carried out and published.

This paper suggests suitable physical exercises for male athletes on high school karate-do teams to improve their physical strength through selective tests to assess and examine the ath-

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letes' conditions after six months of training. Finally, the growth rate of each test was determined to evaluate the effectiveness of the proposed method.

Methods

We interviewed experts, coaches, and teachers, and then distributed tests on improving specific aspects of physical strength based on their opinions. These tests include: 1) repeatedly jerking hands for 30 seconds; 2) alternately straight punching in kiba-dachi in 10 seconds; 3) repeatedly cross-punching to the target in 15 seconds; 4) roundhouse kicking with front and back legs to the target in 15 seconds; 5) cross-punching and roundhouse kicking to the target in 15 seconds.

Repeatedly jerking hands in 30 seconds

Required tools: rubber mat (otherwise, do the test on the floor), a timer. How to perform: The participant stands on the spot with fists clenched in front of the chest, then simultaneously punches forward and jerks hands back to the first position (the whole process counts as one time). Repeat in 30 seconds as in Figure 1. How to count: Count the number of times performed in 30 seconds.

FIGURE 1. Repeatedly jerking hands in 30 seconds

Alternately straight punching in kiba-dachi in 10 seconds

Required tools: rubber mat (otherwise, do the test on the floor), a timer. How to perform: The participant stands in kiba-dachi (horse stance), then alternately and repeatedly punches to the target. Perform twice, each time in 10 seconds, with a break of 30 seconds, as in Figure 2. How to count: Count the time with the better performance.

FIGURE 2. Alternately straight punching in kiba-dachi in 10 seconds

Repeatedly cross-punching to the target in 15 seconds

Required tools: rubber mat (otherwise, do the test on the floor), a timer. How to perform: The participant stands in front stance and performs cross-punching to the target. Perform 3 ses-

FIGURE 3. Repeatedly cross-punching to the target in 15 seconds

sions, each session in 15 seconds, with a break of 1 minute between two sessions, as in Figure 3. How to count: Count the time with the best performance.

Roundhouse kicking with front and back legs to the target in 15 seconds

Required tools: rubber mat (otherwise, do the test on the floor), a timer, kick pads. How to perform: The participant stands in defence posture, alternately performs roundhouse kicking with front and back legs to the target. Perform 2 sessions, each session in 15 seconds, with a break of 1 minute, as in Figure 4. How to count: Count the time with the better performance.

FIGURE 4. Roundhouse kicking with front and back legs to the target

Cross-punching and roundhouse kicking with front leg to the target in 15 seconds

Required tools: rubber mat (otherwise, do the test on the floor), a timer, kick pads. How to perform: The participant stands in front stance, performs cross-punching then roundhouse kicking with front leg to the target. Perform 2 sessions, each session in 15 seconds, with a break of 30 seconds, as in Figure 5. How to count: Count the time with the better performance.

FIGURE 5. Cross-punching and roundhouse kicking with front leg to the target in 15 seconds

Results

To carry out the experiment, we selected 15 male athletes from the karate-do team of Binh Hung Hoa High School, Binh Tan District, Ho Chi Minh City, Vietnam. The six-month training was divided into three stages (24 weeks), with three training sessions per week, each session took 90 minutes. The first stage is to adapt to the normal speed, with the period from week 1 to week 8. This stage to develop general speed. Focusing on exercising groups including muscles, tendons, and ligaments to improve joint flexibility. The second stage is to maximize the focus and speed, with as much strength and high speed as possible, and the period from week 9 to week 16. The third stage is to develop specific strength. This stage is mainly practiced to increase the speed of the leg, reduce the weight, and increase the intensity of the exercise. The results are presented as in Table 1 and Figure 6 below:

Table 1. Growth rates in physical strength of male athletes in high school karate-do team

Tests	M1	M2	d	w (%)	t	p
Repeatedly jerking hands in 30 seconds (times)	52.33	58.53	6.20	11.01	8.14	<0.05
Alternately straight punching in kiba-dachi in 10 seconds (times)	24.27	29.73	5.47	20.23	11.87	<0.05
Repeatedly cross-punching to the target in 15 seconds (times)	26.53	31.47	4.93	16.93	12.89	<0.05
Roundhouse kicking with front and back legs to the target in 15 seconds (times)	17.00	20.73	3.73	19.68	10.07	<0.05
Cross-punching and roundhouse kicking to the target in 15 seconds (times)	11.60	13.27	1.67	13.51	13.69	<0.05

Legend: M1 - the average achievement before training; M2 - the average achievement after 6 months of training, d - the difference of the average; w - the growth rate; t - the test value of 2 related samples; p - the correlation coefficient.

The test of repeatedly jerking hands in 30 seconds: the average achievement after six months of training is 58.53 times, 6.20 times more than that before training, which is 52.33 times, corresponding to the growth rate w=11.01%. This difference is statistically significant as $t_{calculated}=8.14>t_{standard}=2.145$ at the possibility $p<0.05$. As a result, the athletes have made obvious progress in repeatedly jerking hands in 30 seconds after the training.

The test of alternately straight punching in kiba-dachi in 10 seconds: the average achievement after six months of training is 29.73 times, 5.47 times more than that before training, which is 24.27 times, corresponding to the growth rate w=20.23%. This difference is statistically significant as $t_{calculated}=11.87>t_{standard}=2.145$ at the possibility $p<0.05$. As a result, the athletes have made obvious progress in alternately straight punching in kiba-dachi in 10 seconds after training.

The test of repeatedly cross-punching to the target in 15 seconds: the average achievement after six months of training is 31.47 times, 4.93 times more than that before training, which is 26.53 times, corresponding to the growth rate w=16.93%. This difference is statistically significant as $t_{calculated}=12.89>t_{standard}=2.145$ at the possibility $p<0.05$. As a result, the athletes have made obvious progress in repeatedly cross-punching to the target in 15 seconds after training.

The test of roundhouse kicking with front and back legs to the target in 15 seconds: the average achievement after six months of training is 20.73 times, 3.73 times more than that before training, which is 17.00 times, corresponding to the growth rate w=19.68%. This difference is statistically significant as $t_{calculated}=10.07>t_{standard}=2.145$ at the possibility $p<0.05$. As a result, the athletes have made obvious progress in roundhouse kicking with front and back legs to the target in 15 seconds after training.

The test of cross-punching and roundhouse kicking to the target in 15 seconds: the average achievement after six months of training is 13.27 times, 1.67 times more than that before training, which is 11.60 times, corresponding to the growth rate w=13.51%. This difference is statistically significant as $t_{calculated}=13.69>t_{standard}=2.145$ at the possibility $p<0.05$. As a result, the athletes have made obvious progress in cross-punching and roundhouse kicking to the target in 15 seconds after training.

Discussion

Through the above analysis, we observed the growth in specific physical achievements of athletes from the karate-do team of Binh Hung Hoa High School, Binh Tan District, Ho Chi Minh City, Vietnam after six months of training. In particular, the test of alternately straight punching in kiba-dachi in 10 seconds results in the highest growth rate with w=20.23%, while the outcome of the test of repeatedly jerking hands in 30 seconds is the lowest with w=11.01%.

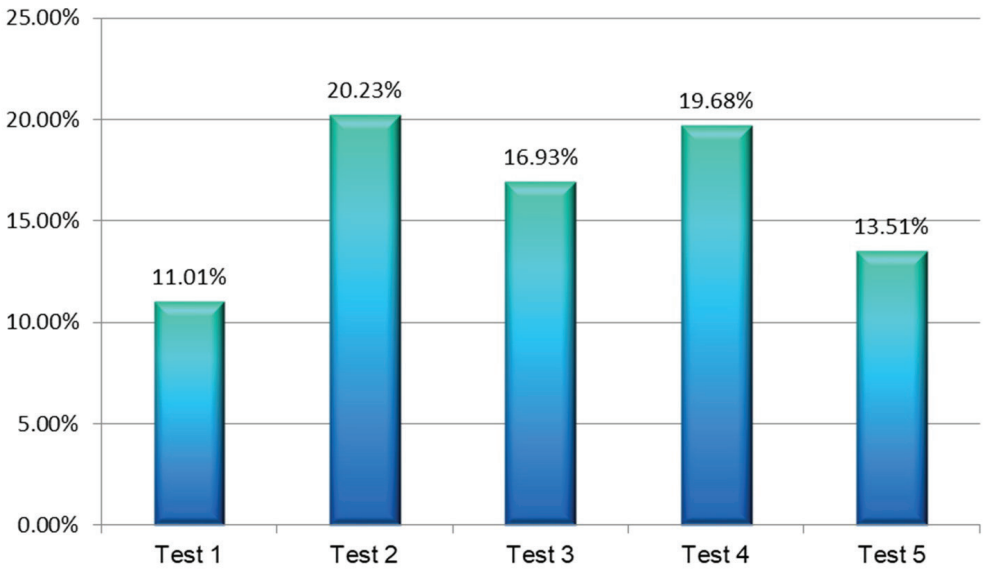

FIGURE 6. The growth rate of the physical strength of male athletes on high school karate-do team.

Le (2012) proposed a system of fitness assessment for female athletes aged 16 to 18 years including side splits, front splits, running, backhand punches, far bounces, push-ups, rope skips, and sit-ups. Nguyen (2002) introduced a system of fitness assessment tests including 6 tests: running 30m, jumping away, running 1500m, bending bridge, side splits, front splits. These studies show that to evaluating the athlete's fitness mainly based on the previous guidelines. Although the authors have given the rating scales for karate-do athletes, but have not shown the reliability of the tests, especially those of the professional test group. Our research has outlined several exercises to improve the fitness of male Karate-do athletes, while also showed the reliability of the tests. Based on the study as a reference, coaches can set out exercises and training methods suitable for karate-do athletes in high schools in Vietnam. However, in the practical application, we need to broaden the research into deeper and more comprehensive on the physical development, strength, psychology, and morphology of male karate-do athletes.

From the study results, we have selected a system of reliable tests to assess the physical strength of male athletes from the high school karate-do teams. The research also assesses the effectiveness of applied exercises in practice. These results are a basic reference for coaches and PE teachers to develop training curriculum of karate-do at the high school level.

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Conflict of Interest
The authors declare that there is no conflict of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Improvement of the Technical and Tactical Preparation of Wrestlers with the Consideration of an Individual Combat Style

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Abstract

The present research reviews a programme for improving athletes' technical and tactical preparation with a consideration of individual combat style. The program has included training models for each style and has considered the characteristics of the current competitive activities of Greco-Roman wrestlers. Thirty qualified Greco-Roman wrestlers of middle-weight categories have participated in the research. Throughout the experiment (a year-long preparation cycle) the indicators of technical and tactical preparedness of the athletes of the experimental group have improved: the efficiency of defence in stand and ground positions has become higher; the reliability and efficiency of attack and defence actions have increased; the wrestlers have begun to perform a greater number of exercises in stand and ground positions, and to perform successful attacks more often; the interval between the attacks has been shortened. During the experiment, the indicators of technical and tactical preparedness of the athletes of the experimental group have increased from 7.3% to 19.7%, while in the control group from 0.4% to 4.9%. It has been determined that all the considered indicators of the experimental group's technical and tactical preparedness after the experiment are statistically higher ($p<0.05$; $p<0.01$) than the indicators of the control group. This finding indicates the efficiency of the proposed programme of improvement of technical and tactical preparedness for athletes considering individual combat style and a possibility of its implementation into the training process.

Keywords: *wrestling, training process, individual combat style*

Introduction

One of the most pressing problems of modern sports science is searching for effective ways of achieving high results on the part of athletes. Simultaneously, the commercialization of sport, competition at the global level, and the social and political significance of athletes' sports achievements grow each year. These facts underscore the necessity of well-directed improvement of various aspects of athletes' training at every stage of a long-term multiannual preparation (Bompa & Buzzichelli, 2018; Viru, 2017). One of the most effective ways of optimizing the training process is the individualization of qualified athletes' preparation. Individualization is built on the definition of leading factors and their development that immediately influence the achievement of maximum possible results in a competition for a given athlete (Dick, 2007; Kozina et al., 2015).

Individualization of the training of athletes plays an important role in various sports: team sports (Lovell & Abt,

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2013; Schelling, Calleja-González, Torres-Ronda, & Terrados, 2015), track-and-field athletics (Manzi, Iellamo, Impellizzeri, D'ottavio, & Castagna, 2009), and combat sports (Buse, 2006; Pavelec, Ostyanov, & Maydanyuk, 2013; Thomson & Lamb, 2016).

In combat sports, athletes can achieve results in various combat styles. A wrester's combat style is formed in the process of many years of preparation and concerns its various aspects. The most significant indicators that influence the individual style are anthropometry, and the physical, technical, tactical, and psychological preparedness of an athlete (Polat, Cetin, Yarim, Bulgay, & Cicioglu, 2018; Utter, Kraemer, Fry, & Rubin, 2001). Specialists in wrestling delineate three basic combat styles: playing, strength, and tempo (Latyshev, Korobeynikov, & Korobeinikova, 2014; Mirzaei & Akbar, 2008).

In recent years, significant changes have been introduced in the wrestling competition rules, and the active search of the optimal competition rules continues; this significantly influences the competitive activities and, as a result, tactical and technical preparedness of athletes. It is necessary to consider this while planning an individual preparation of wrestlers (Bromber, Krawietz, & Petrov, 2014; Latyshev et al., 2020).

Therefore, the improvement of the technical and tactical preparedness of athletes with the consideration of individual combat style and the requirements of the modern competitive activity justify the present research and open new reserves for the improvement of successfulness of Greco-Roman wrestlers' competitive activity.

In recent years, sufficient studies have been devoted to various aspects of the analysis and development of technical-tactical skills in Greco-Roman wrestling. The technical-tactical performance in wrestling has been analysed (Boyko, Malinsky, Andriitsev, & Yaremenko, 2014); the time-motion analysis model based on technical-tactical interactions has been determined (González & Miarka, 2013); technical actions at competitions have been analysed (Soyguden & Imamoglu, 2017). Other studies (Boltikov et al., 2018; Firouzja, 2018) provide data about the development and the stages of the formation of technical-tactical skills. Unfortunately, there is a lack of empirical evidence about the impact of individualization on the development of technical and tactical preparedness in Greco-Roman wrestling.

The research aims to develop and substantiate a programme for improving the technical and tactical preparedness of athletes with consideration of an individual combat style.

Methods

Participants

Thirty wrestlers of the middle-weight categories (72 kg; 77 kg; 82 kg) took part in the research. The participants have been divided into two groups: a control group (CG) comprising 15 athletes, average age is (18.9±1.1) years; an experimental group (EG) comprising 15 athletes, average age is (19.1±0.9) years. All the athletes of the experimental group have been divided according to the individual combat styles based on video recordings of national championship and tournaments during 2017–2018. The distribution of wrestlers to a certain combat style has been conducted by a group of experts (n=7), the concurrence of the estimation of the experts has been proved by a concordance coefficient values (W=0.55–0.70; $p<0.05$). It has been estimated that four wrestlers conduct a fight in playing style, five athletes in tempo style and six wrestlers in strength style.

Description of the experiment

The analysis of scientific and methodical literature, video recordings of competitive matches of elite Greco-Roman wrestlers at the international competitions, has been conducted during the study's previous stages. The characteristics of basic combat styles in Greco-Roman wrestling (strength combat style, playing combat style and tempo combat style) have been formulated based on the conducted analysis (Tropin, Korobeynikov, Shatskikh, Korobeynikova, & Vorontsov, 2019). For greater accuracy, the term "individual combat style" is defined as certain predominant abilities (physical, psychological, technical, tactical, theoretical, etc.), which impact specific aspects of the competitive activity, and are formed in the process of sports improvement in wrestlers (Goranov, 2011; Latyshev et al., 2014). The characteristics of basic combat styles wrestlers:

1. Wrestlers of strength combat style grapple mainly at a moderate tempo at a close distance, occasionally attacking in single actions with serious preliminary preparation. Their good physical development allows them to enforce firm grabs, leading to an opponent's uncomfortable position in a match (Latyshev et al., 2014; Tropin et al., 2019).

2. High motor activity and a richness of technical and tactical actions during the whole combat are distinctive for wrestlers of tempo combat style. Wresters of this style conduct attacking movement incessantly, mainly at a medium or long distance, with a preliminary preparation (Tropin et al., 2019).

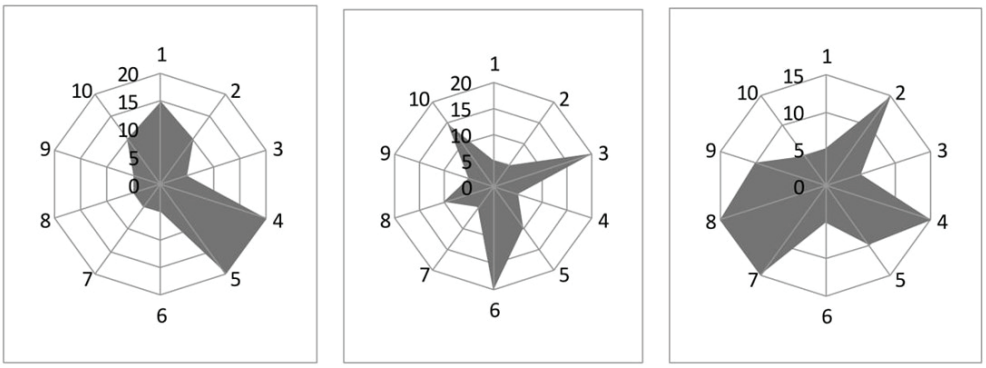
3. Wrestlers of playing combat style use a wide range of technical and tactical actions, creatively and innovatively resolve problematic situations in matches. Constant changes of distance, tempo, switch between attacking and counterattacking actions and combinations in accordance with an existing situation are distinctive for these wrestlers (Latyshev et al., 2014; Tropin et al., 2019).

The programme of the improvement of technical and tactical preparation of wrestlers has been developed based on the conducted analysis of the data of the elite athletes. The proposed programme has considered the characteristics of the modern competitive activities in Greco-Roman wrestling, including the competition rules' most recent changes and an individual combat style. The programme for the improvement of technical and tactical preparation aims to identify the individual combat style and develop it with the proposed models. The models include the main combat indicators of technical and tactical actions for each style and the level to which athletes should aim: the number of attacks per unit of time; duration of the actions; the level of effectiveness of actions; the list of optimal actions to perform.

The main goals of technical and tactical preparation of a wrestler are increasing the volume of technical and tactical actions; the honing to perfection of three or four main actions; mastering various tactical combat style actions with consideration of the specific features of an opponent in a competitive situation; enlargement of a number of preliminary actions for conducting main actions; improvement of technical and tactical actions in various conditions; learning fragmentary elements of technical and tactical skills of wrestlers (the ability to enforce their grab, combat at the edge of a mat, pushing an opponent out, demonstration of the activity, maintaining advantage, defence in a ground position), that are characteristics of modern Greco-Roman wrestling.

A model of training exercises for improvement of wres-

tlers' technical and tactical preparation according to the individual combat style of wrestlers and the characteristics of the modern competitive activity in Greco-Roman wrestling has been developed and presented in Figure 1.



Legend: 1–combinations with repeated attacks (%); 2–use of an opponent's pressure for conducting an action (%); 3–use of a pressure on an opponent based on the pressing (%); 4–use of tactical actions for creating dynamic situations (%); 5–enlargement of a range of technical and tactical actions (%); 6–conducting technical actions amid growing fatigue (%); 7–conducting actions faster than an opponent does (%); 8–wrestling at a short distance, performing actions during firm grips (%); 9–maintenance of advantage during a match (%); 10–increase in advantage during a match (%).

FIGURE 1. Model of Training Exercises on Improvement of Technical and Tactical Preparation of Wrestlers of Playing (a), Tempo (b) and Strength (c) Combat Styles

Training exercises for improvement of the technical and tactical preparedness of wrestlers with consideration of an individual combat style and the characteristics of the modern competitive activity of Greco-Roman wrestling has been realized in a one-year cycle (Table 1).

A pedagogical experiment for testing the impact efficiency

Table 1. Distribution of Means of Technical and Tactical Preparation of Wrestlers of the Experimental Group in a One-Year Cycle

Year		2018							2019			
Periods of a one-year preparation		Pre-season		In-season			Off-season		Pre-season		In-season	Off-season
Month		5	6	7	8	9	10	11	12	1	2	3	4
Improvement of technical and tactical preparation	Actions in stand and ground positions	65	60	50	50	45	75	65	60	50	50	45	75
	Training exercises on the solution of a match episode	10	10	15	15	20	10	10	10	15	15	20	10
	Training exercises on combat in various grips	20	20	20	10	10	10	20	20	20	10	10	10
	Training exercises on solution of tasks in accordance with an individual style of a wrestler	5	10	15	25	25	5	5	10	15	25	25	5

of a developed programme on improving the technical and tactical preparation of wrestlers was conducted from May 2018 to April 2019. The experiment has been built according to the plan that suggested the organization of two identical study groups. In the experimental group, the training process was performed according to developed models of training exercises.

At the beginning and the end of the experiment, the wrestlers participated in competitions. Wrestlers' technical and tactical preparedness has been evaluated based on their performances in competitions (Tünnemann & Curby, 2016). The following indicators of the wrestlers have been noted:

1. The efficiency of the technique used in stand and ground positions (this has been defined by a division of the quantity of successful attacks by the number of real attempts to perform the action and multiplied by 100%).

2. The efficiency of defence in stand and ground positions (this has been defined by a division of the quantity of deflected attacks by the number of real attempts to perform the action and multiplied by 100%).

3. The performance in stand and ground positions (this has been evaluated in points: 1 point, 2 points, 4 points, 5 points): the average number of points achieved by athletes, in stand and ground positions separately.

4. The interval of an attack (this has been defined as a ratio (correlation) of a number of the quantity of attempts to perform an attack to the duration of a match).

5. The interval of a successful attack (this has been defined as a ratio (correlation) of the number of performed attacks to the duration of a match).

Statistical analysis

Statistical analysis of the received data has been fulfilled with the help of a licensed MS Excel 2010. We have determined indicators of the descriptive statistics mean arithmetic value, stan-

dard deviation (Antomonov, 2006). The reliability of the differences in average values has been estimated by the Student's t-test; the withdrawal has been considered to be reliable at ($p<0.05$).

Results

An experiment for testing the efficiency of the developed programme to improve the technical and tactical preparation of wrestlers has been conducted. Before the experiment, the received indicators of technical and tactical preparedness in the experimental (n=15) and the control (n=15) groups did not have significant differences in every parameter, which indicates the homogeneity of the studied groups ($p>0.05$); value t varies from 0.03 to 0.85 (with t critical 2.05).

All the indicators of technical and tactical preparedness of wrestlers of the experimental group have increased over the studied period. Statistically significant positive changes in all of the considered indicators ($p<0.05$; $p<0.01$; $p<0.001$) have been discovered. The detailed results are shown in Table 2.

Table 2. Indicators of the Technical and Tactical Preparedness of Wrestlers of the Experimental Group before and after the Experiment (n=15)

Indicators	Before		After		t-test	p
	Mean	SD	Mean	SD		
Efficiency of an attack in stand position, %	49.00	4.31	57.33	6.31	4.08	<0.001
Efficiency of an attack in ground position, %	49.40	4.57	59.13	7.86	4.01	<0.001
Efficiency of defence in stand position, %	76.73	5.20	82.33	5.45	2.78	<0.01
Efficiency of defence in ground position, %	65.87	9.11	72.40	6.91	2.14	<0.05
Performance in stand position, points	2.84	0.49	3.26	0.49	2.22	<0.05
Performance in ground position, points	3.01	0.61	3.51	0.61	2.17	<0.05
Interval of an attack, s	60.07	8.71	53.13	6.66	2.37	<0.05
Interval of a successful attack, s	106.47	15.10	97.13	7.40	2.08	<0.05

Legend: critical values of t-test – t=2.05, $p<0.05$; t=2.76, $p<0.01$; t=3.67, $p<0.001$.

The analysis of the results received for the control group demonstrated that all the results have improved throughout the experiment. However, statistically significant changes between the indicators of technical and tactical preparedness before and after the pedagogical experiment were not detected. The detailed results are presented in Table 3.

Table 3. Indicators of the Technical and Tactical Preparedness of Wrestlers of the Control Group before and after the experiment (n=15)

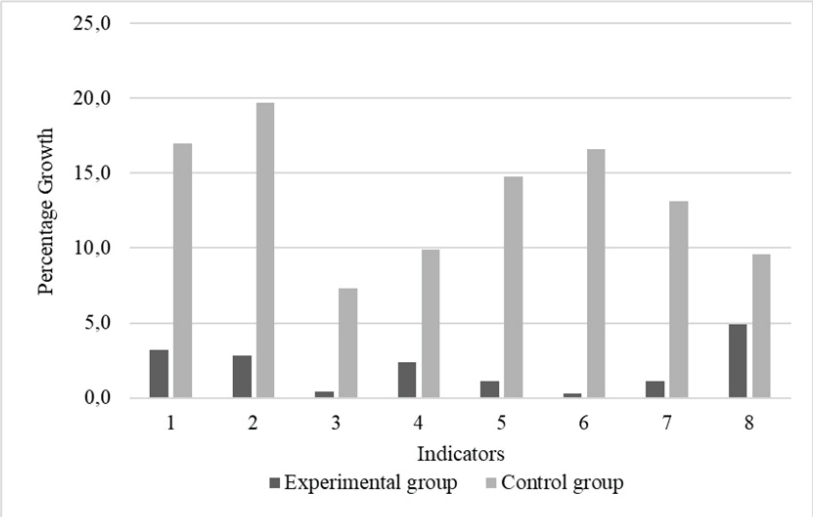
Indicators	before		After		t-test	p
	Mean	SD	Mean	SD		
Efficiency of an attack in stand position, %	48.00	5.30	49.53	5.25	0.77	>0.05
Efficiency of an attack in ground position, %	49.60	4.53	51.00	4.69	0.80	>0.05
Efficiency of defence in stand position, %	76.80	5.61	77.07	6.78	0.11	>0.05
Efficiency of defence in ground position, %	65.47	6.61	67.7	5.94	0.67	>0.05
Performance in stand position, points	2.76	0.49	2.79	0.48	0.18	>0.05
Performance in ground position, points	3.02	0.38	3.03	0.44	0.07	>0.05
Interval of an attack, s	59.87	6.66	59.20	7.00	0.26	>0.05
Interval of a successful attack, s	110.73	11.23	105.60	9.97	1.28	>0.05

Legend: critical values of t-test – t=2.05, $p<0.05$.

A statistical analysis of the values between the groups after the experiment demonstrates that the indicators of the experimental group are significantly higher than those of the control group: efficiency of an attack in the stand (t=3.55; $p<0.01$) and in the

ground position (t=3.33; p<0.01) efficiency of defence in the stand (t=2.27; p<0.05) and in the ground position (t=2.19; p<0.05), performance in the stand (t=2.54; p<0.05) and in the ground position (t=2.37; p<0.05), the interval of an attack (t=2.35; p<0.05) and the interval of a successful attack (t=2.55; p<0.05).

The percentage (relative) growth of the indicators during the experiment is demonstrated in Figure 2. For the athletes of the experimental group, the studied indicators of technical and tactical preparedness have increased in the range from 7.3% to 19.7%, and from 0.4% to 4.9% in the control group.



Legend: 1–efficiency of an attack in the stand position; 2–efficiency of an attack in the ground position; 3–efficiency of defence in the stand position; 4–efficiency of defence in the ground position; 5–performance in the stand position; 6–performance in the ground position; 7–interval of an attack; 8–interval of a successful attack

FIGURE 2. The Increase in the Results of the Indicators of Technical and Tactical Preparedness of the Wrestlers of the Control Group (n = 15) and the Experimental Group (n = 15)

Thus, the results of a percentage increase in the indicators of technical and tactical preparedness indicate the superiority of the wrestlers of the experimental group compared to the similar indicators of the athletes of the control group, which indicates the effectiveness of the proposed program of improvement of the technical and tactical preparation of wrestlers of various combat styles and the possibility of its implementation in the training process.

Discussion

The programme's effectiveness for improving technical and tactical preparation for wrestlers of various combat styles has been confirmed in the pedagogical experiment. The analysis of the indicators' results after the experiment has demonstrated that there have been significant differences between the control and experimental groups in all the indicators of technical and tactical preparedness (p<0.05; p<0.01).

The programme's main guidelines are identifying the individual combat style and the development of the technical and tactical level, according to it. For the playing combat style, it is necessary to improve the combinations of actions: more attention was paid to creating favourable dynamic situations for the effective performance of actions; performing attack actions, taking into account the features of the created situation; using the errors of the opponent; performing forward attacks and counterattacks; acting creatively and originally; performing actions at the edge of the mat and dangerous positions.

Tempo combat style wrestlers need to improve: active start of the combat; performing many attacks and counterattacks; increasing the pace of the combat; performing throws; wrestling in a mutual grip; correctly performing the technical actions in the fatigue conditions. For the strength combat style, it is necessary to improve: performing high-quality single actions; conducting combat at close distance; performing the actions of unbalancing the opponent and shackling.

As recent studies (Boyko et al., 2014; Zhumakulov, 2017) analysing the competitive activity in wrestling show, the ability to conduct an effective attack is critical to achieving victory. The present paper demonstrates that increases in the attack efficiency indicators are greater than the increases in defence efficiency indicators (in the experimental and control groups). This is due to the features of preparation in wrestling. The efficiency of an attack in the experimental group has increased from 15.8% to 15.9%, and in the control group from 2.8% to 3.2%. Simultaneously, the efficiency of defence has increased less both in the experimental (from 7.3% to 9.9%) and in the control groups (from 0.4% to 2.4%).

The performances of wrestlers in the stand and the ground positions determine the number of earned points for the match and successful athletes (Biac, Hrvoje, & Sprem, 2014; Tropin & Pashkov, 2015; Tünnemann & Curby, 2016). The athletes in the experimental group had a higher increase in performance in the stand and in the ground positions (14.8–16.6%) than the wrestlers in the control group (0.3%–1.1%).

Wrestling specialists (Sadowski & Gierczuk, 2009) believe that the necessary condition for the competitive activity's success is the conduct of matches that is most consistent with the individual style. The papers of other authors (Pavelec et al., 2013; Saienko, 2016) also confirm that in combat sports the formation and improvement of an individual style has a significant positive effect on an athlete's level and increases performance competitions. The positive influence of individualization for playing, tempo, and strength combat styles in free-style wrestling is also confirmed by research (Latyshev et

al., 2014).

In summation, it is possible to say that the process of wrestlers' preparation should be built individually, considering the patterns of athletes' training in the modern sports (Dick, 2007; Goranov, 2011). If these conditions are met, an effective individual combat style has been formed to prepare for the highest achievements. Only if an athlete conducts fights in his own style is it possible to achieve high international results.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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ORIGINAL SCIENTIFIC PAPER

The Development of Physical Education Learning Models for Mini-Volleyball to Habituate Character Values among Elementary School Students

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Abstract

This research aims to produce, implement, and test the effectiveness of a mini-volleyball learning model, in particular, to habituate character values among elementary schools students. It was conducted using a research development (R&D) method. The research samples comprised 30 physical education teachers and 252 elementary school students. The data were collected using quantitative and qualitative approaches. The research instruments were interview, questionnaires, rubrics, and authentic assessment. The learning model's content validity was tested by seven experts, and construct validity was tested using Explanatory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Furthermore, the model's effectiveness instrument was developed based on a rubric and authentic assessment to assess character development. The validity was tested by three experts, and the reliability was tested with an interclass correlation (ICC) test. Four inter-rater or independent observers were involved in assessing the model's effectiveness. The results of this study determined that the model of mini-volleyball learning materials successfully habituated the character values of discipline, cooperation, and hard work with a t-value of -11.700 and significant value is 0.000.

Keywords: *physical education, mini-volleyball, character, values*

Introduction

Character and values are strongly associated with personal principles and attitudes in one's daily routine (Lestari, Adhe, & Al Ardha, 2019). They develop the most during childhood (Navarro-Patón, Pazos-Couto, Rodríguez-Fernández, & Arufe-Giraldez, 2020). Furthermore, children's environments have the most significant contribution in providing any character model (Ganiere, Howell, & Osguthorpe, 2007). Sport can be an appropriate source of conveying character values, with direct application in the field (Montesdeoca, Marchena, & Mateos, 2019). For example, children learn about cooperation, respect for friends and opponents in volleyball (Gomes & Buckley, 2017). Team sport activities are a great environment to enrich, develop, and display good character for children (Steen, Kachorek, & Peterson, 2002). Moreover, a sports environment benefits child with social and moral character experiences (Rudd, 2005).

Physical education (PE) not only develops students' physical development and motor skills but also their characters (Martín Ruiz, da Vinha Ricieri, Ruiz Sanchis, & Santamaría Fernández, 2018). It utilizes sport and physical activities to accomplish the learning objectives in school. This unique characteristic of the PE classroom may direct many sport activities in the class, including team sport activity, requires students to cooperate to strengthen the students as individuals in teams and to attempt to work together with others in teams (Barker, Quennerstedt, & Annerstedt, 2015). Moreover, teamwork creates a strong bond among the students via hard work and discipline (Halldorsson, Thorlindsson, & Katovich, 2017).

This learning model is expected to facilitate all students in

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their learning, including those that have special needs or concerns (Reich & Lavay, 2017). The Activity Theory of Leont'ev (1978) states that activities should: 1) facilitate for analysis; 2) be tiered in quality; 3) be carried out consciously by objects; 4) be able to change dynamically when conditions change; 5) have their internal and external elements fused; 6) be the smallest unit of analysis; 7) be impossible to be separated from their contexts; 8) have relations with artefacts or other activities; 9) be useful to develop research; 10) be able to be explained by Vygotsky's sociocultural theory. Hashim and Jones (2007) state that conscious understanding is an essential key in learning activities. Furthermore, the activity system has six core components, including subject, object, tools, community, rules, and worker division (Foot, 2014).

The present study aims to develop mini-volleyball learning models to habituate character values for elementary school students, specifically, discipline, cooperation, and hard work.

Method

Participant

Thirty physical education teachers (32±3.1 years old) and 252 students (11±0.8 years old) were involved as research subjects; they were selected by proportional random sampling technique. They were from five districts in Yogyakarta, Indonesia, with different mountainous, urban, and rural areas.

Measures

There were four instruments used in this research development R&D method. The first was unstructured interviews to explore the initial information or need assessment from the 30 physical education teachers. The second instrument was a questionnaire for the students and teacher. The last were rubrics and authentic assessment to test the effectiveness of character habituation (discipline, hard work, and collaboration). The rubrics and authentic assessment were given by an inter-rater or three physical education expert to verify the model's effectiveness.

Procedures

The schools were chosen by using proportional random sampling from each district. The parents were informed about this research and signed the inform consent for their children. The interviews were conducted during teachers' community service activities. The conceptual learning model was validated and tested to determine the content and construct validity. The treatment was conducted at five elementary schools, with 252 students from July to December 2019. This research is part of dissertation at a graduate school in Yogyakarta State University. Moreover, the research procedure was approved by the Yogyakarta State University Ethics Board.

Data Analysis

The data analysis was conducted using both qualitative and quantitative approaches. The qualitative approach was used to analyse the data of expert assessment and then quantitatively analysed using the formula of Aiken's V. Exploratory Factor Analysis, and Confirmatory Factor Analysis was conducted to check the questionnaire. The learning model's effectiveness was tested using pretest-posttest design and dependent t-test analysis with SPSS software. The rubric was designed based on students' performance and tasks characteristic (Wiggins, 2011). The authentic assessment involved teachers' formative feedback in helping students understand their strengths and weaknesses (Fook & Sidhu, 2010).

Results

Based on the results of the interviews with 30 physical education teachers in elementary schools, there were three types of

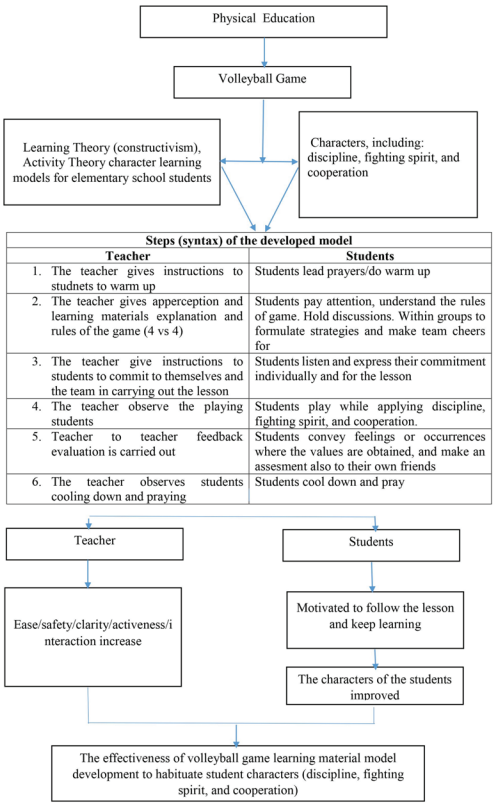

FIGURE 1. Conceptual learning model for mini-volleyball games

learning models applied: 1) the tactical approach (TGfU) was applied by five teachers (16.7%); 2) the psychomotor approach was applied by eight teachers (26.7%), and 3) the drilling approach was applied by 16 teachers (53.3%) in their learning processes. This result indicates that all of the PE teachers in elementary school focus on volleyball skill and knowledge in their teaching. As a result, the new conceptual learning model for mini-volleyball games was designed based on character values or its effects.

Then, this conceptual learning model was assessed by seven experts (physical education scholars and physical education teachers) by using Aiken's calculation method (Table 1). There were five items to be assessed: Item 1 (The purpose of the learning model); Item 2 (Character values and physical activities in volleyball games); Item 3 (Learning model); Item 4 (Facility size); and Item 5 (Authentic valuation items). The resulting learning model compiled by the researchers has adequate content validity, greater than 0.82 in every assessment item.

Table 1. Expert validation calculation of the model using Aiken V

Evaluator	Item 1		Item 2		Item 3		Item 4		Item 5	
	Score	s	Score	s	Score	s	Score	s	Score	s
A	0	0	1	1	1	1	1	1	1	1
B	1	1	1	1	1	1	0	0	1	1
C	1	1	1	1	1	1	1	1	1	1
D	1	1	1	1	0	0	1	1	1	1
E	1	1	0	0	1	1	1	1	1	1
F	1	1	1	1	1	1	1	1	1	1
G	1	1	1	1	1	1	1	1	0	0
∑ s	6		6		6		6		6	
V	0.857		0.857		0.857		0.857		0.857	

Subsequently, a small-scale test involving 60 students was arranged to verify the conceptual learning model's construct validity. It used factor analysis and varimax rotation of SPSS 23.0 to investigate the distribution of items on variables for a number of factors. Furthermore, if an item's factor loading is below 0.30, the item will be discarded. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO MSA) was also used to measure the degree of intercorrelation between variables and factor analysis. The factor analysis can be conducted if the value of KMO MSA is greater than 0.50. The resulting KMO value was 0.758; thus, factor analysis can be performed.

Table 2. Eigenvalues

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.191	46.572	46.572	4.191	46.572	46.572
2	2.001	22.230	68.802	2.001	22.230	68.802
3	1.262	14.024	82.826	1.262	14.024	82.826
4	.435	4.837	87.663			
5	.358	3.979	91.642			
6	.261	2.898	94.540			
7	.201	2.228	96.768			
8	.157	1.750	98.517			
9	.133	1.483	100.000			

Based on the result of factor analysis and varimax rotation, there are three factors for which the value is greater than 1; and three of them could explain 82.826%. Factor 1 included the basic motion of passing, the basic motion of service, and the basic motion of the blocks respectively with a loading factor above 0.564. Factor 2 included mini-volleyball, the volleyball field or modifications to it, and mini-volleyball learning support tools with a loading factor is above 0.657. Factor 3 included the use of language in the model book, pictures in the model book, and the design of the model book with loading factors above 0.500.

The instruments of the large-scale test using CFA, in five elementary schools in the Special Region of Yogyakarta (Turunan Panggang State Elementary School of Gunung Kidul; Muhamadiyah Sapen Yogyakarta Elementary School; Muhammadiyah Pendowoharjo Sewon Elementary School, Bantul; Klopo Sawit Turi State Elementary School, Sleman and Proman State Elementary School, Kokap Kulon Progo) in five districts and conducted by random cluster sampling in which the schools are either public or private, with the number of students of 252 people (Figure 2).

Figure 2 shows that the learning model consists of the variables: physical activity of volleyball game (K), volleyball game facilities and equipment (L), and language, pictures, and book design in the learning model (M). Indicators of the physical activity of volleyball variable include low and top passing

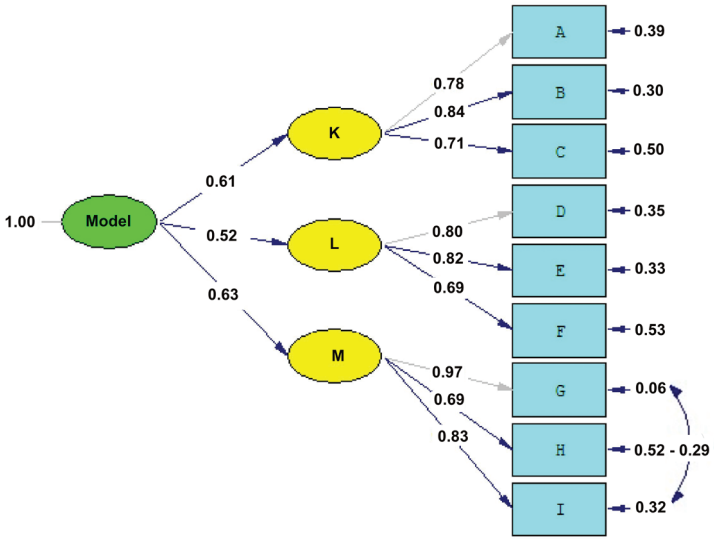

FIGURE 2. Standardized CFA.

motion material (A), basic serve move material (B), and basic smash and block moves material (C). Indicators of the volleyball game facilities and equipment include mini-volleyball (D), mini-volleyball court or its modification (E), and learning support equipment: blankets, cones, baskets (F). Indicators of language variables are the model book design and pictures, including language in the model (G), picture in the model (H), and the model of book design (I).

The learning model effectiveness was an instrument that was formed by rubrics and authentic assessment of discipline, cooperation, and hard work character. The effectiveness instrument was validated by the expert in character education, the experts in the field of educational evaluation, and the experts in the field of physical education. The results of the experts' validation of the instrument for the test of model effectiveness can be seen in Table 3.

Table 3. Experts' validation for the test instrument of model effectiveness

Evaluator	Item 1		Item 2		Item 3	
	Score	s	Score	s	Score	s
A	1	1	1	1	1	1
B	1	1	1	1	1	1
C	1	1	1	1	1	1
∑ s	3		3		3	
V	1		1		1	

The instrument's reliability of effectiveness was conducted by using the interclass correlation (ICC) test. The ICC value is 0.929 or in the excellent reliability criteria. The effectiveness instrument was given by the inter-rater or four independent observers in every treatment. The resulting mean difference between pre-test and post-test is -2.507, while the t value is -11.700 with a significance value of 0.000 (Table 4), which means that there are significant differences in discipline, cooperation, and hard work of students before and after the implementation of the learning model.

Table 4. Paired Samples Test

		M±SD	t	df	p
Pair 1	Pre-test Post-test	-2.507±1.855	-11.700	74	.000

Discussion

Based on the t-test result, there was a significant difference after the implementation of the mini-volleyball learning model. The treatment successfully enables students to possess the characteristics of discipline, cooperation, and hard work. In addition to those three characteristics, the implementation of character habituation in this research included: 1) the value of self-confidence, shown when students succeeded in doing a large number of top pass with 43 times pass to the wall; 2) the value of helping or mutual assistance, shown when one student fetched the fallen chest number of another student and returned it to their friend; 3) the value of honesty, shown when a student reported to the teacher that their shift number was damaged due to being exposed to the ice cream that they had eaten; 4) the value communication, shown on blanket ball play where the four players counted together when throwing and catching the ball; 5) the value of courage, shown when students dared to ask to the teacher questions, and when one of the students dared to perform their slogans and playing pledges; 6) the value of sportsmanship, shown when playing mini-volleyball, in which each player played earnestly but not caring who ultimately won or lost, and everyone could accept

whatever the results of the game were.

The hierarchy of character habituation activities in this research began with the value of cooperation as the main philosophical value of mini-volleyball games. Furthermore, character values of discipline and hard work are interconnected with each other in every mini-volleyball activity. Activities in the mini-volleyball game begin with the lowest level of difficulty, then increase to a higher level of difficulty in order for the students to easily learn the material of moves activities and the habituation of values in the game. These learning activities consciously carried out by students were also relevant to the theory of games that must be done consciously, voluntarily, and seriously (Hashim & Jones, 2007). The activity can be modified in any conditions, such as the weather and/or the students. It can also utilize both printed media and/or IT, which can be accessed by the teacher or the student's devices.

The teacher's role in this learning model was to observe, model, assess, and facilitate the habituation of students' character values through mini-volleyball games (Spray, 2002). The teacher also interacted with students in order to achieve learning goals. The teacher should also guide the students to understand the causes and the consequences of physical education learning (Thompson, 2002).

The learning model has three main components: physical activity learning, learning facilities, and tools. Therefore, it is appropriate to habituate the character values, which is a learning process that cannot be automatically formed but requires a long process, in which learning is habituated both in theory and practice to prepare the children to face future challenges. It is important to follow the character education basic guidelines for developing children's character (Pala, 2011).

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Conflict of Interest
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SportMont

ORIGINAL SCIENTIFIC PAPER

Lower Extremities' Kinematic Sequence and Kinetics during first Pull in Classic Snatch

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Abstract

The primary purpose of this study was to identify and compare the lower extremities' kinematic joints initiation sequence during the first pull phase of the classic snatch among male and female elite weightlifting athletes. As the secondary purpose, the maximal angle extension of joints, sub-phase duration, joint angular displacement and velocity, barbell velocity and the ground reaction force produced during the classic snatch sub-phases were determined and compared between genders. Six men (age: 19.9±2.29 years, height: 1.67±0.04 m, and body mass: 87.96±2.68 kg) and six women (age: 19.72±1.35 years, height: 1.55±0.42 m, and body mass: 70.25±10.78 kg) were tested for 85% of their 1 repetition classical snatch movement. Kinematics were captured at 100 Hz using a Qualisys motion capture system with eight cameras, and markers were placed bilaterally on the hips, knees and ankle joints. Kinetics were captured using the Kistler fixed force plate. The results revealed that a significant difference between males and females in term of hip joint initiation sequence, ground reaction force and barbell velocity. The hip angle among the female athletes initiates the start movement earlier than among male athletes. The ground reaction force and barbell velocity are higher in males compared to females. These findings suggest that the female weightlifters are not in a position to produce higher degrees of extension, thus reducing their efficiency in lifting and ability to take more substantial resistance. Having a limited angle extension results in the involved muscles not being fully contracted.

Keywords: *weightlifting, initiation sequence, joint kinematics, joint kinetics, biomechanics, snatch*

Introduction

Weightlifting can be considered a competitive strength-based sport that demonstrates power and techniques, by which athletes shift the barbell location from the floor to the above-head position in attempting a maximum weight single lift. The entire lower kinematic and kinetic chain works to complete its motion. Weightlifting performance is strongly dependent on technique, explosive strength, and flexibility (Schilling et al., 2002). Weightlifting is a full-body exercise that involves even minor muscles. The lower extremities play a vital role in weightlifting, not only by starting the initial movement but directing the motion of the barbell and force produced for the movement. To succeed in the snatch movement, a high level of skill is required in using physical output excellently to the barbell and holding the barbell above the head. Importantly, the snatch in which the barbell is held above the head lasts not more than two seconds. Not only force is involved, but a great amount of explosive power output is required in this motion (O'Shea, 2000).

The classic snatch, one of two Olympic weightlifting events, is the focus of this paper. The snatch involves the most technically sophisticated component of a weightlifting competition (Gourgoulis, Aggeloussis, Mavromatis, & Garas, 2000). The classic snatch exercise is commonly used to improve explosiveness and develop overall athleticism (Daws, 2007). The snatch is merely moving a barbell from the floor to above head in one quick movement (Gourgoulis et al., 2000). However, this primary explanation barely begins to describe the in-

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tricacy of the lift. The movement requires a combination of strength, coordination, explosiveness, mobility, and stability.

A 3-D analysis of snatch movement under competitive conditions was carried out by Bauman, Gross, Quade, Galbierz, and Schwirz (1988). In that study, the entire movement was divided into six phases: (1) the first pull (Figure 1), (2) the transition from the first to the second pull, (3) the second pull, (4) the turnover under the barbell, (5) the catch phase, and (6) the rising from the squat position (Bauman et al., 1988).

From the biomechanical point of view, a few studies have described the movements of the bar and the lifter; these include those such as those carried out by Lukashev, Medvedev, and Melkonian (1979), Bartonietz (1996), Bauman et al. (1988), Isaka, Okada, and Funato (1996), Stone, O'bryant, Williams, Johnson, and Pierce (1998), Gourgoulis et al. (2000), and Schilling et al. (2002). These papers provide in-depth information on the action of the parameters that cause the lifters' maximum performance. Although most lifters use similar technical styles (Garhammer, 1981), several differences in barbell trajectories and kinematic or kinetic characteristics exist among lifters with diverse experience or skill levels (Bauman et al., 1988; Burdett, 1982; Enoka, 1979; Garhammer, 1981; Garhammer, 1985). However, papers focusing on differences between lower extremities kinematic of male and female lifters during the first pull phase are rare.

This study aims to analyse and compare the angular kinematics of lower extremities (i.e., the hips, knees, and ankle joints) among male and female elite weightlifters during the first pull phase of the classic snatch, by evaluating the techniques of those elite weightlifters according to sub-phases, as described in this study, and stated as the relative position of the lower extremities joints in relation to the weightlifting bar when it is at start, shank, knee, and mid-thigh. The rationale is that by understanding the biomechanical variables such as the kinematic angle of hips, knee, and ankle joint on bilateral limbs during the snatch technique, we could obtain information that could further facilitate the technical and physical training of weightlifters, ultimately enhancing overall performance.

Methods

The analysis would excerpt and analyse an observable set of biomechanical patterns that would be linked to improvement in techniques which are important for weightlifting performance. To identify the similarity between biomechanical design and techniques improvement, we measured the kinematic and kinetic data of the hip, knee, and ankle joints. The participants need to lift 85% of their respective one repetition maximum (1RM). Joint kinematic and joint kinetic data were recorded to provide the most detailed information about movement performance (Bauman et al., 1988). Ethical approval for this study was granted by the human research ethics review committee of the Sultan Idris Education University. Each participant voluntarily provided written informed consent before participating.

Participants

Twelve subjects consisted of six men (age: 19.9±2.29 years, height: 1.67±0.04 m, and body mass: 87.96±2.68 kg) and six women (age: 19.72±1.35 years, height: 1.55±0.42 m, and body mass: 70.25±10.78 kg) were recruited for this study. All the subjects vigorously engaged in a resistance training plan that includes weightlifting routine and were presumed to be technically capable. They were all coached by elite national weightlifting coaches. All the participant were tested during the in-season training phase.

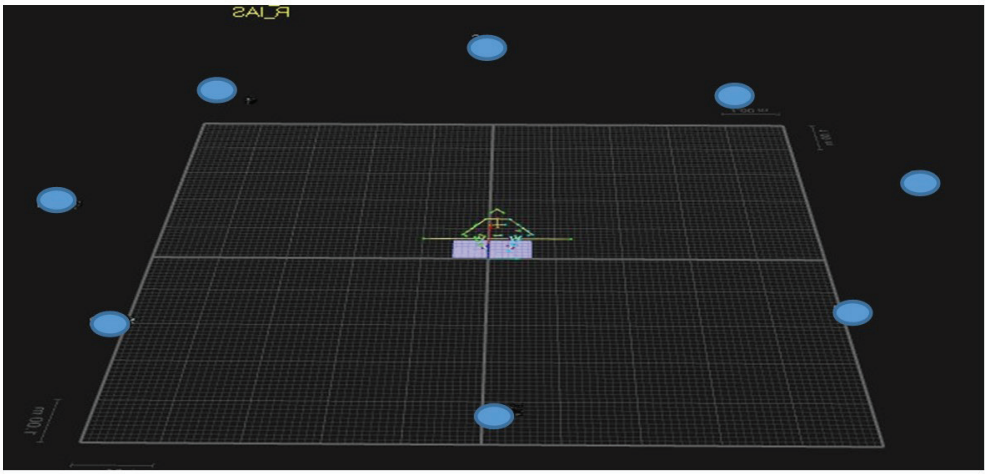

FIGURE 1. Camera Position

Experimental Equipment

An eight-camera Qualisys 3D motion analysis system was utilized to record the lower limb movements at a sampling rate of 100 Hz. Three cameras were placed in front of the participant and three behind them. Another two cameras were positioned to the left and right of the subject (Figure 1). One force plate (Kistler model 9281A, Kistler Instrument Corp., Amherst, NY, USA) that was built into a weightlifting platform used to collect kinetic data at 1,250 Hz (Kipp et al., 2011). Qualisys Track Manager Version 2.17 (Qualisys Motion Capture Systems, Qualisys AB, Sweden) software was used to analyse the classical snatch movement and extract the data collected.

Procedures

For kinematic analysis, 38 reflective markers were placed on the iliac crest, the greater trochanter, the medial and lateral femoral condyles, the sacrum, the anterior superior iliac spine, the medial and lateral malleolus, the heel and the head of the first and fifth metatarsals. Four markers

consisting of rigid bodies were attached to the shank and thigh. Kinematic information was analysed to assess the angular movement of the knee, ankle, and hip joints. To observe the trajectory of the barbell, two markers were fixed on both ends of it. Finally, the first pull phase was divided into three phases (static-shank, shank-knee and knee-mid thigh) based on movement in the knee angle and the position of the barbell.

The lifters were first briefed about the procedure and what they had to do. Their weight and height were then recorded using the Tanita WB-3000 Digital Health Care Scale (Tanita, Japan). They were then instructed to do their warm-up in a similar way as they would prior to their competitions. The lifters then performed 2–3 repetitions at 55, 65, and 75% of their self-reported 1RM for the classical snatch exercise for familiarization. They then proceeded to do the three repetitions of the classic snatch at 85% of their 1 RM while their kinematic and kinetic data were recorded by the 3D cameras around them. Three minutes of rest were given between each repetition. The subjects were let to sit or stand for their rest session as they preferred, but fatigue was never an issue. For analysis in this study, 85% of 1RM weight were used because the weightlifting technique stabilizes at loads >80% of 1RM; the 85% load was used as a reference for competitive weightlifting performance (Lukashev et al., 1979). Another reason is for this was that technique correction needs to be done at a weight that is neither light nor too heavy. A heavier weight will result in an autonomous movement that is difficult to be corrected by the lifters.

Data Analysis

All marker data were low-pass filtered using a Butterworth filter with a cut-off frequency of 6 Hz. Qualisys provided valid and reliable data on its own (Figueiredo et al., 2013; Senior, 2004). A fourth-order Butterworth filter was also used to filter kinetic data at 25 Hz (Winter, 2005). The contrasts in the kinematic and kinetic variables between male and female lifters were analysed by using a t-test for independent samples. The period of the phases was compared using a two-way (gender × phase) analysis of variance (ANOVA) for independent samples. The angular kinematics were analysed using two-way (gender × joint) ANOVA for independent samples. Bonferroni tests were performed post hoc to pinpoint the effect(s). All statistical analyses were made using the Statistical Package for Social Science version 25.0 (SPSS, Chicago, IL, USA). The level of significance was set at $p<0.05$.

Results

The results show that there was no significant interaction between gender and angle sequence initiation time of ankle and knee joints for males and females ($p>0.05$). However, there was a significant main effect of the hip joint sequence initiation between males and females ($p<0.05$; Table 1). The hip angle among the female athletes initiates the start movement earlier than among the male athletes.

Table 1. Angle Initiation Sequence and Maximum Angle Extension

	AIS (sec)		MAE (deg˚)	
Joint	**Male**	**Female**	**Male**	**Female**
Ankle	0.17	0.18	19.93	14.82
Knee	0.1	0.08	62.14	47.47
Hips	0.3	0.19*	55.12	44.69

Legend: *-p<0.05; AIS - Angle initiation sequence; MAE - Maximum angle extension

For maximum angle extension of the joints between genders, the results show that there is no significant interaction between gender and maximum angle extension of the ankle, knee, and hip joint, ($p=0.139$; $p=0.066$ and $p=0.184$; Table 1). The maximum angle extension in male is greater in the ankle, knee, and hip joints when compared to those of women, but there was no significant difference between them.

As for the first pull sub-phase duration, no significant interaction was observed between gender and joint in the duration of the sub-phases ($F=3.199$, $p>0.05$, power=0.480; Table 2). In contrast, there was a significant main effect between sub-phases in duration ($F=16.223$, $p<0.05$, power=0.995). The static-shank phase was of the longest duration, while the knee-midthigh phase was the shortest duration.

Table 2. Sub-phase execution time and angular displacement during sub-phase between genders

	Sub-phase (sec)		AD (deg˚)	
Sub-phase	**Male**	**Female**	**Male**	**Female**
Static-Shank*	0.36	0.2	Ankle: 9.16 Knee: 25.20 Hips: 5.59	Ankle: 5.61 Knee: 14.91 Hips: 3.22
Shank-Knee	0.21	0.2	Ankle: 9.64 Knee: 28.18 Hips: 19.56	Ankle: 8.81 Knee: 27.94 Hips: 19.68
Knee-Mid Tight*	0.17	0.12	Ankle: -4.35 Knee: 4.80 Hips: 34.82	Ankle: -4.74 Knee: 2.45 Hips: 26.95

Legend: *-p<0.05; Sub-phase - Sub-phase execution time; AD - Angular displacement

As for angular displacement (angle) between subphase, there was no significant interaction between genders and joints in the angular displacement of the lower extremities joint that is the ankle joint angle, ($F=0.710$, $p>0.05$, pow-

er=0.143), knee joint angle, (F=0.869, p>0.05, power=0.165) and hip joint angle, (F=1.111, p>0.05, power=0.201; Table 2). Angle extensions of the ankle, knees, and hip joints at the end of the static to shank phase have greater value in men, but not significantly. Furthermore, during the shank-knee phase, the knee angle flexed approximately 28° in men and 27° in women, thus showing a small difference between them. Men showed greater knee extension at the end of the knee-midthigh phase compared to women but not significantly. The difference is just a small degree in comparison.

As for angular velocity, the ankle joints' velocity showed no significant interaction between gender and joint in the angular velocity of lower extremities (F=0.113, p>0.05, power=0.064; Table 3). However, there was a significant main effect of the sub-phase in velocity (F=42.209, p<0.05, power=1.000). The shank-knee phase demonstrated the highest pace (velocity), and the static-shank phase was lowest in pace. The knee joint velocity, in contrast, also shows no significant interaction between gender and phase in the duration of phases (F=0.030, p>0.05, power=0.054). However, there was a significant main effect between phase in joint velocity (F=20.270, p<0.05, power=0.999). The shank-knee phase was of higher velocity, while the knee-mid thigh phase was the slowest. The hip joint velocity also shows no significant interaction between gender and phase (F=0.025, p>0.05, power=0.053). However, there was a significant main effect between sub-phases in hip joint velocity (F=30.124, p<0.05, power=1.000). The knee-mid thigh phase was of the higher velocity while the static-shank phase was the slowest.

Table 3. Angular velocity, ground reaction force and barbell velocity value over sub-phase between gender

	AV (deg/s)		GRF (N)		BV (mm/s)	
Sub-phase	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Static-Shank	Ankle: 25.92 Knee: 71.02 Hips: 15.18	Ankle: 28.73 Knee: 74.59 Hips: 15.56	1403.44*	959.17	573.23*	517.95
Shank-Knee	Ankle: 45.72 Knee: 134.25 Hips: 93.71	Ankle: 45.73 Knee: 144.54 Hips: 103.61	1356.97*	732.73	989.74*	878.68
Knee-Mid Tight	Ankle: -31.55 Knee: 21.07 Hips: 226.19	Ankle: -37.25 Knee: 22.68 Hips: 224.69	1786.98*	1020.10	1402.5*	1168.86

Legend: * - p<0.05; AV - Angular velocity; GRF - Ground reaction force; BV - Barbell velocity

There was a significant main effect between the genders in the ground reaction force produced during a classic snatch (F=65.650, p <0.05, power=1.000). There is also a significant effect among gender between difference subphase of the first pull in the snatch (F=1.528, p<0.05, power=0.263; Table 3).

Barbell velocity also shows a significant difference between gender with (F=14.635, p<0.05, power=0.939) whereas no significant different on barbell velocity among gender between the sub-phase in the first pull of the classic snatch.

Discussion

This study aimed to provide information on the weightlifting biomechanics that differ between male and female elite athletes and, in turn, could contribute to differences in the performance of both genders.

For female lifters, the first pull was almost synchronized with hip and knee joint moving simultaneously. From a technical point of view, the women tended to shift the load to lower back early instead of breaking the first pull with the quads group of muscles, which is a disadvantage, especially when the intensity of lifting is greater.

The reason that it shows no significant different probably lies in the fact that the athletes that were tested are elite, which means that they are the best among the best, and they were being coached every day in the same way regardless of their gender, this could lead to the relatively same pattern and sequence of initiation between the angle joint of males and females.

For the maximal angle extension of joints between genders, the results show that there were no significant differences between males and females for the maximum angle of triple extension in the ankle, knee, and hip angles. However, men had a relatively higher range of motion compared to women. From a technical point of view, this is a disadvantage for women as they do not contract their muscles to a greater range of motion, which causes them to fail when undertaking higher intensities.

Females tend to execute smaller maximum angle compared to men, which could ultimately affect their performance. For example, an inadequate ankle joint execution means that the muscle involved is not fully contracted, which in turn reduced the sum of force generated from the ankle joint during the process of pulling the bar in the classic snatch movement (triple extension).

Men seem to have a slightly longer duration in execution time compared to women. Technically, this difference could be caused by the differences in body height and the time required for the displacement of the bar. There is a trend of continuous acceleration on the bar. Among female athletes, we can see the bar velocity is almost the same during the static-shank and shank-knee phase. The reason that the static-shank phase in male is slower could lie within the aspect of body segment length difference between male and female, which is because the body segment length in male is relatively longer compared to female. This could be the underlying reason for the results shown. Another possible reason could be the fact that the anatomical structure of females reduces the displacement distance of the female arm length relatively shorter distance compared to the male arm displacement. That is why the time travel of the barbell between static to shank is faster in females than in males.

The subjects of this study are elite weightlifters who are very familiar with the classic snatch techniques and have been training together for a long time. This could be the reason there is no significant difference in term of angular displace-

ment (angle) between male and female along the sub-phases of the first pull in the classic snatch.

The women had higher knee and hip joint angular velocity in the shank-knee phase. This phase is quite critical for lifting the weight in a streamline that is vertically upward. Higher knee and hip joint angular velocity in this phase lead to the bar being pulled backwards, resulting in the displacement of the body from its original stance position (a sort of backward jump).

The probability of women having higher knee and hip joint velocity during the first pull was the result of drawing the bar away from the body resulting in a backward jump among the female athletes. To generate the backward jump, the athletes need to displace the central gravity beyond the base of support.

In weightlifting, the ankle, knee, and hip joints extensor muscles contribute to the movement of antagonistic muscles in a sequence starting from the hip to the ankle. This movement is related to the sequence of the three phases of the pull during this lifting task (Isaka et al., 1996). In the present study, referring to the joint velocities, the velocity of the hip joint showed a significant increase during the end of the first pull. In adult weightlifters, the hip joint is the lead joint to reach its maximal extension velocity during the second pull. Followed then by the knee and ankle joints, each reaches its maximum extension velocities (Gourgoulis et al., 2000).

This study highlight the critical component in the first pull phase of the classic snatch, which could be essential in the success or failure of the lift. In term of techniques in the first pull, the women took less time in initiating the moment due to the short nature of their body segments. The hip joint and knee joint extension velocity in women in a controlled manner are crucial in the classic snatch during the 1st pull. The women tend to have higher knee and hip joint velocities, which resulted in backward jumps during the receiving of the bar in the squat position, which would lead to failure of lift and probable injury when executed with higher intensity. The result also highlighted that the women are not in a position to produce higher degrees of extension, thus reducing their efficiency in lifting and ability to take more substantial resistance. This should be examined closely in order to prevent any injury. Having a limited angle extension results in the muscles involved is not fully contracted. Muscles that are not fully contracted are prone to injury.

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Conflict of Interest
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ORIGINAL SCIENTIFIC PAPER

Throwing Speed of Kosovo Handball According to Playing Position

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Abstract

The goal of this paper was to assess the throwing speed of the ball without jumping, and three steep jumps by playing position (backcourt, wing, pivot, and goalkeeper) In this research, we measured 93 players from Kosovo's elite league (22±4.70 years old; training experience 8.30±4.29 years; body height 183±7.83 cm; weight 84±13.74 kg); measurements were made with a radar speed gun. The results obtained were analysed through descriptive statistics for morphologic parameters, but throwing speed was analysed using ANOVA and the Kruskall-Wallis post hoc test. The overall average throwing speed without jumping was 85.67±8.13 km/h, while throwing seed with three-step jump was 84.20±8.68 km/h. measured by the radar gun. Without jumping back-court players have been distinguished compared to wingers and goalkeepers while there were no significant differences with pivots. Also, almost the same results have been achieved in the throwing speed of jump shot. As differences in throwing speed have been established according to the playing positions, we think the exercises for each position should also be differentiated.

Keywords: *handball player, throwing speed, play position*

Introduction

Handball consists of intensive play, swift (sprints), jumps, declines, and "battles" within official rules of the game, and, where permitted, catching, drawing, pushing and holding opponent players (Havolli, Bahtiri, Begu, Ibrani, & Makolli, 2018). The physical demands of handball include running with and without changes of direction at speeds ranging from walking to rapid sprints, vertical jumping, various types of throwing, and direct physical contact, plus an ability to make multiple sprints at high speed. Several qualitative and quantitative studies of top-level male handball players have demonstrated that key characteristics of the successful professional include endurance capacity, sprint performance, jumping ability, and high throwing speed (Hermassi, Chelly, Tabaka, Shephard, & Chamari, 2011; Manchado, García-Ruiz, Cortell-Tormo, & Martínez, 2017).

Handball players are usually classified according to their specific playing positions when attacking: goalkeepers, located in the goal, the first line made up of backs and centre backs, and the second line made up of the pivots and wings (Sibila, Mohoric, & Pori, 2010).

In handball, as in other team sports, shooting a ball at the goal is the culmination of an offensive phase. The morphological characteristics of the body and motor abilities certainly have great influence on outstanding performance in handball (Sibila et al., 2010). Handball is characterized by running, jumping, blocking, catching, and throwing; even though most of the work is done with the legs, play is realized by the hands. Success or failure depends on whether a team attains its ultimate aim: scoring a goal. Throwing efficiency is the key to winning or losing matches and has been the subject of various studies (García et al., 2011). Throwing efficiency largely depends on the accuracy and speed of a throw (Gorostiaga, Granados, Ibanez, & Izquierdo, 2005). Also in this type of movement, the joint and body segments must be synchronized to achieve maximum throwing speeds (Werner, Fleisig,

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Dillman, & Andrews, 1993). There are several arguments for the efficacy of this organization, which include mechanical (derived from Newton's Laws) and muscular aspect (a result of muscle pre-stretching or of optimal muscular coordination). According to various studies (Joris, Edwards, Van Ingen Schenau, & Kemper, 1985), the factors that determine throwing velocity are technique, coordination, and maximum explosive power of the muscles in the upper and lower body, which indicates the importance of developing training methods that improve both accuracy and throwing velocity. The correlation between the throwing speed of the ball in the goal and some motor skills has been proven in the work of Alves and Marques (2013).

Another factor that makes the speed shot important is that recently goalkeepers have improved their performance; researchers emphasize that the handball goalkeeper is worth 50% of the team (Çitaku, 1999), and the low speed of the ball means the goalkeeper can accomplish more saves (Rivilla-Garcia, Grande, Sampedro, & van Den Tillaar, 2011).

According to the literature, handball in Kosovo began to be played in the early 1950's, with modest results. The best result for Kosovar handball players recently is the qualification of the Kosovo U-21 Representation in the World Championship, which was held in Spain in 2019. Also, these players have been part of this research. Earlier in Kosovo, some partial research studies were carried out, with a specific and mainly morphological sample. Our sample is comprehensive (includes players playing in Kosovo's elite league). Many different handball researchers have noted that morphological and motor characteristics are essential in the performance of handball players during the game; in this paper, we wanted to treat the throwing speed to the goal as one of the most important parameters in the handball game.

The purpose of this paper was to evaluate some morphological parameters and to assess the throwing speed of the ball in the goal with and without bouncing, according to the positions of the players on the field.

Methods

To perform this research, all samples were initially conducted at a medical control centre of sports medicine in Pristina; all the players were confirmed to be sufficiently healthy to train for handball and, in accordance with the Helsinki Declaration, all participants were informed about the purpose and procedures of testing and experimental treatment.

Participants

The sample of subjects consists of 93 handball players of Kosovo's Elite League (22±4.70 years old; training experience 8.30±4.29 years; body height 183±7.83 cm; weight 84±13.74 kg). The sample was classified into four groups according to the specific playing position: backs (B), pivots (P), wings (W) and goalkeepers (G).

Procedures

All measurements were performed on parquet flooring in College Universi in Prishtina at the same time and day, with a specialized framework and directly with the participation of the author of the study. At the beginning of the study, all participants underwent morphological characteristics measurements (body height and body weight) were obtained according to the international guidelines.

Body height was measured while standing barefoot using a SECA stadiometer Selectronic scale (Seca Instruments Ltd., Hamburg, Germany) to the nearest 0.5 cm, while weight is measured with a Biospace Inbody 720 bioimpedance device (Inbody Co., Leicester, United Kingdom).

Before the throwing velocity assessment, the subjects performed a 15-minute warm-up focused on overhead throwing. Handball throwing performance was evaluated by measuring the speed of a standing shot and the speed of a three step jump shot using a Bushnell Radar device (Overland Park, USA). Each participant performed one familiarization shot and two test shots from each position with a one minute of rest between each shot.

Statistical analysis

The difference between the throwing speed according to the playing positions was calculated using one-way analysis of variance (ANOVA) for normally distributed variables and homogeneous variances; otherwise, the Kruskall-Wallis test was applied. All statistical analyses were performed using IBM SPSS version 21 (SPSS Inc., Chicago, Illinois, USA), and the level of significance was set at $p<0.05$.

Results

The results obtained were analysed through descriptive parameters for morphologic and age parameters in Table 1.

Table 1. Descriptive statistics morphologic parameter (N=93)

	Mean±St.Dev.	Min	Max
Age	22.13±4.70	17	39
Training duration (years)	8.30±4.29	2	25
Height	183.97±7.83	161.0	204.5
Weight	84.10±13.74	59.4	118.5

In Table 2, the differences according to the game positions of some morphological parameters, age and experience in handball are presented. There were statistically significant differences in the playing positions in measured anthropometric variables and ($p<0.01$; Table 1). The wings were significantly smaller compared to backcourt players ($p=0.000$), pivots ($p=0.035$) and goalkeepers ($p=0.018$). Similar significant differences were obtained in weight (pivots vs wing, $p=0.000$; wings vs backcourt players, $p=0.000$; wings vs goalkeeper, $p=0.000$) whereas there are no significant differences in terms of age and experience of handball players according to game positions.

Table 3 presents throwing speed as analysed using ANOVA and Kruskall-Wallis tests. The results obtained from the throwing speed of the ball measurement with the radar gun. According to the positions of the players regarding the speed of the standing shot, the best results are made by backcourt players with an average of 88.94 km/h, while the poorest re-

Table 2. Differences according to game positions of morphological parameters according to ANOVA and Kruskal-Wallis test

	backcourt (N=35)	wing (N=26)	pivot (N=15)	goalkeeper (N=17)	p
	Mean ± Standard Deviation				
Age	22.80±5.24	21.46±4.47	22.13±3.83	22.18±4.68	0.163
Training duration (yrs)	9.34±4.65	7.65±4.31	7.87±3.65	7.53±4.00	0.253
Height (cm)	187.16±7.761	178.47±6.70	184.81±6.931	185.08±6.281	0.000
Weight (kg)	86.75±10.931,2	74.52±8.70	101.73±11.131,2	77.75±10.31	0.000

Legend: 1 - significantly different from wing; 2 - significantly different from goalkeeper

sults were with goalkeepers at 78.47 km/h. Statistically significant differences were obtained between wings and goalkeepers (p=0.003), pivots and goalkeepers (p=0.000), backcourts and goalkeepers (p=0.000), backcourts and wings (p=0.027).

Table 3. Differences according to the positions of the shooting speed game through ANOVA and Kruskal-Wallis test/post-hoc

		M±Std.Dev.	ANOVA	Kruskal-Wallis test	p
Speed of standing shot	backcourts	88.94±7.25	0.000	wings-goalkeepers	0.003
	wings	84.35±8.87		pivots-goalkeepers	0.000
	pivots	88.47±5.36		backcourts-goalkeepers	0.000
	goalkeepers	78.47±5.60		backcourts-wings	0.027
	Total	85.67±8.13			
Speed of jump shot	backcourts	87.69±7.17	0.000	wings-goalkeepers	0.007
	wings	82.81±8.82		pivots-goalkeepers	0.000
	pivots	87.13±8.93		backcourts-goalkeepers	0.000
	goalkeepers	76.59±5.82		backcourts-goalkeepers	0.028
	Total	84.20±8.68			

Almost the same results have been achieved in throwing speed of jump shot: the wings and goalkeepers have significant differences of p=0.007, the pivots and goalkeepers of p=0.000, the backcourts and goalkeepers of p=0.000, and the backcourts with the wings at the significance level of p=0.028.

The same results in which the goalkeepers had the poorest shooting speed is also confirmed by Rivilla-Garcia et al. (2011).

Discussion

Most authors agree that one of the main morphological features in handball is body height. As can be seen from the results, the average height in our work was 183.9 cm and weight 84.10 kg. In comparison, Croatian players' height was 190.79 cm and weight 91.29 kg (Srhoj, Marinovic, & Rogulj, 2002). From this, we understand Kosovo handball players to be about 17 cm smaller and about 6 kg leightner. The body height and body weight of Slovenian players are 188.44 cm and 89.56 kg (Sibila & Pori, 2009).

Table 2 shows that in morphological terms there are significant statistical differences according to game positions: winger players are shorter and lighter in weight compared to backcourt players, pivots and goalkeepers. While backcourt players have resulted better in morphological parameters than wingers, this difference is not very significant with pivots and goalkeepers.

The main goal in this paper was to assess the throwing speed of the ball in the goal, with and without bouncing, according to the positions of the game winger, back, pivot and goalkeeper. The overall average speed of standing shot was 85.67 km/h and 84.20 km/h speed of jump shot measured by the radar gun. The significance of the difference between the play positions were determined by ANOVA and Kruskall-Wallis. Post hoc test showed differences in the speed standing shooting between the play positions in significance of $p<0.05$ between the goalkeeper and wings. The differences gained have a logical flow because it is known that the role of the goalkeeper is not to shoot at the port. The same difference at the significance level ($p<0.05$) is between wing and backcourt; also this difference can be implied by considering the selection where the backcourt are players with more developed morphological parameters. Their positions during the game are more predisposed to shooting, while there is no difference between the pivot and the backcourt player. Almost the same results were obtained in the goal-scoring for which the difference between the goalkeeper and the winger is in favour of the latter; also the goalkeeper has differences with all players according to the positions of the game ($p<0.05$). Even backcourt players with wings have differences at the level of significance ($p<0.05$) while there are no statistically valid differences between back and pivot.

Almost the same results have been obtained by other authors (Shalfawi, Seiler, Tønnessen, & Haugen, 2014). We can conclude that players with larger morphological parameters may have greater predispositions for goal-scoring speed, which is also confirmed in the work of many authors. The good news is that many authors agree that with proper exercise and programming, the speed of shooting in the goal can be increased (Cherif, Chtourou, Souissi, Aouidet, & Chamari, 2016).

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Conflicts of interest
The authors declare no conflict of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Relationship between Tibia Length Measurements and Body Height: A Prospective Regional Study among Adolescents in the Eastern Region of Kosovo

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Abstract

This study aims to determine standing height in males and females from the Eastern Region in Kosovo and its association with tibia length, as an alternative to standing height prediction. A total of 364 individuals (185 male and 179 female) took part in this study. The anthropometric measurements were provided in accordance with the ISAK guidelines. The relationships between body height and tibia length were defined using simple correlation coefficients at a ninety-five per cent confidence interval. A means comparison in standing height and tibia length between males and females was performed using a t-test. In the end, a linear regression analysis was implemented to examine how tibia length can reliably predict standing height. The results showed that Eastern Kosovan males are 178.79±6.07 cm tall and have a tibia length of 38.58±2.49 cm, while Eastern Kosovan females are 164.74±4.89 cm tall and have a tibia length of 35.32±1.85 cm. This finding defines Eastern Kosovans, male and female, as a tall group, but slightly shorter than the general Kosovan population. Moreover, tibia length reliably predicts standing height in Kosovan males and females but not as sufficiently reliably as arm span does. This study also indicates the need to develop separate height models for each region in Kosovo because the results from Eastern Kosovans do not correspond to general values.

Keywords: *prediction, measurement, stature, tibia length, Kosovan*

Introduction

Kosovo is located in south-eastern Europe, in the central region of the Balkan Peninsula. Covering an area of 10,908 km², it has a population of 1,883,018 inhabitants (Gardasevic, 2019a; Arifi, Gardasevic, & Masanovic, 2018). Administratively, it is subdivided into five regions (Eastern, Western, Northern, Southern, and Central) and is bordered by four countries (Albania, Macedonia, Montenegro, and Serbia) (Arifi et al., 2017). This study aims to analyse the standing height of adolescents from the Eastern region of Kosovo and its estimation utilizing tibia length measurements. This region contains two districts (Ferizaj and Gjilan) and eleven municipalities (Ferizaj, Hani i Elezit, Kaçanik, Štimlje/Shtime, Štrpce/Shtërpcë, Gjilan, Kamenica, Klokot, Partesh, Ranilug, and Vitina). Covering an area of 2,236 km², it has a population of 366,589 inhabitants (Masanovic, Gardasevic, & Arifi, 2018; Gardasevic, 2019a; Arifi, Masanovic, & Gardasevic, 2020). While Kosovo is small, it has a highly varied terrain. One part belongs in the Dinaric Alps, so it can be assumed this fact might influence this study's main objective because of the type of the soil and other socio-economic and geographic characteristics as potential influencing factors (Popovic, 2018).

Many scientific studies confirm that the measurement of standing height is an essential element in assessing nutritional status and evaluating basic energy requirements (Arifi et al., 2017; Datta Banik, 2011; Popovic, Arifi, & Bjelica, 2017). It is

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also a significant factor in assessing children's growth, adjusting the measures of physical capacity, predicting drug dosages and setting standards of physiological variables, such as muscle strength, metabolic rate, lung volume, and glomerular filtration (M. Golshan, Crapo, Amra, Jensen, & R. Golshan, 2007; Ter Goon, Toriola, Musa, & Akusu, 2011; Gardasevic, Rasidagic, Krivokapic, Corluka, & Bjelica, 2017).

However, exact standing height is sometimes impossible to measure in the standard way (e.g., due to paralysis, fractures, amputation, scoliosis, and pain). In such situations, standing height estimation should be assessed from other reliable anthropometric indicators, such as hand and tibia length, foot length, knee height, length of the forearm, length of the sternum, vertebral column length, sitting height, length of scapula, arm span as well as cranial sutures, skull, facial measurements et cetera (Fredriks et al., 2005; Popovic, Gardasevic, Masanovic, Arifi, & Bjelica, 2017). All these anthropometric indicators, which are used as an alternative to standing height prediction, are also crucial in assessing decreases in body height that emerge as a result of ageing. They are also very helpful when it is necessary to determine the standing height of a person with disproportionate growth abnormalities, skeletal dysplasia, mobility problems, kyphosis, in a person with standing height loss during surgical procedures on the spine as well to anticipate standing height in older people who cannot keep upright or maintain erect posture due to ageing (Hickson & Frost, 2003; Masanovic, Arifi, & Gardasevic, 2019). Lastly, it should not be forgotten that this knowledge is relevant in sport science because standing height represents a significant factor influencing success in various sport disciplines (Gusic, Popovic, Molnar, Masanovic, & Radakovic, 2017; Popovic, 2017; Arifi, Bjelica, & Masanovic, 2019; Masanovic, 2019).

Numerous researchers emphasize the benefit of using various body parameters in predicting standing height, and almost all agree that arm span is the most reliable one in adults (Mohanty, Babu, & Nair, 2001; Brown, Feng, & Knapp, 2002; Bjelica et al., 2012; Masanovic, 2018). Some authors believe that foot length measurement is the most reliable predictor during adolescence (Jakhar, Pal, & Paliwal, 2010; Popovic et al., 2017), because ossification occurs earlier in the foot than in the long bones, and standing height will be more accurately predicted from this measurement than by using long bones during adolescence.

Furthermore, it has been established that the relationship of long bones and standing height varies in different ethnic and racial groups (Steele & Chenier, 1990; Reeves, Varakamin, & Henry, 1996; Quanjer et al., 2014; Khatun, Sharma, Jain, & Gupta, 2016) and also in various regions (Milasinovic, Popovic, Matic, Gardasevic, & Bjelica, 2016; Masanovic, Gardasevic, & Arifi, 2018a; Masanovic, Bavcevic, & Prskalo, 2019; Masanovic, Arifi, & Gardasevic, 2020; Masanovic, Arifi, & Gardasevic, 2020a); therefore, researchers propose designing specific formulas for calculating standing height from long bones for each ethnic or racial group, and for different regions. The mentioned variations might also be the case with tibia length predictions, mostly because the Dinaric Alps population has a specific body composition (Popovic, 2017; Starc et al., 2020; Popovic, Masanovic, Martinovic, Bjelica, & Gardasevic, 2020). Many studies on this subject are available worldwide; some data is available on Kosovan subjects, but most have covered the whole Kosovan population, and few have studied regional differences. Some studies confirm that Western Kosovans, Southern Kosovans, and Northern Kosovans have specific standing height/tibia length ratios compared to the general population in Kosovo (Gardasevic, 2019b; Gardasevic, Masanovic, & Arifi, 2018; Gardasevic, Masanovic, & Arifi, 2019). Considering the rather sparse recent scientific literature, the purpose of this research was to examine the standing height in both Eastern Kosovan genders and its association with tibia length.

Method

This research gathered 364 final-year high-school students (185 male and 179 female) from Kosovo's Eastern Region. The reasons that qualified the selected individuals are 1) related to the fact that the growth of an individual ceases by this age, and 2) related to the fact that there is no age-related loss in standing height at this age. The average age of the male subject was 18.20±0.40 years old (range 18–19 years), while the average age of the female subject was 18.15±0.36 years old (range 18–19 years). It is important to underline that the researchers have excluded from the data analysis the individuals with physical deformities and those without informed consent. Another exclusion criterion was being non-Eastern Kosovan.

The anthropometric measurements, including standing height and tibia length, were conducted according to the International Society for the Advancement of Kinanthropometry (ISAK) protocol (Marfell-Jones, Olds, Stew, & Carter, 2006). Trained measurers conducted the assessment of selected anthropometric indicators, while the quality of their performance was evaluated against the prescribed "ISAK Manual". Finally, the age of each subject was obtained directly from their birthdays.

The analysis was performed by using the Statistical Package for Social Sciences (SPSS) version 20.0 (Chicago, IL, USA) adjusted for use on personal computers. Means and standard deviations (SD) were obtained for both anthropometric variables. A comparison of means of standing height and tibia length between genders was performed using a t-test. The relationships between standing height and tibia length were determined using simple correlation coefficients at a ninety-five per cent confidence interval. Next, a linear regression analysis was carried out to examine the extent to which the tibia length can reliably predict standing height. Statistical significance was set at $p<0.05$.

Results

In Table 1, a summary of the anthropometric measurements in both genders is shown. The mean standing height for males was 178.79±6.07 centimetres, and tibia length was 38.58±2.49 centimetres, while for females the standing height was 164.74±4.89

Table 1. Anthropometric Measurements of the Study Subjects

Subjects	Body Height Range (Mean±Stand.Dev.)	Tibia Length Range (Mean± Stand.Dev.)
Male	161.4-193.0 (178.79±6.07)	30.1-45.7 (38.58±2.49)
Female	153.3-178.0 (164.74±4.89)	31.0-40.3 (35.32±1.85)

centimetres, and tibia length was 35.32±1.85 centimetres. The gender difference between standing height and tibia length measurements was significant (standing height: t=24.849; p<.000; and tibia length: t=14.177; p<.000).

In Table 2, the simple correlation coefficients and their ninety-five per cent confidence interval analysis between the anthropometric measurements are displayed. The associations between standing height and tibia length were significant (p<0.000) and high in this sample, regardless of gender (male: 0.671; female: 0.640).

Table 2. Correlation between Body Height and Tibia Length of the Study Subjects

Subjects	Correlation Coefficient	95% confidence interval	Significance p-value
Male	0.671	0.562-0.779	<0.000
Female	0.640	0.526-0.754	<0.000

In Table 3, the results of the linear regression analysis are shown. The first of all models were extracted by including age as a covariate. However, it was found that the contribution of age was insignificant; therefore, it was eliminated as a factor from the study, and estimations were derived as a univariate analysis. The high values of the regression coefficient (male: 0.671; female: 0.640) signify that tibia length notably predicts standing height in both Eastern Kosovan genders (male: t=12.227, p<0.000; female: t=11.072, p<0.000), which confirms the R-square (%) for the male (45.0) as well as for the female (40.9).

Table 3. Results of Linear Regression Analysis Where the Tibia Length Predicts the Body Height

Subjects	Regression Coefficient	Standard Error (SE)	R-square (%)	t-value	p-value
Male	0.671	4.514	45.0	12.227	0.000
Female	0.640	3.638	40.9	11.072	0.000

The associations between tibia length measurements and standing height among the above models are plotted as a scatter diagram (Figure 1).

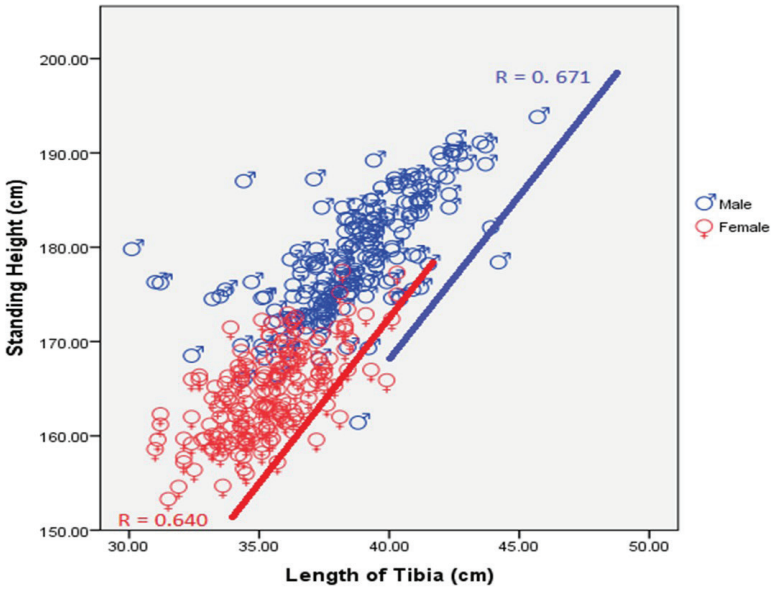

FIGURE 1. Scatter Diagram and Relationship between Tibia Length Measurements and Body Height among Both Genders

Discussion

Over the centuries, many researchers have studied the assessment of standing height using various anthropometric measures. It must be emphasized that arm span has been evaluated as the most reliable body indicator for predicting standing height (Ter Goon et al., 2011; Popovic, Bjelica, Georgiev, Krivokapic, & Milasinovic, 2016; Masanovic, Popovic, Jarani, Spahi, & Bjelica, 2020), while tibia length was a very close second (Agnihotri, Smita, Jowaheer, & Pratap, 2009; A. Kaore, B.P. Kaore, Kamdi, & S. Kaore, 2012; Khatun et al., 2016). Furthermore, it should be considered that the individual and ethnic variations referring to standing height and its association with tibia length can vary from among ethnic groups and races. Consequently, the effect of racial and ethnic differences on these measures reduces the possibility of generalization (Popovic, 2018; Masanovic et al., 2019). This study's findings are consistent with results of the study conducted by Agnihotri et al. (2009), which confirmed a very high linear correlation between standing height and tibia length in both genders of an Indo-Mauritian population, and with the results of the study conducted by Khatun et al. (2016), which showed a significant correlation between standing height and tibia length in

both genders of an Indian population, in which the correlation coefficient for tibia length is r=0.67 in males and r=0.58 in females. As the correlation between tibia length and standing height was significant in both Eastern Kosovan genders, the tibia length measure, therefore, seems to be a reliable indirect anthropometric indicator for estimating standing height in both genders of the Eastern Kosovan population.

The necessity of developing separate standing height models for each population on account of ethnic differences has been confirmed by several studies. Arifi et al. (2017) analysed the entire Kosovan population and found specific correlation coefficients between standing height and arm span in Kosovan male (r=0.794) and female (r=0.766) population. Also, some recent studies have confirmed the regional differences between the same ethnic groups (Arifi, 2017; Popovic et al., 2017). Care should be taken here because the three regional studies indicate the specificity for height prediction using the tibia. In the first study, Gardasevic (2019b) found specific correlation coefficients for standing height and tibia length in Western Kosovan males (r=0.538) and females (r=0.559) compared with the entire Kosovan population; in the second study, Gardasevic et al. (2018) found specific correlation coefficients for standing height and tibia length in Southern Kosovan males (r=0.734) and females (r=0.639) compared with the entire Kosovan population; in the third study, Gardasevic et al. (2019) found specific correlation coefficients in standing height and tibia length in Northern Kosovan males (r=0.730) and females (r=0.675) compared with the entire Kosovan population. Therefore, the main goal of this study is to examine whether this hypothesis also applies to the Eastern Kosovans (i.e., for one the of five Kosovan regions). The results of the studies mentioned previously confirm the necessity of developing separate standing height models for both genders in Kosovo, and also recommended that further studies should consider dividing the population of this country into regional subsamples and analysing them separately to remove the doubt that geographical differences exist (such as type of soil) influencing the average standing height in both Kosovan genders as well as its association with tibia length. This was based on the fact that the whole of Kosovo does not fall into the Dinaric Alps racial classification (Masanovic et al., 2019b). In parallel, this study confirms that assumption and also that it is necessary to develop separate standing height models for each population on account of regional variations in Kosovo.

Finally, it is necessary to point out that a limitation of this study might be the composition of the respondent sample, which comprised high school students. This limitation is based on the fact that some studies question whether the growth of an individual ceases by this age (Grasgruber et al., 2017). This assumption might be supported by the fact that university-educated individuals are taller than the high school graduate population in Hungary and Poland (Szollosi, 1998; Wronka & Pawlinska-Chmara, 2009). However, this was not the case in Montenegro (Popovic et al., 2017). This dilemma could be resolved by comparing the average standing height measures of this study to the results of a study with a sample of university students. Another limitation of this study is the fact that both genders of the subjects in Kosovo had not yet reached their full genetic potential, since various environmental factors controlled their development (war and the difficult economic situation of the previous three decades). Further continuous monitoring is necessary, mostly because the secular changes influencing standing height are expected to rise in the next two to three decades.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Do Lipid Profiles, Body Composition, and Physical Fitness Improve after a FIFA 11+ Training Programme from Obese Women?

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Abstract

Studies dealing with the effectiveness of the Fédération Internationale de Football Association (FIFA) 11+ prevention programme to improve lipid profiles, body composition and physical fitness outcomes in obese women aged 30–40 years are limited. The present study aims to indicate the effects of the application of the FIFA 11+ warm-up programme on lipid profiles, body composition, and physical fitness in obese women. The randomized controlled trial design was used in this study. Participants were 54 obese women, divided into a FIFA 11+ n=27; age: 35.29±2.90 and a control group n=27; age: 35.29±2.71 and trained for six weeks. Before and after the training period, blood was taken, and body composition test, VO2max performance, muscular strength test, and balance tests were assessed. Significant differences were found in the HDL-cholesterol, LDL-cholesterol, triglycerides, BMI, body fat, waist circumference, VO2Max, arm curl, wall-sit test and Y balance test in favour of FIFA 11+ over the control group. However, there were no significant effects on cholesterol. The main findings of this study suggest that just six weeks of implementation of the FIFA 11+ improves lipid profiles, body composition, and physical fitness in obese women.

Keywords: *FIFA 11+, lipids profiles, body composition, cardiorespiratory, muscular strength, balance, obese women*

Introduction

Obesityin women is a serious public health concern worldwide (World Health Organization, 2017). In Indonesia, 14.8%ofwomen aged 30-40 years had obesity in 2012 (Kesehatan et al., 2019). In 2013–2018, these figures had risen to 21.8% (Kesehatan et al., 2019), highlighting the need for effective prevention strategies tostem and reverse the growth of obesityin women in Indonesia. Specifically, with evidence of the greater burden of obesity in the most disadvantaged in developed countries, obesity-treatment strategies targeting healthy disadvantaged communities are required. In addition, more women suffer from obesity or extreme obesity compared to men (Ogden, Carroll, Kit, & Flegal, 2014).

Literature regarding lipid profiles is also relevant to obese women. Total cholesterol, triglycerides, and LDL cholesterol are higher in obese women (Rizk & Yousef, 2012). LDL cholesterol and total cholesterol have a contribution to cardiorespiratory disease and its clinical consequences such as coronary heart disease (Jiang et al., 2013). The risk of cardiovascular disease is also affected by HDL-C (Shah & Mathur, 2010). Low levels of cardiorespiratory fitness (VO_{2max}) and a high percentage of body fat (% BF) are risk factors for many chronic diseases,including diabetes, hypertension, dyslipidaemia, and cardiovascular diseasethat increase risk of morbidity and mortality. Another consequence of low levels of physical activity is poor muscular strength,which is an independent risk fac-

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tor for diabetes and cardiovascular disease as well as a general cause of mortality.

Exercise has a greater and direct effect on these risk factors for obesity diseases (Landry & Driscoll, 2012). Despite the well-documented benefits of exercise training, many obese individuals do not participate in physical activity with lack of time as the largest barrier (Greenway & Pekarovics, 2012). Only 1.5-3.0% of obese women meet the current recommendations of 150 min/week of exercise (Tudor-Locke, Brashear, Johnson, & Katzmarzyk, 2010), so research is needed to identify practical and effective exercise modalities in this population.

The "11+" programme of the Fédération Internationale de Football Association (FIFA) is a widespread measure aimed at injury prevention. Whilethe injury prevention programme is created for football,it also received attention from other sports (Reis, Rebelo, Krustrup, & Brito, 2013). As FIFA 11+ may share similarities with aerobic exercise as moderate to higher intensity (>30-40% VO_2max) and 250-300 minutes/week (20 minutes/day) may also be similar (Fogelholm, 2010).

Thus, this study aimed to analyse theeffects of the FIFA 11+ on lipid profiles, body composition, cardiorespiratory fitness, muscle strength, and balance of obese women. Based on current literature, we hypothesize that performing the FIFA 11 + for six weeks may induce improvements in lipid profiles, body composition, cardiorespiratory fitness, muscle strength, and balance in obese women.

Methods

Participants

The participantswere obese women aged 30-40 years old from Yogyakarta, Indonesia,recruited through an advertisement placed around the area. Sixty-seven answered our request. Subsequently, study details were described by the researcher. A period of six weeks was given to obtain full consent. Following this period, thirteen participants wereendorsed forparticipation in the study. The main reason for declining participation was transportation difficulties for attending the laboratory assessments. Fifty-four samples were selected and randomly allocated by a blinded assistant into two groups: control (twenty-seven) and FIFA 11+ (twenty-seven). The participants were evaluated according to the eligibility criteria to determine if they met the requirements to participate in the study. The inclusion criteria for this study were: 1) to obese women between 30-40 years old; 2) BMI[3]25-29.9 (Obesity I (World Health Organization, 2000)); 3) physically inactive less than 3 months (exercise≤45 min/session and ≤ 2 times/week); 4) HDL cholesterol < 114.29 mg/dL, triglycerides ≥ 150.56 mg/dL. The exclusion criteria were: obese women whose health conditions including diabetes, hypertension,injuries such as fractures, sprains, surgery or conditions requiring immobilization,or obese women following a doctor-prescribed diet. Written informed consent was provided by the participants, and all procedures were handled according to the Declaration of Helsinki. The study obtained approval from the ethics committee of Khon Kaen University (Decision number: HE622224).

Study design

The randomized controlled trial design was used in this study. The fully eligible participants that participated in the study were randomized and assigned using the web service www.randomizer.org, without any affiliation or acknowledgement of the participants in the control and experimental groups. All participants were tested at three points in time: baseline, after the thirdfull week of intervention, and after a six-week period. At point, the participants were submitted to the following testing procedures: lipid profiles (HDL cholesterol, LDL cholesterol, total cholesterol and triglycerides), body composition (BMI, body fat, waist circumference) and physical fitness (cardiorespiratory fitness, muscular strength, balance) of the participants.

Settings and locations where the data were collected

The research was conducted in Yogyakarta, Indonesiaat the Faculty Sport Sciences Laboratory of the Yogyakarta State University. The study commenced in January 2020 with the baseline measurements and ended in March 2020.

Interventions

The FIFA 11+ training programme consists of three parts: beginning with running exercises (part I); followed by six exercises to develop strength, balance, muscle control, and core stability (part II); and ending with advanced running exercises (part III) (Daneshjoo, Mokhtar, Rahnama, & Yusof, 2013). Table 1 shows the details of each part.

The assistant of the intervention group was selected to administer the FIFA 11+ during the warm-up with the intensity controlled that each subject's HR was monitored, with formal training guaranteed by the researcher. The assistant was selected as the key element to administer the programme to reassure a better rate of participant's compliancetowards it. Paper and video support wereprearranged for the participants in the intervention group. The researcher provided a thorough explanation of each exercise to the participantsusingthedatadownloadedfromawebsite(http://www.footballmedicinecentre.com/11-warm-up-program/)and emphasized theimportance of maintaining appropriate posture and body control, such as leg alignment, kneepositioning over the toes, and smooth landings during exercise. To help participants familiarize themselves with the exercises, the downloaded data wereprinted and distributed. All participants started in level 1 and moved to level 2 in three weeks, as predicted in the FIFA 11+ manual, meaning that all participants had three weeks of FIFA 11+ in level 3.

FIFA 11+ was executed three timesa week, as this is the minimum recommended frequency to collect proclaimed effects of the programme, over a sixweek period. The average of 20 minutes to complete the FIFA 11+ and short breaks of 1-2 minutes were allowed. Every participant wore an HR monitor (Polar Electro, Finland) during the training. An alarm on the HR monitor was set at ± 5 beats of the target HR to judge the exercise intensity. The researcher set up the field for the FIFA 11+ training programme in advance. Six cones were placed in 5-6 m intervals, and another row of cones was placed next to the first row. Next to the cones, there was an area prepared so all participants could perform the movements without interfering with one another. Parts I and III were performed in the cone area, and Part II was performed in the separate area next to the cones.

During the intervention, adoctor and aphysiotherapist visited the group. The control participants maintained their individual habits of physical activity and did not engage in any prescribed exercise training during the interventions. The researcher visited the group regularly to ascertain the correct execution of the programme. The presence of the participants and the frequency of sessions were recorded on predefined data collection forms.

Table 1. Components of FIFA 11+ training program

Exercise	Protocol
Part I: Running exercise (8 minutes)	
Running straight ahead	2 Repetitions
Running hip out	2 Repetitions
Running hip in	2 Repetitions
Running circling partner	2 Repetitions
Running shoulder contact	2 Repetitions
Running quick forwards and backwards	2 Repetitions
Part II: Strength, plyometric, balance (10 minutes)	
The bench	
Level 1: static	3 x 20-30 sec
Level 2: alternate legs	3 x 20-30 sec
Level 3: one leg lift and hold	3 x 20-30 sec
Sideways bench	
Level 1: static	3 × 20-30 sec (each side)
Level 2: raise and lower hip	3 × 20-30 sec (each side)
Level 3: with leg lift	3 × 20-30 sec (each side)
Hamstrings	
Level 1: Beginner	3-5 Repetitions
Level 2: Intermediate	7-10 Repetitions
Level 3: Advanced	12-15 Repetitions
Single-leg stance	
Level 1: hold the Ball	2 x 30 sec
Level 2: throwing ball with partner	2 x 30 sec
Level 3: test your partner	2 x 30 sec
Squats	
Level 1: with toe raise	2 x 30 sec
Level 2: walking lunges	2 x 30 sec
Level 3: one leg squats	2 x 30 sec (each leg)
Jumping	
Level 1: vertical jumps	2 x 30 sec
Level 2: lateral jumps	2 x 30 sec
Level 3: box jumps	2 x 30 sec
Part III: Running exercises (2 minutes)	
Running across the pitch	2 Repetitions
Running bounding	2 Repetitions
Running plant and cut	2 Repetitions

Outcome measures

The participants' baseline characteristics, such as age and dominant leg, were recorded with a pre-designed questionnaire. Participants only used minimal clothing (underwear), and jewellery wasremoved.Participants were advised not to move and not talk during body composition measurements (body weight (kg), fat per cent (%)) using Karada Scan Body Composition HBF 375 (Omron Healthcare, Kyoto, Japan). The Body Mass Index (BMI) is calculated by the formula weight (kg) divided by height (m) that is expressed in squares (kg/m2). A measuring placed on a measuring tape at the part of the iliac crest to measure waist circumference is measured in centimetres (cm) and the height of the players with the digital stationary stadiometer (DS-103, DongSahn Jenix, Seoul, Korea).

For each testing protocol, all participants received verbal directives and visual demonstrations from the examiner. All tests were performed at the beginning of the week, after a 48-hour rest period following the last intervention in the end.

Lipid Profiles

Trained nurses took blood from the antecubital vein, and the sample was transported to the Yogyakarta State University laboratory to be analysed by trained laboratory technicians. Once sufficient blood had been collected (minimum 5

ml around three times included pre-, post1- and post2-test). Participants were prohibited from eating, drinking alcohol, smoking, exercising, and bathing for 30 minutes before taking measurements and fasting overnight 12 hours. They removed tight clothes from the arms then sat onachair with feet flat on the floor. Theirhands were on the table so that the cuff was at the same level as the heart. Total cholesterol, triglyceride, LDL-cholesterol and HDL-cholesterol analyses were performed with a Hitachi 704 analyser, which is serviced by Roche Diagnostics (formerly Boehringer-Mannheim Diagnostics).

Cardiorespiratory fitness (VO_{2max})

The YMCA cycle ergometer submaximal test to measure cardiorespiratory fitness (measurement of VO_{2max}) (Golding & Sinning, 1989). Submaximal exercise test to estimate VO_{2max} using the ergometer cycle. Age HRmax was predicted for two consecutive workloads and increased to close to 85% of HRmax by using three protocols or 3-minute consecutive workloads designed to increase HR between 110 bpm; 50 rpm was set as the initial pedalling speed, and 150 kpm•min-1 (25W) was set as the initial workload. At 15 seconds at the last minute, it is used to measure HR to determine the next workload. For example, if HR was around 80-89 bpm or 90-100 bpm, then in the second stage, there was an increase in workload to 600 or 450 kpm•min-1. The formula from Golding (Golding & Sinning, 1989) is used to estimate maximum oxygen consumption (ml•kg-1•-min-1).

Muscular strength

The arm curl test part of Senior Fitness Test (Rikli & Jones, 2001)measured the number of times that the full extension and curl was performed for 30 s with a two kg dumbbell while sitting in a chair (the muscle strength of the upper limb). The wall sit test was used to measure the time taken to maintain posture by leaning against the wall as if sitting on a desk with legs open to shoulder width leg (the muscular strength of the lower extremities).

Balance

The Y-balance test, developed to standardize the modified star excursion balance test, is a simple, reliable test to measure dynamic balance and has demonstrated very good levels of reliability (ICC ranging from 0.80 to 0.9) (Shaffer et al., 2013). First, the Y-balance test was demonstrated, followed by four practice trials before the activeassessment trials took place (Robinson & Gribble, 2008). The testing was performed with the participant standing with the heel of the weight-bearing foot in the centre of the grid, maintaining the base of support. The participant was instructed to slide the box, reaching as far as possible and to return the initial upright position without losing balance in the three testing directions. The assessor recorded the distance that the participant reached after each of the three activeassessment trials. As the heel was aligned with the middle of the grid, the foot length was subtracted in the anterior reach distance, avoiding re-alignment of the foot during the testing procedure. The trial was discarded if the participant rested the foot or gained balance by touching the floor, if he failed to return the reaching foot to the starting position,orif the weight-bearing foot was lifted or moved. The reach distance was normalized to the participant's leg length (anterior superior iliac spine to inferior medial malleolus), providing a measure of performance (Robinson & Gribble, 2008). The composite reach distance was obtained by calculating the total of the greatest reach distance from each direction, giving the overall performance of the test. The best trial of each direction was considered for analysis.

Data analysis

Statistical analysis usedSPSS version 20.0 (IBM SPSS Statistics for Windows, IBM Corp, Armonk, New York, USA). Data were expressed as the mean±standard deviations (SD). The normality of the data was evaluated using the Kolmogorov Smirnov test. If the normal distribution is found to be parametric, the statistics are used analysis. Independent t-tests are used to determine differences between baseline values. The statistical significance level was set a $p \leq 0.05$ for all analyses.

Results

In the present study, no severe injuries were observed that would influence participation in the study. A total of 54 participants participated in the study, being allocated to the FIFA 11+ (n=27) and the control group (n=27). At baseline the FIFA 11+ group presented a higher body mass index (28.03±0.75), a higher level of cholesterol (154.00±25.43), a higher number of triglycerides (153.81±33.28),a higher number of LDL-C (94.11±9.85), a higher R postero-lateral (11.18±1.33), a higher L postero-lateral (10.84±1.23) and a higher L Composite (25.24±1.52) (Table 2).

Table 2. Baseline characteristics of the participants stratified by group (mean ± SD)

Characteristics	FIFA 11group	Control group
Age (years)	35.29 ± 2.90	35.29 ± 2.71
Weight (kg)	72.41± 3.21	72.22 ± 3.36
Height (m)	1.60 ± 0.03	1.60 ± 0.03
BMI (25.9-29.0)	28.03 ± 0.75	27.96 ± 1.06
Body Fat (%)	35.61± 1.11	35.52 ± 1.62
Waist circumference (cm)	90.11 ± 1.18	89.37 ± 1.75
Systolic	140.18 ± 5.94	137.07 ± 7.62
Diastolic	95.55 ± 3.85	93.92 ± 4.67
Cholesterol (mg/dl)	154.00 ± 25.43	158.00 ± 23.92
Triglycerides (mg/dl)	153.81 ± 33.28	154.55 ± 32.77
HDL-C (mg/dl)	48.48 ± 10.45	52.48 ± 10.18

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Characteristics	FIFA 11group	Control group
LDL-C (mg/dl)	94.11 ± 9.85	95.62 ± 8.67
VO2Max	28.69 ± 1.20	28.99 ± 1.20
Arm Curl Test	9.18 ± 1.21	9.48 ± 0.97
Wall Sit Test	25.70 ± 3.38	26.62 ± 2.22
R anterior	9.05 ± 0.41	9.15 ± 0.41
R postero-lateral	11.18 ± 1.33	11.48 ± 1.33
R postero-medial	7.70 ± 0.63	8.01± 0.63
R Composite	27.94 ± 1.71	28.24 ± 1.71
L anterior	7.88 ± 0.52	7.98 ± 0.52
L postero-lateral	10.84 ± 1.23	11.14 ± 1.23
L postero-medial	6.51± 0.72	6.81 ± 0.72
L Composite	25.24 ± 1.52	25.54 ± 1.52

The pre-test 1 and post-intervention results of each group are reported for descriptive purposes in Table 3 (FIFA 11+ and control groups).

After sixweeks, the FIFA 11+ training programme in the cholesterol, triglyceridesand LDL-cholesterol was notably decreased, and HDL-cholesterol was notably increased. In the body composition, there were significant effects for BMI, body fat, and waist circumference.Furthermore, the effect of FIFA 11+ improves performance in physical fitness in the VO_{2max}, arm curl, wall sit test, and Y balance test.

Table 3. Pre-test and Post-test changes in lipid profiles, body composition, and physical fitness

	FIFA 11+ Group			Control Group		
	Pre-test	Post-test	p	Pre-test	Post-test	p
BMI	28.03 ± 0.75	24.79 ± 0.20	0.000	27.96 ± 1.06	27.72 ± 1.06	.630
Body Fat	33.61 ± 1.11	31.10 ± 0.90	0.000	35.52 ± 1.62	35.18 ± 1.62	.683
Waist Circumference	90.11 ± 1.18	81.40 ± 2.06	0.000	89.37 ± 1.75	88.22 ± 2.15	.062
Cholesterol	154.00 ± 25.43	134.25 ± 23.32	0.000	158.00 ± 23.92	151.00 ± 21.64	.510
Triglycerides	153.81 ± 33.81	135.37 ± 32.08	0.000	154.55 ± 32.77	150.81 ± 37.70	.915
HDL-C	48.48 ± 10.45	59.33 ± 11.17	0.000	52.48 ± 10.18	54.33 ± 11.58	.771
LDL-C	94.11 ± 9.85	79.74 ± 13.89	0.000	95.62 ± 8.67	92.44 ± 16.78	.680
VO2max	28.69 ± 1.20	33.38 ± 0.65	0.000	28.99 ± 1.20	28.79 ± 1.21	.830
Arm Curl	9.18 ± 1.21	19.07 ± 1.29	0.000	9.48 ± 0.97	9.18 ± 1.14	.582
Wall Sit	25.70 ± 3.38	36.67 ± 1.81	0.000	26.62 ± 2.22	26.48 ± 2.94	.975
R anterior	9.05 ± 0.41	11.42 ± 1.11	0.000	9.15 ± 0.41	8.95 ± 0.42	.220
R postero-lateral	11.18 ± 1.33	12.45 ± 1.07	0.000	11.48 ± 1.33	11.18 ± 1.34	.704
R postero-medial	7.70 ± 0.63	10.09 ± 0.95	0.000	8.00 ± 0.63	7.70 ± 0.64	.220
Composite R	27.94 ± 1.71	33.96 ± 2.60	0.000	28.24 ± 1.71	27.94 ± 1.72	.809
L anterior	7.88 ± 0.52	10.15 ± 0.80	0.000	7.98 ± 0.52	7.68 ± 0.53	.106
L postero-lateral	10.84 ± 1.23	12.85 ± 1.07	0.000	11.14 ± 1.23	10.84 ± 1.24	.664
L postero-medial	6.51 ± 0.72	8.66 ± 0.83	0.000	6.81 ± 0.72	6.51 ± 0.73	.303
Composite L	25.24 ± 1.52	31.67 ± 2.12	0.000	25.54 ± 1.52	25.24 ± 1.53	.764

Discussion

Despite the great success of the FIFA 11+ Injury Prevention Programme, it was difficult, in practical terms, to persuade obese women to apply this programme regularly solely to prevent injuries andimprove health, so the aim was to prove that it also has a positive and direct impact on obese women's lipids profiles, body composition, and physical fitness. The findings of the current study indicate that the training stimuli provided by the implementation of FIFA 11+ three times per week for sixweeks appear to be sufficient to elicit significant improvements in some (HDL-cholesterol, LDL-cholesterol, triglycerides, BMI, body fat, waist circumference, VO_{2max}, arm curl, wall sit test and Y balance test).

In this study, obese women aged 30-40 years with FIFA 11+ were more effective with regard to lipid profiles (HDL cholesterol, LDL cholesterol, and triglycerides) than controls with the same respondent criteria. Meanwhile, there are FIFA 11+ effects on lipid profiles (total cholesterol) which show that

FIFA 11+ effects were more effective than the control group in obese women aged 30-40 years.

In this study, FIFA 11+ regardinglipid profiles (HDL cholesterol, LDL cholesterol, and triglycerides) were judged to be more effective than the control group in obese women aged 30-40 years. This is because HDL directly inhibitsatherosclerosis by removing cholesterol from cells and inhibiting LDL oxidation (Crichton & Alkerwi, 2015) while low-density lipoprotein cholesterol (LDL-C) has a significant decrease in the maximum heart rate effect (only 75%).

In this study, obese women aged 30–40 years with FIFA 11+ in body composition (VO_{2max}, Arm Curl, Wall Sit, R anterior, P-lateral L, CompositeR, L anterior, L-Postero-lateral, and Composite L) more effective than the control group in obese women aged 30-40 years. Meanwhile, when viewed from the composition of the body (R postero-medial and L postero-medial), FIFA 11+ is no more effective. Physical fitness associated with the effects of sports training cannot be concluded and contested where no exercise protocol consistently results in measurements of body composition and positive changes in different populations. FIFA 11+, which takes 12-16 weeks to produce a significant change in abdominal obesity, but for body mass there is only a slight decrease.

In addition, those people withBMI on a scale of 25-29.9 kg/m^2 undergoing 6 to 16 weeks of training intervention training will have a minimal effect on body composition (Nicklas et al., 2015). Reducing fat mass needs to be done because energy expenditure is very important and it is generally said that FIFA 11+ programme is isocaloric and there are no dietary interventions combined with training programmes (Heydari, Freund, & Boutcher, 2012).

Some study limitations should be acknowledged, one of whichmay be associated with the fact that the participants were not blinded to control/intervention, which may lead to special motivational efforts or create expectations generated by the admission to theintervention group. We also knew the FIFA 11+ training is well-known to be associated with injury prevention. However, we only observed changes inlipid profilesor performance caused by FIFA 11+ training and did not investigate how much these changes contributed to injury prevention among obese women. Another limitation isthe short study period, which may be a limiting factor in this study. In the next study, it will be necessary to examine the effects of FIFA 11+ in obese women by lengthening the study period. Finally, this study based on research exclusively on an Indonesian population, and further research is needed to extend it to other ethnic groups.

The main findings of this study suggest that just 6 weeks of implementation of the FIFA 11+ warm-up programme improves lipids profiles, body composition and physical fitness in obese women. Therefore, the FIFA 11 + programme can be considered appropriate for this age, as it seems to be adequate for inducing significant performance enhancements in obese women. Moreover, given the improvements in lipid profiles, body composition, and physical fitness, our study would advocate the introduction of these essential movement competency skills in obese women aged 30-40 years. Ultimately, thedue to evidence-based health benefits of the FIFA 11+ warm-up programme, this study'starget population could be expanded to obese youth and children in a school environment, with the aimof improving public health.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Analysis of Main Ergometric Parameters of Elite Kayak Athletes Specialized in Different Distance Events

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Abstract

The purpose of the study was to determine the level of the general functional potential of the body of elite kayak rowers for its subsequent effective realization under conditions of special training and competitive loads. The study involved 38 elite athletes, who had been the members of the Ukrainian national kayaking team. This article presents the results of the assessment of the functional state of elite athletes specialized in kayaking and canoeing. It was determined that athletes at a race distance of 1000 m under conditions of work at maximum aerobic capacity had the highest level of the power of the respiratory system (in terms of the level of pulmonary ventilation). The lowest level of the power of the respiratory system and a less economical type of breathing were observed in rowing athletes at a race distance of 200 m. Under conditions of maximum-intensity physical load with the engagement of the anaerobic glycolytic and aerobic systems to energy supply, which simulated the conditions of 500 m and 1000 m races in kayaking, significant differences ($p<0.05$) were found in the maximum level of aerobic capacity and relative contributions of the anaerobic and aerobic metabolism in the overall energy production. The results of our study indicate that the level of general (basic) functional (aerobic and anaerobic potential of the body of elite rowing athletes is important for its subsequent realization.

Keywords: *functional capabilities, rowing athletes, kayaker, kayak, distance*

Introduction

One of the most crucial objectives in predicting the level and features of the specific working capacity in elite athletes specialized in kayaking is to identify the criteria and indicators that are most appropriate for an unbiased evaluation of the functional capabilities of the body systems critical for supporting motor activity in a given sport (Trivun, Vukovic, & Pasic, 2011; Kropta et al., 2017; Bohuslavska, Furman, Pityn, Galan, & Nakonechnyi, 2017; Zhyrnov et al., 2017; Winchcombe, Binnie, Doyle, Hogan, & Peeling, 2019). Athletes of different sports specializations typically have a high physical working capacity, primarily in the types of muscle activity that are familiar to them. Typically, this should be associated with the corresponding morpho-functional and physiological adaptation mechanisms (Valeria et al., 2017; Galan, Andrieieva, & Yarmak, 2019) The specificities of sports technique, which require a strictly defined response of physiological systems to various conditions of muscular activity in different sports, make it impossible to reliably predict characteristics and the level of specific working capacity, as well as the degree to which the functional potential of the body of elite rowing athletes is realized, from any single set of

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functional parameters even in similar sports disciplines (Lysenko, Shinkaruk, Samuilenko, Rossokha, & Spichak, 2004). For example, the indicators of functional capabilities of the cardiorespiratory system that can be used for this purpose in cycling do not objectively reflect the motor abilities of rowers or runners, even if the intensity and duration of competitive activity in these sports are approximately identical (Korobeynikov et al., 2019).

This problem is especially difficult when it us necessary to predict the characteristics of the specific working capacity in athletes at the stage of maximum realization of individual capabilities and at the stage of maintenance of athletic excellence. In this context, in addition to considering competitive activity, an important condition for a reliable and informative evaluation is to take into account the individual characteristics of the body of elite athletes, as well as to identify indicators that describe the reserve capabilities of the body, their realization under conditions of competitive activity and, as a result, predetermine an increase in specific working capacity and competitive performance.

The purpose of the study was to define the grade value of the body's overall functional potential of elite kayak athletes for further effective implementation in the framework of special training and competitive exertion.

Methods

At the first stage, specialist literature was analysed to identify current approaches to improving the realization of functional capabilities of elite athletes, taking into account the role of physiological mechanisms of adaptation of the body to the conditions of a particular physical activity. Much attention was paid to studying the conceptual framework of modern sports science, as well as to addressing particular issues related to the search for new data regarding the realization of the functional capabilities of a healthy person under conditions of intense physical activity and, in particular, related to the realization of the functional capabilities of kayak athletes. The most relevant ideas were modified in relation to the training system for kayak athletes.

At the second stage, we formed a group of 38 elite kayak rowers who consistently attained high athletic performance at 200 m, 500 m, and 1000 m race distances.

We assessed the physical working capacity and the cardiorespiratory system response to conditions of maximum and standard physical workload to determine the aerobic and anaerobic capabilities of the body in elite athletes.

Athletes' functional capabilities were assessed using cardiopulmonary diagnostic equipment, including an Oxycon Pro apparatus (Jager, Germany) and a relevant methodological approach. Athletes' central haemodynamics, blood pH shifts, and physical working capacity were studied with ergometric testing workloads of different durations and intensities that enabled evaluating the capabilities of different energy systems. The power of the aerobic energy system was estimated using the power output at critical intensity workload (WCr) when performing a graded exercise test to volitional exhaustion, as well as using the power output at the anaerobic threshold (WAnT). We used a 105-second (1 min 45 s) maximum-intensity test that simulated the conditions of a 500 m rowing race (Wmax-500); and a 225-second (3 min 45 s) maximum-intensity test that simulated a 1000 m race (Wmax-1000). Ergometric parameters of workload including power, maximum time or the total amount of performed work were used as indicators of the achieved adaptation effect.

Results

To examine the characteristics of top-ranking kayak rowers, who specialized in different distance events, under conditions of 105-second (1 min 45 s) maximum-intensity test that simulated the conditions of a 500 m-rowing race and 225-second (3 min 45 s) maximum-intensity test that simulated a 1000 m race, the following evaluation parameters of the ergometric tests were assessed: average and maximum power output during physical work, average stroke rate (number of strokes per minute), distance per stroke in metres, total distance travelled during the test, and estimated time to complete a race over 500 m and 1000 m.

The most important time characteristic of physical work in rowing is stroke rate. This parameter is especially valuable because it is easy to measure: the duration of two full stroke cycles (four strokes) is recorded, then the number of strokes per minute (spm) is calculated. In kayaking, the maximum stroke rate is observed at short segments and at the start of a 500 m race, where it reached up to 140 spm; while in the middle and at the finish of a race, the stroke rate is 105–120 spm in a 500m race and slightly lower in a 1000 m race. Despite significant individual differences, the stroke rate is reliably and closely related to the speed of the kayak. During the training session, it is extremely important to control the stroke rate when performing high-speed exercises, as well as to develop a "sense of pace" in athletes, that is, the ability to assess subjectively the stroke rate with sufficient accuracy.

An analysis of the study results revealed that elite kayak rowers, who specialized in different distance events (200 m, 500 m, and 1000 m races), differ in the maximum and average power output, as well as in the stroke rate, which affects the distance per stroke in metres, estimated time to complete a race over 500 m and 1000 m, and the total distance travelled with these parameters of physical work. Table 1 presents the main ergometric parameters of the tests that simulate the conditions of 500 m and 1000 m races in elite athletes specialized in different distance events.

As can be seen from Table 1, significant differences in the power output during the 105s maximum-intensity test (Wmax-500, $p<0.05$) were found between the top-ranking kayak rowers specialized in different distance events. In particular, the highest physical working capacity was recorded in top-ranking athletes specialized in a 1000 m race (Wmax-500 = 3.69 W·kg-1; S = 0.06 W·kg-1, $p<0.05$) and the lowest value was in high-ranking athletes specialized in a 200m race (Wmax-500 = 3.15 W·kg-1; S = 0.14 W·kg-1, $p<0.05$). An analysis of performance in the 225 s maximum-intensity test (Wmax-1000, Table 1) revealed the more pronounced significant differences in the level of physical working capacity and functional capabilities of the body between top-ranking athletes specialized in 200 m, 500 m, or 1000 m events ($p<0.05$). The highest level of physical working capacity was observed in top-ranking athletes specialized in a 1000m race (Wmax-1000 =3.52 W·kg-1; S = 0.11 W·kg-1, $p<0.05$), while the lowest level was found in high-ranking athletes specialized in a 200m race (Wmax-1000 = 2.57 W·kg-1; S = 0.14 W·kg-1, $p<0.05$) and the average level of physical performance was in high-ranking athletes specialized in a 500 m race (Wmax-

Table 1. The main evaluated ergometric parameters of performance test in elite kayak rowers specialized in different distance events (N=38)

Parameters	Top-ranking athletes specialized in different distance events			p<0.05
	1000 m, n=13	500 m, n=15	200 m, n=10	
	1	2	3	
	M±SD	M±SD	M±SD	
Test simulating a 500 m race				
Maximal power output (Wmax-500), W	303.47±11.97	287.20±12.62	274.03±14.82	1-3
Maximal power output (Wmax-500) per kilogram of body weight, W·kg-1	3.69±0.06	3.43±0.08	3.15±0.14	1-2, 3; 2-3
Average power output (Wav-500), W	248.50±4.99	239.63±5.89	227.01±4.14	1-3; 2-3
Average power output (Wmax-500) per kilogram of body weight, W·kg-1	3.26±0.21	2.85±1.19	2.61±0.13	1-3
Average to maximum power output ratio %	81.89±0.15	83.44±0.14	82.83±0.09	-
Distance travelled, m	482.06±9.99	474.02±9.98	462.04±8.69	1-3
Estimated time to complete a 500 m race, s	109.03±1.21	116.10±2.09	126.05±0.99	1-2, 3; 2-3
Test simulating a 1000 m race				
Maximal power output (Wmax-1000), W	291.60±15.25	246.78±45.17	223.50±48.39	1-3
Maximal power output (Wmax-1000) per kilogram of body weight, W·kg-1	3.52±0.11	2.98±0.19	2.57±0.14	1-3
Average power output (Wav-1000), W	215.04±9.08	189.90±5.79	179.03±2.54	1-2, 3
Average power output (Wmax-1000) per kilogram of body weight, W·kg-1	2.81±0.39	2.24±0.19	2.06±0.09	1-2, 3
Average to maximum power output ratio %	73.73±2.54	76.54±2.95	80.01±1.05	
Distance travelled, m	939.02±6.89	823.00±3.86	807.09±1.96	1-2, 3; 2-3
Estimated time to complete a 1000m race, s	239.80±10.96	298.21±8.04	302.83±2.98	1-2, 3

Legend: statistically significant difference at the level of p<0.05 in the leading athletes during the distances of 1 - 1000 m; 2 - 500 m; 3 - 200 m

1000 = 2.98 W·kg-1; S = 0.19 W·kg-1, p<0.05).

Furthermore, top-ranking athletes specialized in a 1000 m race were found to demonstrate, for a given level of power output, the greatest distance travelled in combination with a shorter estimated time to complete a race over 500 m and 1000 m, that allowed us to conclude that they can reach a higher speed under conditions of competitive activity. The shortest distance travelled during the test and the longest estimated time to complete a race over 500 m and 1000 m were observed in top-ranking athletes specialized in a 200 m race.

Thus, a higher stroke rate combined with a lower stroke force is more effective for realizing the general aerobic capacity of kayak rowers and for demonstrating specific physical working capacity in a race over 1000 m. To realize the potential of an elite kayak rower in a race over 500 m, a lower stroke rate and a higher stroke force are more efficient.

The results of the analysis of blood lactate concentration (HLa, mmol·L-1) at the 3rd minute of recovery after performing various tests, shown in Table 2, indicate that an activation of anaerobic glycolytic processes involved in energy production occurred.

However, there were no significant differences in the activity of anaerobic processes among top-ranking athletes: blood lactate level varied between 13.0-14.4 mmol·L-1 in the test simulating a 500 m race and between 14.4-15.3 mmol·L-1 in the test simulating a 1000 m race.

Significant differences (p<0.05) between top-ranking athletes made it possible to reveal the analysis of the ratio between the power of physical work and blood lactate concentration (W/HLa, W·mmol-1·L-1). The obtained results indicate the power of work performed, which accounts for each 1 mmol·L-1 increase in blood lactate concentration during physical work and characterizes the efficiency of metabolic processes (Table 2).

The greatest efficiency of metabolic processes under the test conditions was recorded for elite rowers specialized in a 1000 m race, while the least efficiency of metabolic processes was observed in athletes specialized in a 200 m event. It should be noted that an increase in the duration and functional strain of the work led to an increase in the differences between elite kayak rowers specialized in different distance events (p<0.05).

The analysis based on a comparison of individual levels of maximum achieved power output at maximum intensity with blood lactate concentrations showed that top-ranking rowers can achieve high levels of physical working capacity at different race distances in many ways as well as with various proportions of energy supplied through aerobic and anaerobic metabolism.

It becomes more and more obvious that with an increasingly equal energy and functional potential of the body's organs, functions, and physiological systems, which are important for a given sport, an athlete who realizes that potential better under the particular conditions of competition has an advantage over the opponents. For a top-rank athlete, the ability to achieve maximum realization of his functional potential under the particular conditions of competitive activity ("realizability") becomes key to success. Analysis of the athlete's realization capabilities can be carried out on the basis of an assessment of the

Table 2. The average values for parameters describing the activity of glycolytic processes in energy production during physical performance tests of different durations (N=38)

Parameters	Top-ranking athletes specialized in different distance events			p<0.05
	1000 m, n=13	500 m, n=15	200 m, n=10	
	1	2	3	
	M±SD	M±SD	M±SD	
Graded exercise test to volitional exhaustion				
Blood lactate concentration at 3rd minute of recovery, HLa, mmol·L-1	9.6±3.22	12.9±2.26	13.6±3.45	
Efficiency of metabolic processes, W/HLa, W·mmol-1·L-1	37.5±4.42	26.2±2.48	18.4±3.31	1-2, 3; 2-3
105 s maximum intensity test that simulate a 500 m race				
Blood lactate concentration at 3rd minute of recovery, HLa, mmol·L-1	13.0±0.55	14.4±0.52	13.4±0.12	1-2
Efficiency of metabolic processes, W/HLa, W·mmol-1·L-1	23.7±0.19	20.4±0.19	21.6±0.31	1-2
225 s maximum intensity test that simulate a 1000 m race				
Blood lactate concentration at 3rd minute of recovery, HLa, mmol·L-1	14.5±0.44	14.4±0.63	15.3±0.25	
Efficiency of metabolic processes, W/HLa, W·mmol-1·L-1	21.0±0.28	17.7±0.19	14.8±0.27	1-3

Legend: statistically significant difference at the level of p <0.05 in the leading athletes during the distances of 1 - 1000 m; 2 - 500 m; 3 - 200 m.

nature of optimizing the response of functional systems and energy systems that ensure achieving high performance in sporting activity. Furthermore, the analysis of the study results shows that there is a need to isolate a set of physiological properties such as functional and metabolic power, stability, ability to respond and efficiency, which fully take into account the requirements for the main aspects of the functioning of the athlete's functional systems under conditions of intense physical loads of various nature.

Discussion

Elite athletes with different levels of long-term adaptation have specific characteristics that ensure the functioning of the cardiorespiratory system under conditions of various types of physical work. High performance in sport is rare and often unique. In order to achieve it, an athlete needs not only to possess genetically determined biological prerequisites, which provide the main basis for demonstrating specific working capacity but also to search new ways to realize them in the process of training and competitive activity.

The rational use of aerobic and anaerobic mechanisms of energy production with the leading role of the cardiorespiratory system forms the basis for the effectiveness of the competitive activity of kayak rowers, which is because modern-day kayaking is a high-intensity sport that places great demands on the main functional systems of the body. Moreover, unlike a number of other sports, it requires the near-maximum development of an entire set of physical qualities, such as strength and speed endurance and speed-strength capabilities, as well as a high level of development of all aspects of the energy production systems (Lysenko, 2008).

The need to maintain a high speed of the boat throughout a race significantly increases the requirements for efficient energy supply of the work and for the functional capabilities of the entire body of the rowing athlete (Briskin, Pitin, & Boguslavskaya, 2016). Kayaking is currently characterized by very high energy expenditures: performance in competitive activity is ensured to a large extent by the limits of the energy and functional capabilities of an athlete, as well as by their effective realization under particular conditions of motor activity (Trivun, Tosic, Vukovic, & Pasic, 2012; Skopek, Bacakova, Bily, & Tunkova, 2019; Hogan, Binnie, Doyle, Lester, & Peeling, 2020).

The results of this study provide additional evidence with respect to the earlier findings (Lysenko et al., 2004; Spichak, 2008; Shynkaruk, Lysenko, & Fedorchuk, 2019) regarding the structure of the functional preparedness of elite kayak rowing athletes specialized in different distance events.

Specific preparedness of an athlete under conditions of competitive activity in kayak rowing can be characterized, first of all, by the parameters of working capacity, power, strength, pace, and other dynamic characteristics of rowing performance in a race over distances of 500 m and 1000 m, as well as through an assessment of the energy systems providing the energy for the work (i.e., the limits and efficiency of aerobic and anaerobic energy production). The presented data indicate the interdependence of the ergometric parameters of specific physical working capacity (average and maximum power output during physical work, average stroke rate (number of strokes per minute), distance per stroke in metres, and total distance travelled) measured in performance tests simulating conditions of a 500 m and a 1000 m kayak rowing races with the main characteristics of the cardiorespiratory system response.

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ORIGINAL SCIENTIFIC PAPER

Creating a Brand on the Identity of a Sports Club: Preliminary Report Creating a Brand on the Identity of a Sports Club

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Abstract

Creating a sports club brand is an important strategic marketing activity. The quality of the content of a sports club brand can be communicated effectively by promoting its key features. A sports club's identity is a critical marketing feature that significantly contributes to differentiation on the market. The paper aims to argue the importance and the marketing practice in Croatian sport of implementing a sports club's identity in its brand image. The research has been conducted during year of 2019 using qualitative and quantitative methods through different sport case studies of three famous basketball and two famous football clubs from Croatia. Although communication of the brand image through its identity is increasingly encouraged in recent scientific literature, it is not yet a common practice in sports in Croatia. Results shows there are no clear links between the brand image and the identity even in Croatian famous professional sport clubs. The sports club's identity is recognized in terms of its existence, social significance, activities, and development to date. The sports brand identity should communicate the core values of the sports club identity. A distinct brand of a sports club is imperative for desirable positioning in the wider environment. The identity of a sports club is a valuable marketing and strategic element of its brand. The distinctiveness of a sports club brand significantly depends on the implementation of its identity in its image. In sport marketing practice in Croatia it needs to be change.

Keywords: *brand, creating, sport, club, identity*

Introduction

The brand is a useful marketing tool in market communication, so the redefinition and management of sports club brands have received increasing research attention (Serić & Ljubica, 2018). These tendencies are particularly pronounced in the area of professional sports (Serić & Ljubica 2018; Jankovic & Jaksic-Stojanovic, 2019). In marketing terms, it is not advisable to generalize about the creating and managing of a sports club brand (Mehmeti & Halilaj, 2018). Sport is a specific social phenomenon (Dwyer & Edwards, 2008; Serić & Ljubica, 2018). As a subject of research, the focus on the sports club brand raises dilemmas in the context of its characteristics that are useful and desirable in communicating with the public. In the practice of managing sports clubs, there are frequent conflicts of opinion regarding on which to base a brand, on its image, or on its identity (Seric & Ljubica, 2018). Recent research findings show the consequences of a disagreement on the image and identity of a sports club on the perception of its brand (Serić & Ljubica, 2018).

In the scientific approach to this issue, it is necessary to analyse the image of the sport subject with possible repercussions on its defined vision and mission. If there are some conflicts regarding that, the possible existing image of a sports club is not a recommended platform for brand management activities (Raju, 2009). How current is the integration of the sports club marketing story and its history into its existing im-

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age? What are the links between the targeted mission and vision of the future of a specific sports club? These are some important questions that need to be answered before designing sports club brand management activities. Professional sports clubs prove that the subject's vision should be implemented in their brands (Serić & Ljubica 2018).

This research focuses on identity as a platform for creation and brand management activities, which was the starting point of the research problem: the process of the development of the sports club's branding on its identity. Considering that a sports club's identity is more than its image, it is necessary to investigate how its followers perceive it, in terms of their loyalty, regardless of the current sports results. It is necessary to determine whether the followers of the sports club's expectations and aspirations are connected with its vision and mission (Jankovic & Jaksic-Stojanovic, 2019). Sport, like tourism, is a specific social phenomenon; therefore, in such research, it is necessary to understand the causes of differences in the perception of the image and identity of a particular sports club (Jankovic & Jaksic-Stojanovic, 2019; Prorok, Seric, & Peronja, 2019).

The identity of a sports club represents its past, present, and targeted future. The image of a sports club represents the public's current insight into its reality. Significant repercussions for a sports club's image can be the consequence of past and present sports results and all things related to its members, fans, and official representatives. The image is subject to change (Candela & Figini, 2010). The current image of a sports club may result from specific circumstances and events of interest to the general public and the specificities of a particular sport (Kaplanidou & Vogt, 2007; Chulhwan, 2019). These are just some of the reasons that the actual image of the sports club could be different from its vision and mission. All these causes indicate that in a sports club's brand management activities, the question of whether it should be based on its existing image should be evaluated.

The sports club's identity enables broader marketing leeway in brand management activities (Seric & Ljubica, 2018). Consequently, it is possible to bring the sports club brand closer to the vision and mission: the target perception of the same in public. Since a sports club's identity comprises its past, present and future, identity-based brand management activities provide a broader scope. A plethora of content and facts representing the identity of a sports club are commercially usable features in brand communication (Jaksic-Stojanovic, Jankovic, & Seric, 2019). A sports club brand should be based on the specific desirable and attractive features of the content to which it is presented to the public (Jankovic & Jaksic-Stojanovic, 2019). In analysing the identity of a sports club, the basic marketing content of a club story needs to be recognized (Seric & Ljubica, 2018). Current sports scores and the current image of the sports club should also be taken into account. Based on these insights, it is possible to decide on the characteristics of a sports club brand that are recommended to communicate frequently. A sports club marketing effective brand should integrate multi-criteria features (Prorok et al., 2019). Creating and managing a sports club brand are strategic marketing activities (Kyongmin, Yong Koo, & Kang-Won, 2020). The content of a sports club brand should be practical for communicating with target segments of the public. The effectiveness of brand management activities will depend significantly on the commercially exploitable specifics of its features (Jankovic & Jaksic-Stojanovic, 2019). Based on all these facts and analysis of recent scientific papers, research hypotheses were defined:

H1: *A recognizable sports brand adds loyalty to followers and fans;*

H2: *The recognizable identity of a sports subject contributes to its positive image in public;*

H3: *An identity-based sports entity brand attracts broader segments of followers and fans.*

These hypotheses focus the research problem on considering the argumentation of creating a sports club brand on its identity. The paper aims to scientifically justify the implementation of a sports club's identity in its brand and its image in public.

Methods

In the conducted research, the authors used selected qualitative and quantitative methods that have proven to be scientifically acceptable in the analysis of social phenomena, since sport is such a phenomenon (Seric & Ljubica, 2018). In the first phase, a survey was conducted of several examples and business cases of sports club brand management and the repercussions of these activities on the loyalty of followers and public attitudes towards the entities represented by these brands. The preliminary research aimed to determine the repercussions of various sports club brand management activities on how they are perceived by the public. In this phase of research, the descriptive method, the inductive and deductive methods, the method of abstraction and concretization, the methods of analysis and synthesis, the method of classification and comparison were used. Sports club brand management activities were analysed using the case study method to select the brands that would be the subject in the primary research. The questionnaire, in the second phase of the research tested the attractiveness and loyalty of the selected brands on the research sample of competent respondents. The competence, that is, the selection of respondents for the research sample, was conducted based on the pretest - respondents selected in the research sample proved that they are well informed about these sports club and their brands, which are a consequence of the perception of their current image. In the sample of brands surveyed, there were those based on identity, but also those based primarily on the current image of the sports club (three famous Croatian basketball clubs and two famous Croatian football clubs). Identity-based brand features are time-based, while image-based brand management is often based on recent trends in a particular sport and the current results of the entity the brand represents. Identity-based brand features often imply a perspective on the future of the sports club. Such a perspective points to the goals pursued by the current management of the sports club. Identity-based sports club brand management activities drive research curiosity as loyalty to such brands is evident in several market segments. Loyalty to brand image-based sports clubs is overwhelmingly recognized in one segment: the fans of a particular sports club.

The survey was conducted during 2019. Hypothesis testing was performed on a sample of 435 persons. The sample included pretesting individuals who fully understood the research problem and expressed a high level of familiarity with the sports brands of three basketball and two football clubs presented and the image content they represent. The study sample was dominated by a population over 30 years old; it

was 74% male and 26% female. The questionnaire contained 28 questions related to the presented brands of three famous basketball and two famous football clubs from the Republic of Croatia. The collected data were processed.

Results

The findings of the study revealed that identity-based sports club brands lead the way for a higher number of demographic segments, while club loyalty to image-based sports clubs depends primarily on the sports results of those entities. Brands of sports clubs based on the image of loyalty are expressed exclusively by the fan segment, while loyalty to brands of sports clubs based on identity is also expressed by members and other public segments, many of whom cannot be classified as fans of a specific sports entity.

During years of a club's inferior sports results, the loyalty of fans to the club brands based on image is significantly diminished, which is not the case with the loyalty of fans and others toward the brand based on the identity of the sports club.

Furthermore, the research findings have proven to be more appealing to sports club brands based on the identity of the entities they represent to the public. Loyalty to these sports clubs' brands is also based on the traditions associated with them, social significance and social action from its founding to the present time. Respondents mostly stated that identity-based sports club brands communicate the broader social values of the entities they represent. The following weaknesses were identified in brands based on the image of a sports club:

- Brand amnesia: the public has the impression that the sports club ignores the mission for which it was founded;
- Ego brand: the public regards the sports club as arrogant because it expects the fans to have patience and understanding for the continuing inferior sports results;
- Brand megalomania: the public considers the sports club to be the only one worthy of the attention of fans and the public in the environment in which it acts;
- Brand deception: the public believes that by such communication of the brand, the management seeks to conceal the real situation and relations in the sports club, which are neither representative nor desirable;
- Brand wear: a sports entity neglects social responsibility even in periods of stagnant performance;
- Brand paranoia: a sports entity neglects communication with the public, believing that there are no conditions or opportunities to achieve better sports results and valuable social action.
- The identified weaknesses of the brand based on the image of the sports club in communication make it inferior to the brand based on the sports subject's identity. Regarding the hypotheses, the following can be concluded from the research findings:
- Sports brand recognition contributes to fan loyalty and a positive image of the sports club in public;
- The distinctive identity of the sports club in its brand contributes to the positive image of the subject in public;
- An identity-based sports entity brand attracts broader segments of followers and fans.

Discussion

The research findings proved that the identity of a sports club in its brand significantly contributes to its differentiation and visibility and the image of the subject that represents it. A brand based on a sports club's identity and the frequently used features of that identity in its management activities contribute to maintaining the loyalty of existing and growing numbers of new followers in various public segments. Such a brand contributes to a higher recognition of a sports club, both nationally and internationally. Based on these findings, it can be concluded that the identity of a sports club is a valuable and commercially viable foundation for its brand. The identity of a sports club is practically communicated through brand management activities. Professional sports clubs are a good example of maintaining visibility and effective brand management. In the practice of amateur sports clubs, brand management activities are modest and often not carried out. The brands of many amateur sports clubs have been created based on the image of a particular sport, neglecting many of the useful local features that would make such brands more visible. The findings of the research also proved that sports club brand management activities cannot be a substitute for the poor sport results of the subject if it significantly deviates from the expectations of followers, fans and the local public.

The identity of a sports club is a consequence of its overall existence. Social activities are particularly important. In this regard, when managing a sports club brand, it is advisable to communicate the basic social values of its identity. Considering the multitude of commercially usable features in the identity of a sports club, it is commercially valuable in both branding and brand management activities.

Despite these insights, sports club brand management activities, apart from professional and globally renowned entities, are rare and modestly developed. Due to such prevailing practices in amateur sport in the Republic of Croatia, brands have no significant market visibility or value, which results in the disinterest of local sponsors and growing problems in maintaining amateur sport. A more significant implementation of a sports club's identity in its brand and its management activities can be realized by using the characteristics of tradition, social action, highlighting locally known athletes/members of the sports club and information on the continuity of the loyalty of local followers, working with youth and openness to recreational activities of the local population.

A recognizable and differentiated brand of a sports club is an imperative for desirable public positioning that will make the entity visible and potentially attractive to sponsors to invest in it. The distinctiveness and differentiation of a sports club's brand significantly depend on the implementation of the identity of the sports entity it represents.

Accordingly, it is advisable to implement as many characteristics as possible in the brand management activities of the sports club's past, present, and future. In this sense, the findings of this research may be a useful starting point for the dilemma of whether identity is the only recommended platform for creating and managing a sports club brand.

The research findings proved that the competitive performance of the sports club is not a sufficient feature in the activities of brand management and maintaining the desired image of the subject. A sports club brand should communicate its social mission and social values, as well as evidence of sports club involvement in society.

A sports club brand in which all of these characteristics are effectively implemented will be attractive to a wider number of social segments and will significantly contribute to the market visibility of the entity. Such a brand of a sports club grows into

a symbol of concrete social reality, for both fans and other segments in the environment in which the subject operates, and even worldwide.

Limitations of the research are the coverage of brands of only five sports clubs from the Republic of Croatia, on the basis of which brands a survey was conducted. These five brands were extracted based on the long sporting tradition of the entities they represent, their social influence, and the large numbers of registered and organized fans.

A further limitation of the research is that some of the respondents are not fully aware of the beginnings of certain sports clubs whose brands and management activities have been discussed. Some respondents were not more familiar with the earlier international successes of one or more sports clubs whose brands were the focus of the survey.

The relatively small sample of respondents can be considered to be a limitation of the survey, since these five Croatian sports clubs have thousands of registered fans and supporters groups without other local followers and those who support them or otherwise express their loyalty to them.

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ORIGINAL SCIENTIFIC PAPER

The Validity and Reliability Study of WHO Quality of Life Scale Short Form (WHOQOL-Bref) in Kazakh Language

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Abstract

The purpose of the current study is to test the validity and reliability of WHO quality of life scale short form (WHOQOL-Bref) in Kazakh language. In this sense, a total sum of 509 students, 208 men (40.9%) and 301 women (59.1), volunteered in the study. The scale was made up of 26 items and 5 sub-dimensions (General Health, Physical Health, Psychological Health, Social Relations and Environment). In the analysis of the study, Confirmatory Factor Analysis was used regarding the structural validity of the inventory and Cronbach Alpha reliability analysis was used to determine internal consistency. In the confirmatory factor analysis results, goodness of fit index values were found as x2/sd(x2=936.08, sd=289)=3.23, GFI=0.88, CFI=0.86, NFI=0.80, RMSEA=0.66, SRMR=0.52, RMR=0.47. Internal consistency coefficient numbers were determined as 0.60 and 0.90. As a conclusion, it is likely to say that "WHO Quality of Life Scale Short Form (WHOQOL-Bref) in Kazakh Language" is a valid and reliable assessment tool.

Keywords: *Life Quality, Validity, Reliability*

Introduction

A qualitative life or life quality has always been an important, controversial issue from the antiquity to the current time (Boylu & Pacıoğlu, 2016). For the first time in history, it is likely to see that there are some arguments over life quality in the philosophical works of "State" by Plato and "Nicomachean Ethics" by Aristotle (Özüdoğru, 2013). The first person touching on life quality, although it is an indirect touch, is Aristotle. Aristotle called the last purpose of people in life as "Uudamania" and explained this understanding as "being blessed with a good soul and energy and starting to live in this way" (Özüdoğru, 2013). As a term, life quality was first mentioned in the article "On the quantity and quality of life" by Long (1960) published in Medical Times. In addition, the place and importance of life quality started to be discussed with the article of "Medicine and quality of life" (Pınar Bölüktaş, 2012).

Even though there are a great many definitions regarding life quality in the related literature, there is no a commonly accepted definition yet. While some of these definitions explain the environmental features of life quality and some explain economic features, some others explain it with sociological and psychological features. WHO defines life quality as individuals' perception of their position in life in connection with their targets, expectations, standards and interests in the context of the cultural and value systems they have (World Health Organization, 1997). It is a wide concept influenced from physical health of an individual, psychological condition, his beliefs, social relations and environment in a complex way (Akyüz, Yaşartürk, Aydın, Zorba, & Türkmen, 2017). Life quality is related to the subjective goodness being of a person. It indicates to what extent a person is contended with his own life (İlhan, 2011). Patric and Erickson define life quality as a basic concept comprising the perception of death and life period, disability, functional status, social, psychological or physical health, and socio-cultural disadvantages (Gönülateş,

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2016). Calman defines life quality as the gap theory between what individuals gain and their expectations (Güldalı, 2017). In another definition, life quality is described as the fact that an individual has the same opportunities with the others regarding how to reach such basic needs as accommodation, school and job in his own living environment and realizing them (Eyili, 2017). In most of the researches, life quality was defined as happiness, satisfaction, consistence and the concept of life quality was used as a synonym of life satisfaction, life content and happiness. Nevertheless, life satisfaction which is one of the most important determinants of life quality is individualistic. The dimensions of life quality vary depending on the studies carried out (Gümüş, 2017).

The purpose of the current study was to investigate the validity and reliability study of WHO quality of life scale short form (WHOQOL) developed by World Health Organization (WHO) in Kazakh language. The fact that Kazakh version of this scale used actively in many languages has not been developed up to now was considered to be a deficiency and it is believed that this study would be a significant source for other studies to be carried out in the future.

Method

Research Group

Similar to the studies in the related literature, the sampling group of the current study, which aimed at assessing the validity and reliability of the WHOQOL-BREF scale in Kazakhstan, was made up of a total sum of 509 students, 208 men (40.9%) and 301(59.1%) women.

Data Collection Tools

WHO Life Quality Scale Short Form (Whoqol-Bref)

World Health Organization Life Quality Scale Short Form is the short form of World Health Organization Quality of Life Assessment (WHOQOL) with 100 question prepared to evaluate how an individual perceives life quality by reducing it to 26 questions. The scale which was comprised of close-ended questions was made up of five sub-fields as general health status, physical, social, environmental and psychological fields. General health was made up of 1st, 2nd; physical field was made of 3rd, 4th, 10th, 15th, 16th, 17th and 18th questions; psychological field was made up of 5th, 6th, 7th, 11th, 19th and 26th questions; social field was made up of 20th, 21st and 22nd questions; environmental field was made up of 8th, 9th, 12th, 13th, 14th, 23rd, 24th and 25th questions. The scale does not have a full score and the increase in the score shows that life quality becomes better (World Health Organization, 1997).

Personal Information Form

It is made up of questions having the demographic information of the students included in the research regarding their gender, age, marital status.

Process

Application Stage

Before handing out the scales to students, they were informed about the purpose of the study. In this sense, it was applied after the necessary consents were taken from their tutors before the course. Any time limit was not made in the collection of the data.

Translation Stage

In the translation process of the scale, standard translation-back translation method that was recommended by Brislin (1986) was used. The original form of the scale was first examined and translated into Kazakh language by the researches firstly and then by two expert psychologists and three experts in the field of sport sciences who had an academic English education beforehand. While translating the scale, Turkish and Russian versions were also taken into consideration. The items in the scale obtained were compared and the items having the same translation were determined. Each translation form of the items having the same and different translation were given to different experts once again and they were asked to be translated into English. The scale items back-translated were compared with the original inventory items, differences and mistakes were determined. Kazakh inventory was finalized with the closest translations by comparing the English translation with the original inventory. In the translation process of the inventory into Kazakh language, the content of the original items was completely stayed loyal as it was thought that there would be no inadequacy resulting from the language itself.

Data Analysis

For data analysis, SPSS 20 and Lisrel 8.7 package programs were used. As the first step, the suitability of the analyses and the evaluation of the blank data for the control of the assumptions, normality test and determination of the extreme values were made. At the end of these processes, the validity and reliability studies of the scale was conducted in line with the answers coming from 509 sportspersons in total participating in the research. In this sense, Confirmatory Factor Analysis was used parallel to the approach in the development of original scale. For the sub-dimensions of the scale and total reliability Cronbach alpha (α) internal consistency coefficient was calculated.

Results

Confirmatory Factor Analysis

In order to investigate whether the factor structure of the original form of the scale was confirmed in the current study that was carried out with Kazakh students, confirmatory factor analysis (CFA) was used. For CFA, multiple fit-index was used and chi-square fit value ($x^{2/sd}$), Goodness of Fit Index, (GFI), Comparative Fit Index, (CFI), Normed Fit Index, (NFI), Root Mean Square Error of Approximation, (RMSEA),

Table 1. Fit index values regarding the confirmatory factor analysis of who life quality scale short form

Values	Normal Value	Acceptable Value	Whoqol-Bref
X2/sd	<2	<5	3.23
GFI	>0.95	>0.90	0.88
CFI	>0.95	>0.90	0.86
NFI	>0.95	>0.90	0.80
RMSA	<0.05	<0.08	0.66
SRMR	<0.05	<0.08	0.52
RMR	<0.05	<0.08	0.42

Standardized Root Mean Square Residual (SRMR) and Root Mean Square Residuals, (RMR) fit indexes were examined. The fit index values in the current study were given in Table 1.

It is likely to say that, as a result of confirmatory factor analysis, 5-factor structure of WHO Life Quality Scale Short Form with 26 items was confirmed as a model and the model exhibited a good fit.

As a result of the Confirmatory Factor Analysis (CFA)

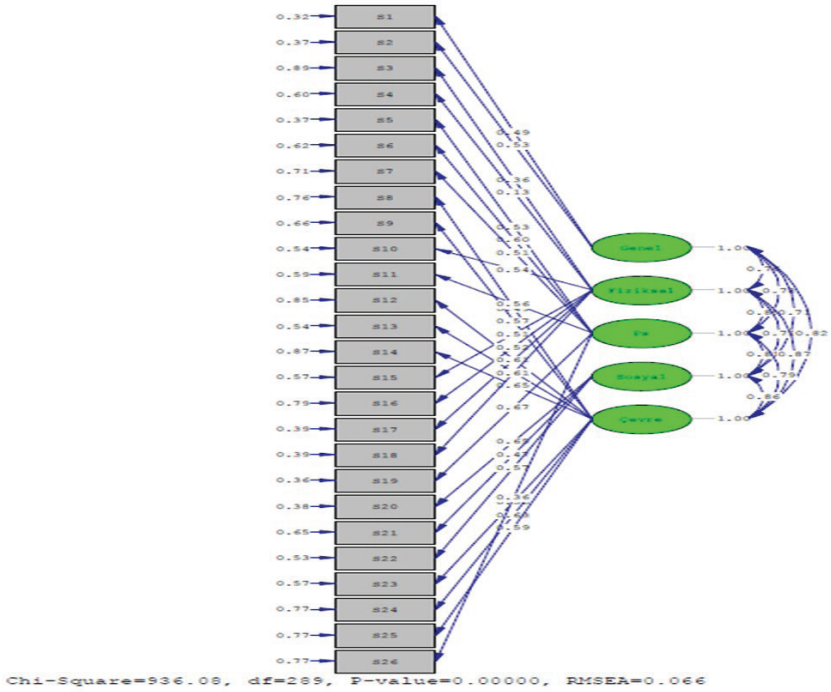

FIGURE 1. Confirmatory factor analysis results

analysis in Figure 1, it is seen that the covariance values between the sub-dimensions of the 26-item WHO Short Form of the WHO Quality of Life Scale (Whoqol-Bref) vary between 0.71 and 0.86.

Another way that was recommended to get some proof for the structural validity of the scale was the calculation of the correlations between the sub-dimensions forming the scale (Şencan, 2005). For that reason, the correlations between the sub-dimensions of WHO Life Quality Scale Short Form were calculated and the results were given in Table 2.

Table 2. The correlation values between the sub-dimensions of who life quality scale short form

N=509	General Health	Physical Health	Psychological Health	Social Relations	Environment
General Health	1	.504**	.510**	.455**	.570**
Physical Health	.504**	1	.610**	.527**	.645**
Psychological Health	.510**	.610**	1	.563**	.621**
Social Relations	.455**	.527**	.563**	1	.623**
Environment	.570**	.645**	.621**	.623**	1

Depending on the correlation values between the sub-dimensions of the scale in Table 2, a positive and significant relation was determined between all sub-dimensions ($p<0.01$).

Reliability of the Scale

In order to determine the items that would form the inventory and reliability of the inventory, item total test correlation and Cronbach alpha (α) internal consistency coefficient

Table 3. Internal consistency coefficient of who life quality scale short form regarding sub-dimensions

Sub-dimensions	Cronbach Alpha (α)
General Health	.60
Physical Health	.72
Psychological Health	.74
Social Relations	.64
Environment	.80
General Internal Consistency Coefficient	.91

was calculated. For 5 sub-dimensions obtained following the factor analysis, Cronbach Alpha reliability coefficient was given in Table 3.

As is given in Table 3, if it is taken into the consideration that reliability level predicted for the assessment tools likely to be used in researches is .60 (Alpar, 2001), general internal consistency coefficient of the sub-dimensions and of the inventory is high.

Discussion

In the current study, it was aimed to carry out the validity and reliability of World Health Organization Life Quality Short Form (WHOQOL) (26 items). First of all, the views of five experienced experts in the fields of English language, psychology and sport sciences were applied. After linguistic equivalence was obtained, the application was made upon the scale form finalized.

Factor structure of World Health Organization Life Quality Short Form was tested with CFA. As a result of the analysis made, it was found that model fit of the scale comprised of 26 items and five factors was significant (x2/sd(sd=164)=3,23 GFI=0.88, CFI=0.86, NFI=0.80, RMSEA=0.66, SRMR=0.52, RMR=0.42). Depending on these results, it is likely to say that the model fit indexes of the scale was at adequate level and that the scale had a structural validity (Schermelleh-Engel, Moosbrugger, & Müller, 2003). Another finding obtained to prove the structural validity of the inventory was that correlation values between the sub-dimensions of the inventory were positive and significant at all sub-dimensions.

In a study by Conrad et al. (2014) carried out over 1.133 individuals between the ages 60-96 in Germany, psychometric features of WHOQOL-OLD scale was investigated and it was found that the scale was a suitable tool to define the needs and wishes of the old age individuals. Al-Fayez and Ohaeri (2011) applied WHOQOL-BREF scale on 4.467 students between the ages of 14-23 in order to examine the relation between the life quality of high school students and parent and socio-economic level. At the end of this study which was carried out in Saudi Arabia, it was found that the life quality scores of boy students were higher compared to those of girl students. The relations with parents were found to be positive and it was found that the fact that divorce and low socio-economic level of father was affected life quality negatively. Hasanah, Naing, and Rahman (2003) applied WHOQOL-BREF scale on the patients having a medical treatment longer than two years and investigated the psychometric features of the scale. At the end of the study, it was found that WHOWOL-BREF scale was valid and reliable for Malaysia. Izutsu et al. (2005) carried out the study of validity and reliability for WHOQOL-Bref scale in Bangladesh. It was applied on 187 boys (average age 14.6) and 137 girl students (average age 15.2) and as a result, the scores of relation dimension of the boy students were found higher in physical and psychological fields. WHOQOL-BREF was found valid and reliable in evaluating the life quality of adolescents in Bangladesh. Berlim, Pavanello, Caldieraro, and Fleck (2005) carried out a study over 89 adults having a depressive disease in order to evaluate the psychometric features of WHOQOL-BREF in Brazil. As a result, WHOQOL-BREF is a valid and reliable tool to assess psychometric features. Chien, Wang, Yao, Hsueh, and Hsieh (2009) applied Taiwanese and Chinese versions of WHOQOL-BREF on 53 individuals being able to read Chinese and know Taiwanese chosen randomly between two disease periods. Between the two versions, medium level differences were found in 17 of 28 components and in 3 out of 4 fields. In 3 fields, the score of Taiwanese was found higher that of Chinese. Noerholm et al. (2004) carried out a study with 578 women and 519 men, in order to investigate the validity and reliability of WHOQOL-BREF in Denmark. Life quality of Danish population was tried to be calculated and the score of women was found to be higher compared to that of men. Jahanlou and Karami (2011) made a comparison of WHOQOL-BREF and IRDQOL scales over 387 individuals with diabetes in Iran. While social and environmental fields exhibited similar results, physical field was found higher in WHOQOL-BREF scale. Bauman et al. (2010) carried out a study into 16.450 individuals chosen randomly in order to determine French reference values for the physical, health, psychological and social relation dimensions of WHOQOL-BREF scale. It was found that the reference values of WHOQOL-BREF scale could be sued in clinical studies in order to evaluate its effect on the life quality of patients. In a study carried out over 304 adults in India by Saxena, Chandiramani, and Bhargava (1998), they thought that WHOQOL-BREF was a suitable tool to asses life quality in a detailed way. Trompenaars, Masthoff, Van Heck, Hodiamont, and De Vries (2005) carried out a study with 553 Dutch adults in order to assess the validity and reliability of the psychometric features of WHOQOL-BREF scale. As a result, life quality was evaluated for the adults in the psychiatry policlinic and good scores were obtained in 25 of 26 questions. Leung, Wong, Tay, Chu, and Ng (2005) applied WHOQOL-BREF scale on 369 individuals with a disease and 113 healthy individuals in Hong Kong. The values of face-to-face interview and those of telephone talk interview had similarities. As a result, telephone or face-to-face interview mode was offered as an applicable choice. Nedjat, Montazeri, Holakouie, Mohammad, and Majdzadeh (2008) applied WHOQOL-BREF scale on 1.164 individuals with an average age of 36.6 in order to develop and assess the validity, reliability in Iran. As a result, positive results were found in all fields except for social relations field. Lucas-Carrasco, Laidlaw, and Power (2011) applied WHOQOL-BREF scale on 286 individuals over 60 years of age in Spain in order to investigate psychometric features. Significant differences were found in the scores at educational level, health status and between the ones with and without caretakers. In a study by Carpiniello, Pinna, Carta, and Orrù (2011) carried out in Italy, WHOQOL-BREF scale was applied on 229 individuals in psychiatry policlinics at the first stage and on 236 individuals at the second stage. It was found that women obtained higher scores in both groups. No significant difference was found in life quality scores in terms of gender and marital status. Kalfossi, Low, and Molzahn (2008) carried out a study to assess the validity and reliability of the WHOQOL-BREF scale over elderly individuals in Canada. A comparison was made by applying the scale over 192 individuals in Canada and 469 individuals in Norway. As a result, the scores of both countries were found the highest in social terms. Min et al. (2000) carried out a study to develop the Korean version of the WHOQOL-BREF scale and to test the validity and reliability of it. A total sum of 538 people, 171 medical patients and 367 healthy individuals, were included in the study. While physical field got the highest score, it was followed by psychological and environmental fields. As a result, it is likely to say that Korean version of WHOQOL-BREF scale is a reliable and suitable test to assess life quality. Colburn,

Masache, and Skordis-Worrall (2020) carried out a study over 309 individuals to test the validity and reliability of the WHOQOL-BREF scale in Malawi. The level of life quality for the individuals having a high education level was found higher. The life quality scores of the married and single individuals were found higher compared to those of widows. As a result, WHOQOL-BREF scale was found clear, valid and reliable for the participants in Malawi. Hanestad, Rustøen, Knudsen, Lerdal, and Wahl (2004) investigated the psychometric feature of the WHOQOL-BREF scale by applying it on the Norwegian population. And 48.5% of the scale sent to 4.000 Norwegian citizens randomly chosen between the ages of 19-81 was answered. As a result, it was found to be a valid and reliable tool for Norway. A total sum of 908 individuals, 470 with a disease and 438 healthy ones, participated in the study by Jaracz, Kalfoss, Górna, and Baczyk (2006) carried out to investigate the validity and reliability of the WHOQOL-BREF scale in Poland. At the end of the study, the most distinctive field between healthy and unhealthy individuals was found to be physical field. A total sum of 300 individuals participated in the study by Fleck et al. (2006) carried out to investigate the validity and reliability of the WHOQOL-BREF scale in Portugal. As a result, the psychometric field assessment of the WHOQOL-BREF scale was offered as a useful alternative to be used in the studies aiming at assessing life quality. Akinpelu, Maruf, and Adegoke (2006) carried out a study over 24 men and 14 women having a story of a stroke in Yoruba and found that the WHOQOL-BREF scale could be used to assess the life quality of the patients having a story of a stroke in Nigeria. Krageloh et al. (2013) carried out a study over 808 individuals in New Zealand and investigated four different fields and psychometric features of the WHOQOL-BREF scale. At the end, they found that the short form of the scale was valid and reliable for New Zealand.

Upon the review of the internal consistency coefficient for the purpose of determining the reliability of the inventory, it was found that these values were general health (α=.60), physical health (α=.72), psychological health (α=.74), social relations (α=.64), environment (α=.80) and (α=.91) for the general scale. Reliability coefficient obtained for the general inventory and for five sub-dimensions were between 0.60 – 0.80 values regarded as quite reliable by Alpar (2001).

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Conflict of Interest
The authors declare that there is no conflict of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Choreography Strategies in Women's Artistic Gymnastics Floor Routines across Five Olympic Games

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Abstract

Routine compositions are an indicator of an exercising trend in a particular Olympic cycle in artistic gymnastics. The primary aim of the current study was to identify which acrobatic and dance elements significantly influence specific scores throughout five different Olympic Games (OG) in elite female artistic gymnasts: finalists of OG 2000-2016. A total of 40 female competitors, participants of floor apparatus finals competitions, were subjects of this study. The results identified the following: 1) at OG 2000, an under-sensitive scoring system did not allow the extraction of individual elements that significantly contributed to a specific score; 2) the performance of acrobatic elements from the highest difficulty groups had a significant impact in OG 2004; 3) At OG 2008, exercises comprising slightly easier elements, performed technically and aesthetically correctly, scored better than exercises comprising elements of higher difficulty values performed with specific technical and/or aesthetic errors; 4) at OG 2012, the performance of the most difficult acrobatic elements without technical errors was the key to a better result; 5) quality performance of the greatest difficulty acrobatic elements, as well as the performance of the highest bonuses between the acrobatic and dance elements was the key to success at OG 2016. The results of this research are possible indicators of future floor compositions in OG 2020 and provide guidance to everyone involved in the long-term planning and programming process of future floor finalists.

Keywords: *exercise trend, difficulty score, execution score, apparatus finals*

Introduction

While artistic gymnastics is a sport in which gymnasts perform short routines on all types of apparatus, except for the vault, floor exercises have remained the most attractive ones, both for the audience and judges. After the abandonment of compulsory exercises in 1996, many successful gymnastics federations were against this decision. However, following that, athletes had to start performing their optional routines according to the rules prescribed by the valid International Gymnastics Federation's Code of Points (CoP). The period between 2000 and 2016 was dramatic in artistic gymnastics and was full of changes, most notably in the judging system. The year 2006 brought the most relevant changes by introducing the open-ended system of scoring and by allowing the evaluation of the judge's performances through video analysis. The open-ended system was argued for by researchers, praising the improvement in judging difficulty but questioning the judging of artistry (Kerr & Obel, 2015). It was after the introduction of the open-ended system that Artistic Gymnastics became an individual technical sport with a highly tactical character. The selection of appropriate tactics is also crucial in extending the relatively short career of elite artistic gymnasts (Delaš Kalinski, Atiković, Jelaska, & Milić, 2016). The tactical character became obvious in choreographing floor exercises in which coaches had to start balancing the difficulty of the routine and the accuracy of the execution. Coaches continue to struggle in deciding whether to pick more difficult elements and increase the difficulty score, or to "play safe" and choose easier but clean execution. The International

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Gymnastics Federation Woman's Technical Committee makes the choice even more difficult by amending the CoP after each Olympic Cycle, and rules influence the composition of the routines and therefore performance (Massidda & Calo, 2012). The border between the difficulty of the exercise and the accuracy of the performance is represented by the level of the athlete's technical skills (Corlaci, 2018).

The majority of researches on this topic focus on male artistic gymnastics (Atiković, Delaš Kalinski, Bijelić, & Avdibašić Vukadinović, 2009; Čuk, Fink, & Leskošek, 2012; Čuk & Forbes, 2010; Leskošek, Čuk, & Bučar Pajek, 2013; Yu-jian, 2007) and are primarily focused on a single competition, such as World Championships or Olympic Games (Xiao-bo, 2007). Trends in choreographing male floor routines have already been debated (Rohleder & Vogt, 2019). The authors are in favour of the highest D score and state that current compositional trends in men's floor exercise encourages including difficult forward jumps and multiple twisting connections concerning the gymnasts' abilities and the decisive influence of stick landings. In contrast, women's artistic gymnastics (WAG) has been less researched (Delaš Kalinski, Božanić & Atiković, 2011), especially floor exercises (O. Donti, A. Donti, & Theodorakou, 2014). The most research reveals the tendency of doing high-risk acrobatic skills and difficult gymnastics elements, mainly by the leading athletes who are adequately prepared. As well as Donti et al. (2014), other researchers also report the continuous drive towards more difficult exercises while execution remained one step behind (Čuk et al., 2012). There is an obvious lack of scientific consensus on which strategy is better; however, regarding floor exercises, scientists agree that performing exercises with minimum errors is a better path.

Due to the constant rule changes between the Olympic Cycles and on an every-day coach's dilemma of whether to "play hard or play safe", a few essential questions arise 1) What influences different scores in a routine? 2) Which elements are crucial to get the best possible score? 3) Which strategy was the best in a specific Olympic Cycle? To answer these questions, the main aim of the current study was to identify which acrobatic and dance elements significantly influence specific scores throughout five different Olympic Games in elite women's artistic gymnasts: finalists of Olympic Games from 2000 to 2016.

Methods

The subject sample included a total of 40 female gymnasts, participants of floor Apparatus Finals Competitions that were held at the Olympic Games from 2000 to 2016. Data about gymnasts' official scores have been retrieved from a website (https://gymnasticsresults.com/). Their floor routines, performed on the analysed competitions, have been reviewed on the official Olympic YouTube channel and noted with gymnastics symbols by two expert gymnastics coaches and one Croatian (national) WAG judge. Accordingly, information and frequencies of performed elements have been obtained, together with the difficulty score (DS), execution score (ES), and final score (FS).

All data were presented using mean±standard deviation, minimal and maximal results together with skewness and kurtosis. One-way between subject's ANOVA together with Bonferroni correction was used to identify the differences in different scores between all analysed OG. Partial eta squared (partial η2) was used for effect size assessment. Furthermore, series of multiple regression analyses were applied to determine the impact of a specific element on different scores in each OG. For all statistical analysis, type one error was set at α=5%. All calculations were performed by using the Statistica v.13 data analysis software system (TIBCO Software Inc., USA).

Results

According to the results of the descriptive statistics of different scores through the entire analysed period, the values of DS experienced a decrease from OG 2000 up to OG 2012 and then a slight increase at the OG 2016 (Table 1). Secondly, the values of ES and FS experienced a continuous decrease from OG 2000 up to OG 2016. The majority of skewness values

Table 1. Descriptive Statistical Parameters of Different Scores in Floor Routines in the Apparatus Finals at the OG Held from 2000 to 2016; Results of One-Way ANOVA with Bonferroni correction

OG		Mean±SD	Min	Max	Skew	Kurt
2000	$DS^{08,12,16}$	9.98±0.07	9.80	10.00	-2.83	8.00
	$ES^{08,12,16}$	9.57±0.29	9.01	9.85	-1.23	0.78
	$FS^{08,12,16}$	19.52±0.34	18.81	19.85	-1.40	1.94
2004	$DS^{08,12,16}$	9.86±0.18	9.50	10.00	-1.52	1.79
	ES^{16}	9.34±0.37	8.50	9.75	-1.92	4.85
	$FS^{08,12,16}$	19.15±0.56	17.90	19.75	-1.85	4.36
2008	$DS^{00,04}$	6.25±0.22	5.80	6.50	-1.28	1.85
	ES^{00}	8.85±0.37	8.25	9.23	-0.94	-0.72
	$FS^{00,04}$	15.08±0.52	14.13	15.65	-0.91	0.00
2012	$DS^{00,04}$	6.13±0.28	5.60	6.50	-0.70	0.78
	ES^{00}	8.68±0.36	8.03	9.10	-0.62	-0.03
	$FS^{00,04}$	14.73±0.66	13.33	15.60	-1.28	2.95
2016	$DS^{00,04}$	6.29±0.43	5.40	6.90	-1.05	2.67
	$ES^{00,04}$	8.34±0.72	6.70	9.07	-1.97	4.89
	$FS^{00,04}$	14.59±1.23	11.80	15.97	-1.85	4.65

Legend: $^{00, 04, 08, 12, 16}$ - significant differences between the specified year and the year in superscript

indicate a shift in the distribution of the results towards the results that are higher than the average result. According to kurtosis values, larger groupings of results were found at distributions of the results of different scores.

The analysis of variance revealed significant differences between years for DS ($F_{35,4}$=468.01; p<0.001; η^2=0,371); ES ($F_{35,4}$=9.89; p<0.001; η^2=0.092) and FS ($F_{35,4}$=93.52; p<0.001; η^2=0.238) together with large effect size. Bonferroni correction revealed a significant difference between 1) DS and FS from OG 2000 and the same scores from OG 2008/2012/2016; 2) DS and FS from OG 2004 and the same scores from OG 2008/2012/2016; 3) ES from OG 2000 and the same score from OG 2008/2012/2016; 4) ES from OG 2004 and the same score from the OG 2016.

Examining the numerical values, primarily the elements with the highest difficulty values that comprise the DS of the exercise, we can see that the most difficult acrobatic element "double salto bwd tucked with 2/1 twist" (difficulty value H) experienced the largest numerical increase from OG2000 (when performed by one gymnast) to OG2016 (when performed by seven gymnasts) (Table 2). The opposite trend was observed in two elements during the analysed period 1) "bwd stretched salto with 3 twists" (difficulty value E) performed by 7 gymnasts in OG2000, and only one gymnast in OG2016; 2) "bwd stretched salto with 2 1/2 twist" (difficulty value D) performed by 6 gymnasts at OG2000 and only two gymnasts at OG2016.

Table 2. Frequencies of certain acrobatic and dance elements performed in floor routines at the OGs held from 2000 to 2016

Acrobatic elements	00	04	08	12	16	Dance elements	00	04	08	12	16
H: double salto bwd tucked with 2/1 twist	1	1	2	2	7	D: split jump with 1 1/2 turn	0	0	0	0	1
H: double salto bwd stretched with 1/1 twist	0	0	1	0	3	D: straddle pike or side split jump with 1 1/2 turn	0	0	1	0	0
H: Arabian double salto stretched	0	1	1	0	0	D: 2/1 turn with heel of free leg fwd at horizontal	0	2	1	2	1
G: double salto bwd stretched with 1/2 twist	0	0	0	0	1	D: 2/1 turn in back attitude	0	0	0	1	0
F: double salto bwd stretched	2	3	2	2	4	D: 2/1 turn with free leg held upward in 180° split position	0	0	0	1	2
F: Arabian double salto piked	0	1	0	1	1	D: 2/1 turn in tuck stand on one leg-free leg straight throughout turn	0	0	0	1	2
F: salto bwd stretched with 3 1/2 twist	0	1	0	0	0	C: 3/1 turn on one leg-free leg optional below horizontal	1	4	3	1	0
E: salto bwd stretched with 3 twist	7	4	6	6	1	C: split leap with 1/1 turn	3	1	6	1	2
E: double salto bwd tucked with 1/1 twist	2	2	4	2	3	C: switch leap with 1/2 turn	0	0	5	2	0
E: double salto bwd piked with 1/1 twist	0	3	2	3	0	C: switch leap to ring position	3	1	5	4	3
E: Arabian double salto tucked	1	0	0	3	1	C: johnson with 1/2 turn	1	0	2	2	0
E: double salto fwd tucked	0	1	1	0	0	C: straddle pike or side split jump with 1/1 turn	3	5	0	0	4
D: double salto bwd piked	5	5	4	6	6	C: split jump with 1/1 turn	0	0	1	0	0
D: double salto bwd tucked	0	0	0	1	1	C: cat leap with 2/1 turn	1	6	1	0	0
D: salto bwd stretched with 2 1/2 twist	6	5	5	4	2	C: tuck hop with 2/1 turn	2	6	0	0	0
D: salto fwd stretched with 2 twist	1	1	1	0	0	B: johnson	3	0	0	0	0
C: salto fwd stretched with 1/1 twist	0	0	4	3	1	B: switch leap	2	1	3	2	4
C: salto fwd stretched with 1 1/2 twist	0	0	3	0	0	B: hop with 1 1/2 turn in horizontal plane to lay in front lying support	1	0	0	0	0
C: salto bwd stretched with 2 twist	3	0	2	0	0	B: straddle pike or side split jump with 1/1 turn landing in front lying support	1	0	1	0	0
C: salto bwd stretched with 1 1/2 twist	1	0	5	4	3	B: stag ring jump	1	1	0	0	0
B: salto fwd with 1/2 or 1/1 twist	0	1	0	0	0	B: cat leap with 1/1 or 1 1/2 turn	1	6	0	0	0
B: salto fwd stretched	0	3	0	3	1	B: tuck hop with 1/1 turn	0	0	0	0	0
B: salto fwd stretched with 1/2 twist	0	0	3	0	1	B: wolf jump with 1/1 turn	4	0	0	0	0

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Acrobatic elements	00	04	08	12	16	Dance elements	00	04	08	12	16
A: walkover bwd from stand or extended tuck sit to hstd	0	0	1	0	0	B: 2/1 turn on one leg	4	3	3	0	0
A: salto fwd tuck or piked	4	1	2	0	0	B: 1/1 turn in back attitude	0	0	1	0	0
A: free walkover fwd	0	0	0	2	3	B: 1/1 illusion turn	1	0	0	0	1
A: whip salto	5	4	1	3	0	A: stag jump	0	0	0	4	0
A: free ariel	0	0	0	0	1	B: stag jump with 1/1 turn	0	0	0	0	0
A: salto bwd tucked	0	0	0	2	0	B: 1/1 turn in back attitude	0	0	0	0	0
Dance elements						A: split leap fwd	1	1	0	2	0
E: 4/1 turn on one leg	0	1	0	1	1	A: straddle pike or side split jump landing in front lying support (also 1/2)	5	0	0	0	0
D: switch leap with 1/1 turn	0	0	0	4	7	A: split jump	0	0	0	1	4
D: split leap with 1 1/2 turn	0	4	0	7	6	A: sissone	0	0	0	0	0
D: split leap to ring position with 1/1 turn	0	0	0	1	2	A: 1/1 turn	0	0	0	1	2

Regarding the dance elements, the "switch leap with 1/1 turn" (difficulty value D) had the largest increase over the years. While it was not performed at all in OG2000, OG2004 and OG2008, as many as seven competitors performed it at OG2016. In contrast, high frequency jumps at the beginning of the analysed period (OG2000), whose appearance was not noted at OG2016, include the following: "straddle pike or side split jump landing in front lying support ½" (difficulty value A), "wolf jump with 1/1 turn" and "johnson jump" (difficulty value B).

According to the results of the regression analyses (Table 3), only a few of all the derived elements had a significant influence on a particular score on certain OGs. No significant influence of any element was identified at OG 2000, while at other OGs elements were found to have significant impacts of different scores, characterized by a) high difficulty values; b) double rotations around the transverse axis of the body ("double salto bwd tucked/piked/stretched"); c) multiple rotations around the longitudinal axis of the body ("salto bwd stretched with 2½ or 3 twists"); d) double rotations around the transverse and simultaneous rotations around the longitudinal axis of the body ("double salto bwd stretched with ½, 1/1 and 2/1 twists"). From OG2008 to OG2016, from the area of dance elements, significant influences on different scores were determined by the "switch leap" and its more difficult derivatives ("switch leap with 1/2 turn and 1/1 turn") and also, the jumps "johnson with 1/2 turn" (OG2012) and "split jump with 1 1/2 turn" (OG2016).

Table 3. Results of regression analyses between specific elements and difficulty (DS), execution (ES) and final scores (FS) at OG 2000-2016

			Element	β	SE(β)	b	SE(b)	p
00	DS	R=0.95 R2=0.90 F(5.2)=3.63 p=0.22	D: salto bwd stretched with 2 1/2 twist	0.97	0.30	0.15	0.05	0.09
			D: double salto bwd piked	-0.06	0.37	-0.01	0.05	0.88
			C: salto bwd stretched with 2 twist	0.51	0.24	0.07	0.03	0.17
			A: salto fwd tuck or piked	0.66	0.43	0.09	0.06	0.26
	ES	R=0.89 R2=0.79 F(3.4)=4.99 p=0.08	B: wolf jump with 1/1 turn	-0.39	0.35	-0.05	0.05	0.37
			A: whip salto	0.44	0.29	0.25	0.16	0.20
			D: double salto bwd piked	-0.53	0.23	-0.30	0.13	0.08
			C: salto bwd stretched with 2 twist	0.34	0.29	0.19	0.16	0.30
	FS	R=0.84 R2=0.71 F(3.4)=3.332 p=0.14	A: whip salto	0.31	0.34	0.21	0.22	0.41
			D: double salto bwd piked	-0.50	0.27	-0.33	0.18	0.14
			C: salto bwd stretched with 2 twist	0.45	0.34	0.30	0.22	0.25
04	DS	R=0.87 R2=0.76 F(3.4)=4.13 p=0.10	C: tuck hop with 2/1 turn	0.96	0.35	0.37	0.13	0.05
			E: salto bwd stretched with 3 twist	1.21	0.49	0.40	0.16	0.07
			B: salto fwd stretched	-0.88	0.55	-0.30	0.19	0.19
	ES	R=0.96 R2=0.93 F(2.5)=33.71 p=0.00	E: salto bwd stretched with 3 twist	1.53	0.19	1.05	0.13	0.00
			F: double salto bwd stretched	1.17	0.19	0.83	0.13	0.00
	FS	R=0.96 R2=0.92 F(2.5)=27.63 p=0.00	E: salto bwd stretched with 3 twist	1.51	0.20	1.58	0.21	0.00
			F: double salto bwd stretched	1.15	0.20	1.23	0.22	0.00

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			Element	β	SE(β)	b	SE(b)	p
08	DS	R=0.88 R2=0.78 F(3.6)=6.97 p=0.02	C: split leap with 1/1 turn	-0.61	0.20	-0.35	0.11	0.02
			E: salto bwd stretched with 3 twist	-0.53	0.21	-0.30	0.12	0.05
			F: double salto bwd stretched	-0.33	0.21	-0.20	0.13	0.17
	ES	R=0.96 R2=0.92 F(4.5)=13.91 p=0.01	E: double salto bwd tucked with 1/1 twist	0.89	0.14	0.57	0.09	0.00
			E: salto bwd stretched with 3 twist	-0.82	0.15	-0.54	0.10	0.00
			B: switch leap	-0.48	0.14	-0.31	0.09	0.02
			H: double salto bwd tucked with 2/1 twist	-0.37	0.13	-0.26	0.09	0.04
	FS	R=0.99 R2=0.99 F(6.3)=63.91 p=0.00	C: split leap with 1/1 turn	-0.92	0.08	-0.97	0.09	0.00
			C: switch leap with 1/2 turn	0.33	0.07	0.34	0.08	0.02
			E: salto bwd stretched with 3 twist	-0.58	0.07	-0.62	0.07	0.00
			F: double salto bwd stretched	-0.70	0.09	-0.80	0.10	0.00
			D: double salto bwd piked	0.40	0.09	0.41	0.10	0.02
			C: switch leap to ring position	0.19	0.08	0.20	0.08	0.09
12	DS	R=0.99 R2=0.99 F(4.3)=124.13 p=0.00	D: double salto bwd piked	0.82	0.06	0.50	0.03	0.00
			E: Arabian double salto tucked	0.61	0.05	0.33	0.03	0.00
			A: salto bwd tucked	0.11	0.06	0.07	0.04	0.16
	ES	R=0.71 R2=0.51 F(1.6)=6.19 p=0.05	D: salto bwd stretched with 2 1/2 twist	-0.10	0.06	-0.05	0.03	0.23
			C: johnson with 1/2 turn	-0.71	0.29	-0.55	0.22	0.05
	FS	R=0.76 R2=0.57 F(1.6)=8.02 p=0.00	C: johnson with 1/2 turn	-0.76	0.27	-1.08	0.38	0.03
16	DS	R=0.95 R2=0.90 F(2.5)=22.04 p=0.00	D: split jump with 1 1/2 turn	-0.76	0.14	-0.93	0.18	0.00
			G: double salto bwd stretched with 1/2 twist	0.46	0.14	0.57	0.18	0.02
	ES	R=0.99 R2=0.99 F(3.4)=103.90 p=0.00	D: split jump with 1 1/2 turn	-1.13	0.06	-2.28	0.13	0.00
			B: switch leap	0.45	0.07	0.61	0.09	0.00
			D: double salto bwd tucked	-0.22	0.06	-0.45	0.13	0.03
	FS	R=0.99 R2=0.99 F(3.4)=95.37 p=0.00	D: split jump with 1 1/2 turn	-1.13	0.07	-3.93	0.23	0.00
			B: switch leap	0.48	0.07	1.11	0.17	0.00
			D: double salto bwd tucked	-0.23	0.07	-0.80	0.23	0.03

Discussion

In the CoP that were valid for a specific analysed period, new difficulty groups of elements appeared, and an increasing number of elements of the highest difficulty groups were derived. Such floor exercise trends, in addition to being partly a consequence of the improvement of the construction of the apparatus, indicate an improvement in the methodology of teaching structurally more complex dance and acrobatic elements, but also an improvement in the preparation of the organism itself to perform these elements. In contrast, a constant decrease in the average values of all scores (DS, ES, and FS) was found. One can conclude that the efforts of the trainees to perform such elements generally led to lower technical and aesthetic quality of the floor compositions. However, it is evident from the examination of the routines that such a conclusion is completely incorrect and that the reduced values of the scores are not due to the lower quality of performance of the elements in the final floor exercises, but to the constant tightening of the evaluation criteria in the analysed period.

The lack of significant influences of elements on any score at OG2000 is an indication of an inadequate and insensitive way of judging at the highest levels of competition (where the quality and uniformity of competitors is higher than in other competitions), confirms the findings of Leskošek et al. (2013) who found excess judges' variability in vault and floor exercises. They attempted to explain these results as a result the shortage of time available to assess the specific vault and by the need for highly subjective judging of artistry and music in floor routines. However, it seems that by the introduction of videotaping and the possibility of re-watching the execution, the reliability and sensitivity of judging has increased.

Considering the extraction of two acrobatic elements from the higher difficulty groups at OG2004 (E: "salto bwd stretched with 3 twists" and F: "double salto bwd stretched") as significantly positive for ES and consequently for FS, it can be concluded that "heavy" acrobatics was a good choice in the floor routines in these OGs. The positive influence of these elements on the ES leads to the conclusion that their performance was free from technical and/or aesthetic errors. However, this conclusion should be taken with caution since these are technically extremely demanding elements, espe-

cially in the landing stages. It is more likely that deductions for technical and aesthetic errors that arose from the performance of these elements were not prescribed in that CoP, but this remains to be verified by further research. As the ES determines the final ranking in the Vault Finals for female gymnasts (Delaš Kalinski, Jelaska, & Atiković, 2017) even with heavy acrobatic elements, it is presumed that similar situation occurs in floor exercises as well, probably because of the need for a higher number of accurately performed landings.

According to the results of the regression analyses for OG2008, two variables were extracted that significantly and negatively affected DS: the dance element C: "split leap with 1/1 turn" and the acrobatic element E: "salto bwd stretched with 3 twists". Although these are elements of high difficulty values that almost certainly became part of the DS, since each of these two elements was performed by six competitors, the performances of these elements did not contribute to their differentiation, and the impact on the DS was found to be negative. Of the four variables (three acrobatic and one dance element), only "double salto bwd tucked with 1/1 twist", had a positive effect on the ES. One can assume that the performance of this element was not characterized by specific technical and/or aesthetic errors, thus contributing to higher ES values. For acrobatic elements belonging to high-value difficulty groups (E: "salto bwd tucked with 3 twists", H: "double salto bwd tucked wit 2/1 twist") and whose performances without technical and/or aesthetic errors are very rare, the negative impact on ES is a logical result.

In contrast to these complex elements, the finding of a negative impact of the structurally non-complex jump B: "switch leap" performed by three competitors, whose difficulty value almost certainly did not form part of the DS, is probably due to the "role" of this jump in the routines of these competitors. Namely, this element is most often used to fulfil a special requirement related to the connection of two jumps, at least one of which must be a jump with a "switch", so the errors in the performance of this jump may be directly the result of a connection with another dance element. Determining the positive impact of some other, slightly easier elements ("switch leap with 1/2 turn", "double salto bwd piked", and "switch leap to ring position") on FS indicates that, according to CoP 2005-2008, to achieve higher FS values in the final floor competition, it was more desirable to have routines composed of slightly easier elements, performed technically and aesthetically correctly, than routines composed of higher difficulty elements performed with certain technical and or aesthetic errors. Confirmation that the performances of high difficulty acrobatic elements at OG2012 (D: "double salto bwd piked" and E: "Arabian double salto tucked") were technically and aesthetically good and contributed to higher DS, is the determination of their positive effect on DS, and the absence of a negative effect on ES. In contrast to these variables, a negative impact on ES, and probably consequently on FS, was determined by C: "johnson with 1/2 turn". However, the premise that this was a performance characterized by certain technical and/or aesthetic errors should be researched given the lower determination values of these criterion variables by a set of predictor variables.

The importance of the quality performance of the highest difficulty acrobatic elements is again emphasized in the results at OG2016. The significant positive influence of the element G: "double salto bwd stretched with 1/2 twist" on DS was found. Since this is an element whose DS contribution is extremely high (0.7 points), this result is logical. Unlike this acrobatic element, which was performed for the first time at OG2016 and immediately had a (positive) effect on DS, the inverse effect was determined for element D: "double salto bwd tucked" on ES and, consequently, FS. Although it is an element whose difficulty is likely to be part of the DS, the additional judge's review of the performance of the only female athlete who performed this element on these OGs found that the element was performed with a classic error related to the same: the gymnast did not sufficiently rotate the element. The deduction for this element is not expected at this level of competition, but given that it was performed within the connection and a shortened run-in, it is not unexpected. The aforementioned leads to the conclusion that the performance of this and similar acrobatic connections, which due to the shortened run-in for the performance of the second element, often have specific errors in the performance of that (second) element, are probably not "useful" for the final result. However, because of the extremely low dispersion of DS at this level of competition, we believe that it is precisely the connections, along with the better performance of other elements, that play a role in the creation of DS, and consequently the FS.

The negative impact of D: "split jump with 1 1/2 turn" on DS and ES is probably because it was a part of the routine of only one (i.e., the worst placed) finalist in the OG2016. Considering that this is the highest-level competitor, this result can be seen through stricter evaluation criteria, which were defined in WAG CoP 2013-2016. In contrast to this complex dance element, a positive influence on the ES and, in particular, on the FS, was found for B: "switch leap". Therefore, the positive influence should be looked especially through the performance of this leap, but also through the fact that by linking this leap with higher difficulty leaps adds bonuses to the final scores, which further emphasizes the importance of the links and/or value of the bonuses of those links in the final result.

The best gymnasts' routines at the highest-level competitions best illustrate what kind of routines gymnasts aspired to, to make the most out of the prescribed rules. Introspection of the frequencies of acrobatic elements in the analysed period generally indicates a decrease in the frequencies of elements with multiple rotations around the longitudinal axis of the body and an increase in the frequencies of elements that requires simultaneous multiple rotations around the transverse and longitudinal axis. For dance elements, jumps with small amplitudes disappeared, frequencies of jumps characterized by only large amplitudes decreased, and an increase in the frequencies of jumps with high amplitudes and rotations around the longitudinal axis of the body was observed.

According to the established results, despite the continuous decrease in the values of DS, ES, and FS, and due to the emergence of new difficulty groups of elements and increasing frequencies of elements from such groups, visible progress in the structural complexity of floor routines during the analysed period was observed. Moreover, the quality of performance is the most important aspect and, according to also the results from OG2016, the connections between acrobatic and dance elements. If the results from OG2016 are seen as a springboard for the results at OG2020, it is to be expected that the routines will consist of a large number of connections of elements of the highest difficulty values.

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Conflict of Interest
The authors declare that there is no conflict of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Differences of Physical Fitness Performance between Basketball Players from Different Competitive Levels (Elite and Sub-Elite) in the State Union of Serbia and Montenegro for the 2004/2005 Season

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Abstract

The purpose of this research was to describe the physical fitness of basketball players from different competitive levels for the 2004/2005 season and to make comparisons between them. The sample included 96 participants divided into two sub-samples; the first sub-sample comprised 48 participants who competed in the First Basketball League of Serbia and Montenegro; the second sub-sample comprised 48 participants who competed in the Second Basketball League of the State Union of Serbia and Montenegro. Standardized tests for the assessment of physical fitness performance were used. Data were analysed using SPSS software, and the descriptive statistics were expressed as a mean and standard deviation for each variable, while the t-test for small independent samples was carried out to detect the possible differences. The results showed that significant differences were found for all nine tests, and the highest differences are found in the results of sit-up and vertical jump tests. Therefore, these findings may give coaches from the region better working knowledge and help them select talented players in the best manner possible.

Keywords: *basketball, motor ability, first league, second league*

Introduction

Basketball is a sport that is essentially available to anyone because it does not require expensive equipment and courts are found in many places; this accounts for the sport's incredibly rapid spread and great popularity (Dogan & Ersoz, 2019). More than 25 million people play basketball casually worldwide (Stopher, 2020); however, the success and opportunity to play basketball professionally is reserved exclusively for the most talented and most capable individuals (Popovic, Akpinar, Jaksic, Matic, & Bjelica, 2013; Vukasevic, Mitrovic, & Masanovic, 2020).

The basic measuring unit of success in elite basketball is the score of the game (Arruda et al., 2014); first, it is necessary to select athletes with an appropriate physique (Monsoon, Brasil, & Hlusko, 2019; Masanovic, 2018), with exceptional psycho-physical predispositions (Karalejić & Jakovljević, 2008; Remiszewska, Miller, Graczyk, & Lachowicz, 2020), and then through long-term and diligent work to improve their performance (Branquinho et al., 2020; Jeon & Eom, 2020; Gardasevic & Bjelica, 2018; Gardasevic & Vasiljevic, 2017). It is generally known that an elite basketball player must possess a polyvalent technique, exceptional morphological characteristics, high functional capacity, as well as explosiveness, coordination, precision and balance, accompanied by cognitive factors of per-

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ceptual reasoning (Trninić, 1996; Sekeljic & Stamatovic, 2008; Karalejić & Jakovljević, 2008; Dragaš, 2011; Ozen, Atar, & Koc, 2020). However, the extent of the influence of certain elements on the success of elite athletes remains difficult to distinguish. This is also influenced by the fact that basketball is a game of divided roles (point guard, the shooting guard, the small forward, the power forward and the centre), and that different characteristics are needed to fulfil different tasks in the game (Krespi, Sporis, & Popovic, 2019; Masanovic, 2019). Therefore, a separate specification equation can be compiled for each playing position (Dragaš, 2011). To specify the extent of the influence of individual characteristics on success would contribute to discovering the nuance that distinguishes good players and those who win medals and to make the training process more economical; this would further contribute to shifting the boundaries of sporting success in certain disciplines.

Characteristics contributing to success in basketball are possible to identify by comparing elite basketball players and sub-elite-level players or comparing basketball players and athletes from other sports with the same fitness level (Delextrat, & Cohen, 2008). In this study, the role of physical fitness on the success of elite basketball players was considered, and success was equated with the rank in which they compete. Therefore, this study aims to determine the level of motor abilities of basketball players from different competitive levels (elite and sub-elite) to assess whether there are differences in motor abilities between basketball players of different levels of competition which motor abilities have the highest difference.

Method

The population of this retrospective cross-sectional study comprises a total of 96 male basketball players divided into two groups. The first sub-sample consisted of 48 players who play for four teams in First League of the State Union of Serbia and Montenegro (Hemofarm from Vršac, Atlas from Belgrade, Mornar from Bar, Lovcen from Cetinje), with an average age of 23.92±5.03 years, while the second sub-sample consisted of 48 players who play for four teams in the Second League of the State Union of Serbia and Montenegro (Vrbas from Vrbas, Lions from Vršac, Ulcinj from Ulcinj, Tivat from Tivat), with an average age of 22.27±4.03 years. The study was approved by the Basketball Federation of Serbia and Montenegro and was conducted in January 2005. The condition for participation in the experiment was optimal psycho-physical health, s minimum of five years of active training and playing, and 70% of games played in the previous season. All study participants gave written informed consent to participate in this study, and they were also able to revoke their participation in testing at any time, but none of them decided to do so.

For the assessment of the motor abilities, nine standard motor tests were applied (Karalejić & Jakovljević, 1998; Rinaldo, Toselli, Gualdi-Russo, Zedda, & Zaccagni, 2020). Movement tasks have been chosen so as to cover all the essential physical characteristics of an athlete and an ever-increasing topographic muscular region. The following motor skills were tested: speed (20m dash), lower and upper limb explosive strength (vertical jump, standing triple jump and distance ball), trunk and upper body repetitive strength and muscle endurance (sit-up and push-ups), agility (4×5m run, T drill), speed endurance (suicides). All motor tests were conducted in an indoor basketball court. Before testing, the players performed a 20-minute warm-up, under the guidance of a coach.

The data obtained by the research were processed using descriptive and comparative statistical procedures. The descriptive statistics were expressed as a mean (SD) for each variable. Differences in the motor skills of basketball players from different competitive levels (elite and sub-elite) in the State Union of Serbia and Montenegro were assessed using a discriminative parametric procedure, t-test for small independent samples. A level of $p<0.05$ was considered statistically significant. All statistical analyses were conducted using SPSS software version 20.0 (Chicago, IL, USA).

Results

The motor abilities of basketball players from different competitive levels (elite and sub-elite) in the State Union of Serbia and Montenegro are shown in Table 1. Based on the values obtained with the t-test, it can be observed that there is a statistically significant difference in the performance on each test in favour of elite basketball players (First League). The highest difference was found in the vertical jump (t=7.414; p=.000) and sit-up (t=7.439; p=.000) tests.

Table 1. Descriptive data and differences of male basketball players from different competitive levels enrolled in the study (n=96)

Variable	First League (Mean±SD)	Second League (Mean±SD)	t	p
20m dash (s)	3.22±0.22	3.35±0.28	-2.619	.010*
Distance ball throw (m)	18.53±1.48	17.36±1.02	4.522	.000*
Vertical jump (m)	59.35±5.59	51.54±4.69	7.414	.000*
Standing triple jump (m)	7.67±0.51	7.16±0.36	5.643	.000*
Sit-up (30s)	35.83±3.56	30.48±3.49	7.439	.000*
Push-ups (n)	14.9±5.24	12.1±5.77	2.482	.015*
4×5m run (s)	6.94±0.35	7.26±0.41	-4.177	.000*
T drill (s)	9.07±0.49	9.53±0.69	-3.731	.000*
Suicides (s)	27.77±1.4	29.36±1.52	-5.347	.000*

Legend: Mean - Arithmetic mean; SD - Standard deviation; t - t test value; p - Statistical significance; * - Significant difference

Discussion

This study aimed to make a specific contribution to supplement the existing database regarding basketball players' fitness for a set period and discover which motor abilities had contributed most to success. It was known that the players and teams, as well as the national team of the Federal Republic of Yugoslavia (i.e., the State Union of Serbia and Montenegro as it was called between 2003 and 2006) always achieved sig-

nificant success on the international competition scene. The exceptional morphological predisposition of players from this area had certainly contributed to these successes, because it is generally known that the inhabitants of this region are among the tallest in the world (Popovic, Bjelica, Molnar, Jaksic, & Akpinar, 2013; Popovic, 2017; Gardasevic, 2019a; Gardasevic, 2019b; Gardasevic, Masanovic, & Arifi, 2019; Starc et al., 2019; Masanovic, Gardasevic, & Arifi, 2019; Masanovic, Bavcevic, & Prskalo, 2019; Popovic, Masanovic, Martinovic Bjelica, & Gardasevic, 2020; Arifi, Masanovic, & Gardasevic, 2020; Masanovic, Gardasevic, & Bjelica, 2021), but without exceptional motor potential, they would not be able to achieve top results (Rienhoff et al., 2013; Masanovic et al., 2020). The proportion of certain characteristics has been described by the specification equations calculated for each sport separately (Gusic, Popovic, Molnar, Masanovic, & Radakovic, 2017; Masanovic, Corluka, & Milosevic, 2018; Arifi, Bjelica, & Masanovic, 2019). Earlier studies have argued that the elements contained in the specification equation should be a guideline for work, regardless of whether it is a selection process or a training process. However, basketball is changing, the tasks that players have to perform are becoming more complex, and the shares of individual characteristics in the equation of specification are changing. Also, the differentiation between positions in the team is higher than before, so different characteristics are required for different individual tasks that players perform; consequently, the specification equation can be set for each position separately (Petway, Freitas, Calleja-González, Medina Leal, & Alcaraz, 2020). This trend of change will continue to exist, and in order to be able to predict it, it is necessary to know at what pace the changes have taken place thus far. Therefore, it is periodically necessary to present data on top athletes' characteristics and update the databases with unpublished data for certain periods. Given that in certain sports, the details decide the winner (Masanovic, Milosevic, & Bjelica, 2019), the share of each motor ability in success must be calculated as precisely as possible.

Previous research does not fully agree regarding the order of motor skills according to their impact on basketball success: some emphasize that speed comes first (Abdelkrim, El Fazaa, & El Ati, 2007), some that it is strength (Delextrat & Cohen, 2008; Chaouachi et al., 2009; Ziv & Lidor, 2010), some that it is agility (Spiteri et al., 2014), but all agree that abilities must be expressed efficiently and economically over the course of four quarters with contributions from both aerobic and anaerobic energy pathways (Schelling & Torres-Ronda, 2016).

The results of descriptive statistics show that elite players from this study (the First League of the State Union of Serbia and Montenegro) achieved significantly better results than players of sub-elite level of competition (the Second League of the State Union of Serbia and Montenegro) for each motor ability. A difference in favour of the elite players is the highest for trunk muscle repetitive strength and endurance (elite players perform an average of 5.35 sit-up more in 30 seconds than sub-elite level players), than for lower and upper limb explosive strength (elite players have an average of 7.81 cm higher vertical jump than sub-elite level players, an average of 51 cm longer triple jump, and an average of 117 cm longer distance ball throw) speed endurance (elite players perform the distance in suicides test on average 1.99 seconds faster than sub-elite level players). A slightly lower difference, but still observable, is in the level of agility (elite players 4×5 m on average perform 0.32 seconds faster, and the T drill test 0.46 seconds faster than sub-elite level players). A difference in favour of the elite players is the lowest for speed (elite players distance 20 m on average perform for only 0.15 seconds faster than sub-elite level players) and upper body repetitive strength and muscle endurance (elite players perform an average of 2.8 push-ups more than players of sub-elite levels). Based on all the above, it can be concluded that success in basketball is significantly affected by all tested motor skills and that their order from the most influential to the least influential is as follows: trunk muscle repetitive strength and endurance; lower limb explosive strength; upper limb explosive strength; speed endurance; agility; speed; upper body repetitive strength and muscle endurance.

It is also interesting to compare the results of the players covered by this study with the professional players from other countries. It can be observed that players from the First League of the State Union of Serbia and Montenegro ran a distance of 20 metres at an average 3.22 seconds which is a few hundredths of a second slower than professional players from Norway and Croatia who ran the same distance with an average time of 3.2 seconds (Milanović, Jukić, & Marković, 2004; Shalfawi, Sabbah, Kailani, Tønnessen, & Enoksen, 2011), and a few hundredths of a second faster than elite British players who ran a distance of 20 metres at an average 3.29 seconds. The time in which the players from the Second League in the State Union of Serbia and Montenegro run the same distance is slower (3.35 seconds), based on which it can be concluded that they still have lower performance than elite European players.

Although faster in running, the same group of professional players of Norway, in the values of the vertical jump lags significantly behind the players from the First League in the State Union of Serbia and Montenegro. The average Norwegian jump height is 48.2 cm, which is considerably lower than the 59.35 cm of players from the First League in State Union of Serbia and Montenegro and 51.54 cm of players from the Second League in the State Union of Serbia and Montenegro. Also, significantly lower results on the same test were achieved by professional Tunisian players and British elite players who measured a 49.5 cm and 56.6 cm jump, respectively (Delextrat & Cohen, 2008; Chaouachi et al., 2009). However, these results are far lower than those achieved by players in the NBA league, who had the average value of a vertical jump of 72.9 centimetres (Hoffman, 2006), which is not a surprise given that it is the highest quality basketball league in the world.

Something similar is seen in the T drill test for the evaluation of agility, where the average running result of players of the First League in State Union of Serbia and Montenegro (9.07 seconds) is slightly faster than the result of the professional players from Tunisia (9.7 seconds), also from elite players from Great Britain (9.21 seconds) and Turkey (9.25 seconds) (Delextrat & Cohen, 2008; Chaouachi et al., 2009; Alemdaroglu, 2012). The time for which the same test is completed by the players from the Second League in the State Union of Serbia and Montenegro is slower (9.53 seconds), based on which it can be concluded that they still have lower performance than elite European players.

Finally, when it comes to speed endurance, players from the First League of State Union in Serbia and Montenegro showed slightly faster-than-average running time (27.77 seconds) for suicide test compared with elite Australian (28.1

seconds) and British (28.97) players (Bloomfield, Ackland, & Elliot, 1994; Delextrat & Cohen, 2008). The time for which the players from the Second League of the State Union of Serbia and Montenegro complete the same test is also slower (29.36 seconds), based on which it can be concluded that they still have lower performance than elite European players.

Based on the results, it can be concluded that players who play in the First League in the State Union of Serbia and Montenegro had high motor potential in the 2004/2005 season. The fact that the measurement was performed at the start of the second part of the competitive season certainly influences the results, and it is to be expected that the results during the playoffs would be far better. This study also has one limitation: the sample of elite players did not include basketball players from Partizan from Belgrade and Red Star from Belgrade, who are traditionally the best teams in Serbia, and also Buducnost from Podgorica, which is the most famous Montenegrin club. However, Hemofarm from Vršac played in the playoff finals that year and was defeated by Partizan with a close result, and Atlas from Belgrade was better placed in the championship than Buducnost from Podgorica, which means that the sample still included the best players in the league.

It is also worth noting that this study has achieved its goal: specifically, it has notably supplemented the existing database regarding the motor abilities of the players from First and Second Leagues in the State Union of Serbia and Montenegro for the 2004/2005 season. A complete sample of the respondents gives a clear picture of the situation in the elite and sub-elite competition level. The strength of this study is that the data contain accurate information about the time the measurement was performed, which allows these data to be used as a reference for comparison with the situation today and in the future.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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ORIGINAL SCIENTIFIC PAPER

Effects of Bodypump Exercise on the Emotions and Life Satisfaction among Women during the Coronavirus Pandemic

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Abstract

The study aimed to investigate the effect of the Bodypump exercise on women's' emotions and life satisfaction during the coronavirus epidemic. To achieve this, we used the quasi-experimental approach on a sample consisting of (34) untrained healthy women, divided into two groups (17) as a control group and (17) as the experimental group. Because of the home quarantine and, in order to face-to-face interaction, we used a questionnaire to measure the emotions and life satisfaction level using the Google Forms web tool. The study tool consisted of 40 paragraphs divided into 20 paragraphs for emotions and 20 paragraphs for life satisfaction. Before applying the experiment, the emotions and life satisfaction were measured among the study sample; next, the experimental group applied the Bodypump exercise programme. Also, the study results have shown that the level of life satisfaction and positive emotions among the two groups came with a low average in the pre-measurement, as well as the emotional stability domain that was the most affected in a negative way through the coronavirus epidemic. Additionally, statistically significant differences existed between the pre and post-measurement in the emotions and life satisfaction among the two groups and in favour of the experimental group.

Keywords: *emotions, life satisfaction, bodypump, female, coronavirus*

Introduction

It is normal for individuals to feel fear, stress and high anxiety during the coronavirus outbreak; this virus is new, and there is no vaccine at the time the present paper is being written (Woods, 2020). Also, people cannot receive medical care in health facilities for fear of contracting the virus. Furthermore, the fear of loss of livelihoods, social isolation, and social relationships leads to boredom and loneliness (Mohammed, Sheikh, & Gidado, 2015; Kinsman, 2012). Wang et al. (2020) indicate that 53.8% of the sample study in China during the coronavirus outbreak had moderate to severe psychological effects, 16.5% had moderate to severe depression, 28.5% had moderate to severe anxiety, and 8.6% suffered from moderate to severe stress. Therefore, the high psychological indicators may affect the efficiency and effectiveness of their immune system, as it is affected by many variables, including social life, mood, depression and anxiety (Woods, Lu, Ceddia, & Lowder, 2000). Studies indicate that people with high-stress levels are more likely to be infected due to imbalances in hormone secretion regulation, which may reduce their immune response (Schmidt, Lichtblau, Minkwitz, Chittka, & HormDnn, 2014).

In general, physical activity at least three times a week for 30 minutes reduces stress and symptoms of depression. Furthermore, this facilitates the release of the endorphin hormone, which is linked to the immune system, as the immune cells are able to produce this hormone; this reflects the bilateral relationship between the nervous system and the immune system, which can be improved in response to physical activity

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(Jonsdottir, 2000). Physical activity improves self-confidence, reduces the risk of depression and improves mood (Tesarz, Schuster, Hartmann, Gerhardt, & Eich, 2012). Furthermore, it contributes to controlling the level of cortisol in the body, which contributes to reducing stress and anxiety, as well as the risk of depression (Bao & Swaab, 2010). There is no question about the positive role of regular physical activity on brain health and thus improved motor communication enetworks (Alicia, 2015). Additionally, physical activity is associated with improving various psychological aspects, such as self-esteem and social interactions, and reducing symptoms of depression (Eime, Young, Harvey, Charity, & Payne, 2013).

The Bodypump exercises consist of a group of exercises divided into nine tracks; each track includes a group of different exercises in terms of weight, range of motion, speed of movement, volume and intensity of the exercise, which are performed for 70-100 repetitions in each track; thus, the total repetitions in the training unit reach 800 repetitions, which last from 30-60 minutes (Harber, Fry, Rubin, Smith, & Weiss, 2004; O'Connor & Lamb, 2003). It is a programme designed to use low weights with high repetitions, and it is the key to improving muscle endurance and increasing metabolic efficiency. This programme mainly aims to reduce obesity and inactive lifestyles by burning calories and fat and improving aerobic fitness (Pritchett, 2014; Les Mills, 2013).

Studies also indicate that many positive psychological benefits can be achieved through this programme, including the emergence of high levels of satisfaction, pleasure and happiness, improved social interaction and low negative feelings and high levels of psychological well-being (Ho, 2000; Lythe, Pfitzinger, & Ho, 2000; Lythe, 2001). Furthermore, satisfaction with life reflects positively on the ability of the individual to confront the situations that interfere with his daily life so that he is less anxious and stressed; this marks it as one of the signs of positive mental health, also an indicator of psychological well-being (Suldo & Huebner, 2006). Empirical evidence indicates that people who enjoy a high level of satisfaction with life have a high level of psychosocial performance, as well as successful social relationships with others, and have fewer behavioural problems with others (Gilman & Huebner, 2006; Suldo & Huebner, 2006; Proctor, Linley, & Maltby, 2010). Additionally, these exercises positively affect the psychological aspects of the practitioners and reduce their mood swings (Les Mills, 2013).

Through the review of many previous studies related to Bodypump exercises, we found that many of them focus on these exercises' physiological effects, such as their effect on the heart, VO_2 max, and blood lactate (Pritchett, 2014). Some of them dealt with its effect on obesity, metabolic processes and the calories expended during the performance of these exercises (Les Mills, 2013). The researchers note a decrease in studies that deal with its effect on the psychological aspects among individuals, which is an urgent necessity during the coronavirus pandemic and the accompanying social distancing. Accordingly, this study aimed to identify the level of life satisfaction and positive and negative emotions among women during the coronavirus pandemic, in addition to the effect of practising Bodypump exercises on these psychological aspects; therefore, the results of this study may contribute to improving their productive ability and developing their communication skills. These findings inform future research and offer insights for policies and interventions aimed at caring for people's psychological well-being during epidemics.

Methods

Patients and study design

To achieve the objectives of the study, we have been using the quasi-experimental approach and Bodypump programme on (34) untrained healthy women. Divided into two groups, each with 17 members: a control group (age, 22.3±2 years; height, 164±5.2cm; body mass, 63.5±3.8kg) and an experimental group (age, 24.5±2 years; height, 160±8.2cm; body mass, 61.8±3.8kg). The members of the study sample did not suffer from any disease, and they had never practised these exercises.

The experiment

Due to the curfew in Jordan and to reduce face-to-face interactions, we built a study tool consisting of a set of questions by using the Google Forms web tool, which consists of 20 paragraphs to measure the level of life satisfaction (psychological stability, social interaction, optimism and emotional stability) and 20 paragraphs to measure the positive and negative emotions by sending the link by the WhatsApp application, where the study sample was confirmed after completing the questionnaire, by pressing "send". The study tool consisted of five paragraphs associated with psychological stability, five paragraphs associated with social interaction, five paragraphs associated with optimism, and five paragraphs associated with emotional stability. An additional 10 paragraphs were associated with positive emotions, and 10 paragraphs were associated with negative emotions.

Before applying the experiment, the level of life satisfaction, the positive and negative emotions were measured among the study sample (for two groups), then the Bodypump programme was sent to the experimental group through the WhatsApp application; it included warm-up exercises, squat, back, shoulders, triceps, biceps and abdomen exercises. It was

Table 1. Exercise programme for the BodyPump group (release no.83)

Music no.	Exercise	Volume (reps)
1 Warming-up Straight leg	deadlift, rowing, shoulder press, squat, lunges and biceps curl	88
2 Leg	Squat	95
4 Back	Rowing, stiff-legged deadlift, clean & press and power press	75
5 Triceps	French press, triceps press, pullover and overhead triceps press	78
6 Biceps	Biceps curl	68
7 Leg	Squat, lunges and squat jump	72+24 jumps
8 Shoulders	Push-up, lateral raise, rowing and shoulder press	76+36 push up
9 Abdominals	Sit-ups, sit-ups to the side and side-plank	51+30 seconds

emphasized that these exercises should be practised for a period of (30-60) minutes, three days per week for six weeks. This programme can be purchased from the Less Mills company and includes special exercises and music (Les Mills, 2013; O'Connor & Lamb, 2003). The application of the gradual principle in training was taken into account, since the study sample had not practised these exercises previously (Table 1).

The study sample was contacted during the performance of the experiment through the Zoom and Skype applications. The experiment was applied from 20 March to 5 May, 2020). Taking into account the gradual expansion of the number of the exercise repetitions, all safety and security instructions were sent to the study sample, including wearing comfortable sportswear for movement and sweating, wearing comfortable athletic shoes, and drinking water and other liquids. The study sample had not previously practised these exercises, and the study aimed to identify the effect of these exercises on some psychological aspects; therefore, these exercises were done while listening to music, which determines the time for each muscle group, and the focus was on exercises that can be performed without bench and tools.

Scoring

Positive Affect score: Add the scores on items 1, 3, 5, 9, 10, 12, 14, 16, 17, and 19. Scores can range from 10 to 50, with higher scores representing higher levels of positive affect. Mean Scores: 33.3 (SD±7. 2). Negative Affect score: Add the scores on items 2, 4, 6, 7, 8, 11, 13, 15, 18, and 20. Scores can range from 10 to 50, with lower scores representing lower levels of negative affect. Mean Score: 17.4 (SD ± 6.2) (Watson, Clark, & Tellegen, 1988).

Scientific coefficients of the study tool

To verify the study tool's validity, we presented it to a committee of five arbitrators with the competence and experience of the faculty members at the University of Jordan to determine the suitability of paragraphs of this questionnaire and its ability to achieve the goals of the study. In addition, we used a triple Likert scale to measure how participants feel about each paragraph (Table 2)

Table 2. The estimation scale of the study sample responses

Tools	The response	Degree	Average	Level
Life satisfaction	Completely applies to me	5	More than 4.20	Very high
	Greatly applies to me	4	3.40- less than 4.20	High
	Moderately applies to me	3	2.60- less than 3.40	Moderate
	Low applies to me	2	2.60- less than 1.80	Low
	Never applies to me	1	Less than 1.80	Very low
Emotions	Not at all	1	Scores can range from 10 to 50, with higher scores representing higher levels of positive affect. Mean Scores: Weekly 33.3 (SD 7.2). Also, lower levels of negative affect. Mean Score: Weekly 17.4 (SD 6.2)	
	A little	2		
	Moderately	3		
	Quite a bit	4		
	Extremely	5		

To verify the reliability of the study tool, we used Cronbach's Alpha coefficient, whose value reached 0.80 for the life satisfaction paragraphs and 0.82 for the emotions; these values are considered a high indicator of the stability among study tool (Table 3).

Table 3. Results of Cronbach's Alpha coefficient

Domain	Cronbach's Alpha coefficient	Reliability level
Life satisfaction	0.80	Good
Emotions	0.82	Good

Ethical considerations

The participants' rights were protected by explaining the purpose and significance of the study. The clients were informed that their participation in the study would remain anonymous and that their privacy was respected. They were provided with a comprehensive explanation that their involvement in the study was voluntary and that they could withdraw at any time, and written approval was obtained from all study participants. As no blood samples were taken, and the experiment was limited to doing the Bodypump programme and answering the paragraphs of the study tool, the Ethics Committee's approval was not required.

Study variables

Independent variable: Bodypump programme; Dependent variables: life satisfaction (psychological stability, social interaction, optimism and emotional stability) and 20 paragraphs to measure the positive and negative emotions

Statistical analysis

To achieve the objectives of the study and answer its questions, the researchers used means, standard deviations, paired and independent sample T-tests to identify the differences between the pre and post measurements for one group and the two groups by using SPSS version 24 with a confidence level of 95% ($p < 0.05$).

Results

Table 4 indicates the mean of life satisfaction and emotions domains in the pre and post-measurement.

Table 4. Results of paired sample T. test for Life satisfaction and emotions among the control and experimental groups (n=34)

Groups	Variables	Pre-measured	Post-measured	p
		Mean±SD	Mean±SD	
Control	Psychological stability	2.20±0.78	2.74±0.28	0.062
	Social interaction	2.27±0.69	2.58±0.71	0.362
	Optimism	2.30±0.78	2.42±0.13	0.717
	Emotional stability	2.18±0.93	2.30±0.93	0.861
	Life satisfaction	2.24±0.99	2.51±0.69	0.582
	Negative emotions	35.2±2.9	31.4±2.6	0.781
	Positive emotions	16.2±1.8	18.3±1.7	0.532
Experimental	Psychological stability	2.25±0.7	3.85±0.76	0.000*
	Social interaction	2.34±0.76	4.10±0.55	0.025*
	Optimism	2.2±0.82	3.75±0.70	0.028*
	Emotional stability	2.15±0.87	3.65±0.81	0.007*
	Life satisfaction	2.23±0.69	3.84±0.72	0.011*
	Negative emotions	36.4±2.8	23.5±2.15	0.021*
	Positive emotions	15.6±1.9	32.2±1.82	0.000*

Legend: * - p<0.05

Table 5 indicates the results of the independent sample T. test for Life satisfaction and emotions among the control and experimental groups in post measurement.

Table 5. Results of independent sample T - test for Life satisfaction and emotions among the control and experimental groups in post-measurement (n=34)

Variables	Mean		t	p
	Control	Experimental		
Life satisfaction	2.51	3.84	2.42	0.006*
Negative emotions	31.4	23.5	2.98	0.021*
Positive emotions	18.3	32.2	2.78	0.011*

Discussion

The corona pandemic required all countries to take many strict procedures, such as social distancing and lockdown, which have many negative effects, such as physical isolation, loneliness, inability to go to physical fitness centres and high levels of anxiety, stress, and negative feelings. By reviewing the values of means among the control and experimental groups in the pre-measurement of satisfaction of life domains, we see that they ranged between 2.15 and 2.34 with a low degree, and the emotional stability domain has the lowest average (2.15-2.18). In contrast, the average of positive emotions in the pre-measurement was 15.6–16.2 and 35.2–36.4 for negative emotions. This reflects the negative effects of lockdown among the individuals. Schyns, Roefs, and Jansen (2020) indicate that lockdown is a tense and anxious time because of the distance from friends and lack of clarity about when normal life can resume. This explains the reason for the increasing demand of individuals for counselling from psychiatrists online.

The coronavirus pandemic is seen as a stressful experience in all aspects (psychological, social and economic). The coronavirus outbreak and the absence of a vaccine accompanied by preventive measures such as curfews contributed to increased social spacing (Brooks et al., 2020), as shown by the results of the study in which the social communication domain in pre-measurement was at a low degree (2.27-2.34). It is normal for individuals to feel fear, stress and high anxiety during the coronavirus outbreak; this virus is new, and there is no vaccine at the time the present paper is being written. Also, many factors contribute to increased psychological pressure among women, such as fear of the future, low material income, not going to the training centers, not moving freely, and the prolonged incubation period for this virus (Woods, 2020). Also, it can adversely affect the bilateral relationship between the nervous system and the immune system.

Similarly, the concern is that women may have more free time than before. Studies indicate that people with a high level of stress are more likely to be infected due to imbalances in hormone secretion regulation, which reduces their immune response as high cortisol levels discourage this response (Schmidt et al., 2014). Also, the coronavirus outbreak is accompanied by the high average of negative emotions, which indicates a decrease in well-being and a positive outlook towards the future. The levels of some negative psychological indicators are related to the behaviour of individuals. Negative feelings are a combination of high uneasiness and high excitement and include many feelings, such as nervousness and sadness, and thus decrease the degree of flexibility of individuals in their ability to overcome psychological pressures effectively. Positive emotions are associated with different areas of life such as work, physical health and personal relationships, and

are linked to the degree of satisfaction with life, as it reflects an individual's perception of the situation he or she lives based on goals, expectations, values and interests (Lythe et al., 2000). The problem here is that some individuals may resort to increased eating to escape stress, which doctors and specialists call "emotional eating". Nutritionists indicate that there is a strong correlation between exposure to stress and weight gain, which an increase in the stress level can explain is accompanied by an increase in the cortisol hormone level in the body, and this contributes to raising the appetite level in individuals and thus may lead to the accumulation of fat in the body, and the metabolism process becomes slower.

Referring to the results of the study, we see that the means of the study sample responses of the satisfaction of life among the experimental group came at a high level and an average (3.84) in the post-measurement, where the social interaction domain achieved the highest level of improvement and average (1.76). There were also statistically significant differences between the pre and post-measurement in the satisfaction-of-life level among the experimental group and in favour of post-measurement, with a marked rise in the average positive emotions and a decrease in the negative emotions' average. The researchers believe that many factors contributed to this positive effect of Bodypump exercises through increased visual, audio, and read communication between the study sample and researchers. These exercises also contributed positively to spending free time and the process of working online. As the regular practice of physical activities, in general, has contributed to reducing stress, symptoms of depression and removing toxins resulting from stress, it is a way to get rid of anger and enhance feelings of self-esteem and self-efficacy and thus increase the ability of individuals to deal with the pressures imposed by the process of home quarantine. Additionally, there was an improvement in the life satisfaction and emotions level among the control group, but it was not statistically significant. The researchers believe that with the passage of time, an adaptation to stresses occurs, and the procedures taken by the state may have contributed to this.

In general, physical activity at least three times a week for 30 minutes reduces stress and symptoms of depression. It also improves self-confidence and reduces the risk of depression, and improves mood (Tesarz et al., 2012). Furthermore, it contributes to controlling the level of cortisol in the body, which contributes to reducing stress, high anxiety, and the risk of depression (Bao & Swaab, 2010). Also noteworthy is the positive role of regular physical activity on brain health and thus improved motor communication networks (Alicia, 2015). Additionally, physical activity is associated with improving various psychological aspects such as self-esteem and social interaction and reducing symptoms of depression (Eime et al., 2013).

These exercises also facilitate the release of the hormone endorphin, which is linked to the immune system and its role in improving the secretion of serotonin. Also, it helps to control the level of the hormone cortisol in the body, which reduces stress and the risk of depression while improving self-confidence and general mood. All of this can improve metabolism and weight maintenance by burning calories from high repetitions of these exercises, reaching up to 800 per training unit. Furthermore, the positive role of regular physical activity on brain health and improved motor communication networks is not overlooked. Studies also indicate many positive psychological benefits that can be achieved through this programme, such as high levels of satisfaction, pleasure and happiness, improved social interaction, decreased negative emotions and a higher level of psychological well-being. Life satisfaction reflects positively on the ability of the individual to face difficult situations in daily life so that the individual is less anxious and stressed. Empirical evidence indicates that people with a high level of satisfaction in life enjoy a high level of psychosocial performance and have more successful social relations.

The corona pandemic has forced nations to take a range of preventive measures, including home quarantine, accompanied by many effects, including social isolation and increased leisure time, which had a negative impact on individuals' emotions and satisfaction-of-life level. This requires following new strategies and applying them in order to enrich the research aspect in this area. The main point in the present research is that women's exercises have contributed positively to reducing the level of negative emotions and the high average positive emotions they have. Furthermore, the exercises positively affected the satisfaction-of-life level and thus can help in overcoming negative life events, such as psychological pressures and improving their outlook on life by raising the level of life satisfaction and investing positively in their leisure time.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Attitudes of Sport Organization Officials toward Links between the Sports Sector, Sports Industry, and Knowledge Organizations with Innovations in Montenegrin Sport

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Abstract

It is well-known that modern organizations stand out as leaders in their industries have one common factor that brings them together around the fact they are successful: they are all principally committed to innovation. This fact also applies to sports. Empirical research was conducted to determine a research analysis of attitudes of sport organization officials toward links between the sports sector, sports industry, and knowledge organizations with innovations in Montenegrin sport. Seventy-five subject representatives of sports organizations were randomly assigned as a sample, while the questionnaire used is based on the Community Innovation Survey (CIS). Descriptive statistics were employed to test the hypothesis. This study confirmed that there is significant potential for improving innovation in sports in Montenegro. Policymakers and other stakeholders, including sports administrators and other sports leaders, should increase the ability of sports organizations to innovate in sports.

Keywords: *sport organization, sport lab, sport society, innovation policies, Montenegro*

Introduction

It is well-known that modern organizations stand out as leaders in their industries have one common factor that brings them together around the fact they are successful: they are all principally committed to innovation (Janinovic et al., 2020; Ringuet-Riot, Carter, & James, 2014). However, the level of commitment to innovation varies from industry to industry (i.e., from sector to sector) (Negassi, Lhuillery, Sattin, Hung, & Pratlong, 2019). As underscored by Oerlemans and collaborators (Oerlemans, 1998), different sectors employ different internal and external resources to become innovative.

Accordingly, innovation activity is the topic of study in many disciplines, which implies certain modifications and adaptations in approaches that depend on the field in which someone wants to innovate. Common to all of them is the need to adopt new business principles and strategies that bring openness to innovation. Therefore, their necessity in achieving a competitive advantage in the market has been confirmed by practitioners and researchers. This situation sets innovations in an unavoidable place in the growth and development of organizations (McDonald, 2007; Sawhney, Wolcott, & Arroniz, 2006; Zimmermann, 1999). Such importance has led to the expansion of research to discover factors that facilitate or hinder the application of innovations. Robbins and Judge (2013)

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highlight innovation as a feature that is essential for assessing an organization's culture.

In general, the property of organizational innovation can be understood as the degree of acceptance or non-acceptance of change, with an important examination of the magnitude of resistance to change. These changes are determined by the need for progress of the organization and can be considered to be impulsive reactions to the demands of the business environment. The inevitable changes in the business environment of all organizations, including sports organizations, require their adaptation to the new circumstances. This includes all stages of innovation, from introduction to implementation. Accordingly, the process of innovation is imposed on modern sports organizations as the biggest challenge. According to Wolfe, Wright and Smart (2006), it should be a constant challenge for those most successful sports clubs, which have a long tradition in a professional sports context. From another aspect, Covell, Walker, Siciliano and Hess (2007) indicate that regardless of success, sports organizations must create a product or service that is better or different from the competition. It can be said that this situation constantly creates pressure on sports managers to compete through their innovations. These factors created the climate in which innovations become an important segment of the development plans of sports organizations. There is almost no segment that is not determined by innovations (technical innovations, stadium, as a programme distribution channel, IT equipment, Internet communications (website, social networks, etc.), advertising equipment, financial (e.g., loyalty cards), organizational-management functions, training-technological methods, devices, props, and similar.

Therefore, it is clear for all sports sectors that special attention needs to be dedicated to innovation in the sports industry. Sports organizations strive to adapt, renew, and develop, like all other organizations, through engaging people who, with their new ideas and creativity, manage to move things forward. New strategies are being established with an emphasis on innovative activities, which leads sport to change from its traditional form in a way it becomes an innovated platform on which we play completely differently, look at it differently, and organize it completely differently (Popovic, Bjelica, Pekovic, & Matic, 2021; Tjønndal, 2016). In other words, sport is adapting to new needs that arise in the market, to position sports organizations and possibly to achieve competitive advantages (Shilburi, 2011).

The aforementioned changes in the sports industry and a certain dominance in the market are due to innovations that primarily reflect the introduction of contemporary technologies in sports in new products (Balmer, Pleasence, & Nevill, 2012; Luptáková, & Antala, 2017; Windt et al., 2020), and services (Chi & Res, 2005; Li et al., 2016; Matsuwaka, & Latzka, 2019; Mukhopadhiai, 2014; Liebermann et al., 2002; Tufekcioglu et al., 2021). However, it should be borne in mind that sport as a dynamic and very turbulent sector is changing much faster than other sectors, and the need for frequent analysis and monitoring occurs faster than in other industries. Furthermore, the research in the field of innovation has improved significantly in recent decades, even though empirical research in the field of innovation in sport is less common (Tjønndal, 2016) and research on strategy in the sports context (Matic, Popovic, Pekovic, & Milovanovic, 2021). Research in sport innovations has increased in recent years, but published articles are scattered in different journals, and knowledge is not linked in joint professional associations. Thus, knowledge about innovations in sport and strategies in sport contexts cannot be found systematized in one place. It is also crucial to mention that the analysis of previous research in the field of innovation found that researchers were mainly limited to studies aimed at the private and public sector while avoiding exploring sport as a vital part of contemporary society, which limits the understanding of innovation as a phenomenon and what preceded the innovation, as well as the potential consequences. This limited the possibility of promoting innovation through strategy and strategic management in sport (Ratten, 2017).

Furthermore, taking into consideration the fact that the share of gross domestic product (GDP), related to sport, varies from 1.76% to 3% in total GDP in the European Union (EU), as well as that total employment in the EU that is generated by sports activities is 7.3 million, which is equivalent to 3.5% of total employment in the EU (Bichi, Wijlens, & Wallace, 2015), it must be unequivocally concluded that sport is an important economic factor in the development of the EU and plays a significant role in all national economies, both within the EU and within the countries of the Western Balkans that aspire to become EU members (Montenegro is a candidate for EU membership in an advanced stage of negotiations). Therefore, any new study is welcome, as well as any gathering within scientific associations, in order to generate knowledge on the subject area, mostly because sport plays an important role in several major social challenges, such as physical inactivity, but also sustainable development and educational gaps.

This study aims to analyse the attitudes of sport organization officials towards the links between the sport sector, sport industry, and knowledge organizations with innovations in Montenegrin sport, in order to determine the situation on the field and possible potential for progress in this area.

Methods

Seventy-five subject representatives of sports organizations were randomly assigned as a sample. They were from all geographical parts of Montenegro and represented their sports organizations as executive directors, presidents, secretaries, founders, and similar who have a basic knowledge of the main business flows of their organization and potential innovative activities.

The questionnaire used is a modified version of the Community Innovation Survey (CIS) applied to collect empirical data (35 items). The questionnaire has contained four separate parts: (1) general information (12 items); (2) innovative activities (12 items); (3) cooperation (6 items); and (4) market (5 items) and was distributed electronically (Google Form). The questionnaire was shared by social network tools and sent to the randomly selected contacts.

Descriptive statistics were employed to test the hypothesis by analysing sports organisation officials' attitudes toward links between the sports sector, sports industry, and knowledge organizations with innovations in Montenegrin sport and promoting (unacceptable) situation on the ground.

Results

From the general information perspective, it is important to emphasize that most of the selected sports organizations do not have more than eight employees, while their business focus (Figure 1), as expected, is directed primarily to services (89.3%), then products (6.7%) and, finally, trading (4.0%).

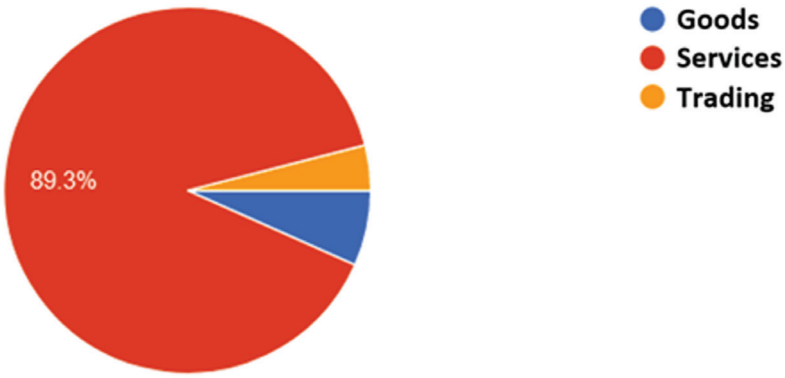

FIGURE 1. The main type of activities of the sports organization.

It is interesting to point out that more than half of these sports organizations are privately owned (50.7%), as well as the fact that in 64% of surveyed organizations annual revenues range from 0 to 100,000 euros, and in 14.7% in the range from 100,001 to 500,000 euros (Figure 2), which does not deviate much from European standards, provided that the distribution is evenly distributed in the first category. However, 32% of respondents indicated that their income has increased compared to the previous year was encouraging, as was the fact that 38.7% of respondents stated that their income has not changed compared to the previous calendar year. Also, it is important to point out that 73.3% of respondents stated that they carry out their activities individually, while 26.7% are part of a group, then 92% of organizations direct their activities at the national level, while 8% have international engagement, as well as that 80% of organizations have clients exclusively from Montenegro.

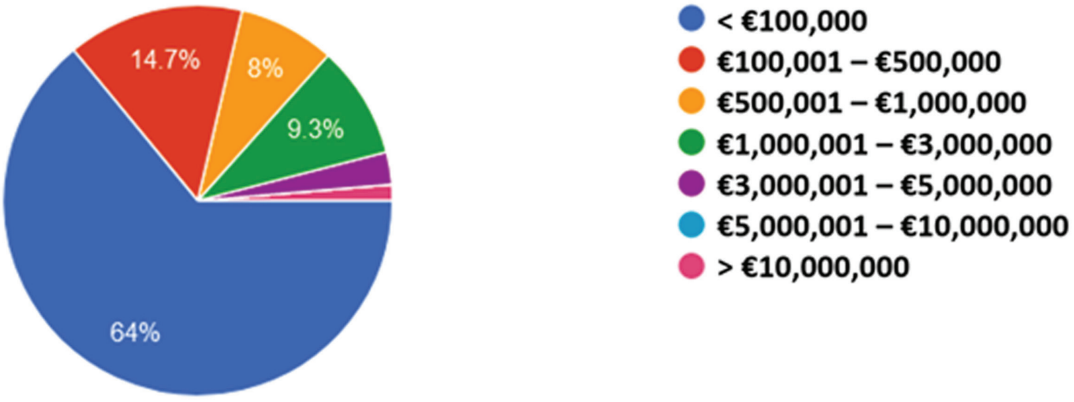

FIGURE 2. Total revenue of sports organization on an annual basis (in 2019).

Furthermore, it is interesting to point out that 58.7% of the surveyed sports organizations do not have an employee responsible for innovative activities (Figure 3), while in those organizations that have one, the majority stated that only one person is in charge of these activities. Nevertheless, 42.7% of respondents stated that, in the previous three years, the organization has introduced new or significantly improved products or services, then new or significantly improved working methods (45.3%), new or significantly improved marketing activities (50.7%), new or significantly improved organizational activities (56%), and new or significantly improved innovative activities related to environmental protection (57.3%), while only 21.3% of respondents indicated that their organization received any form of financial support for innovative activities.

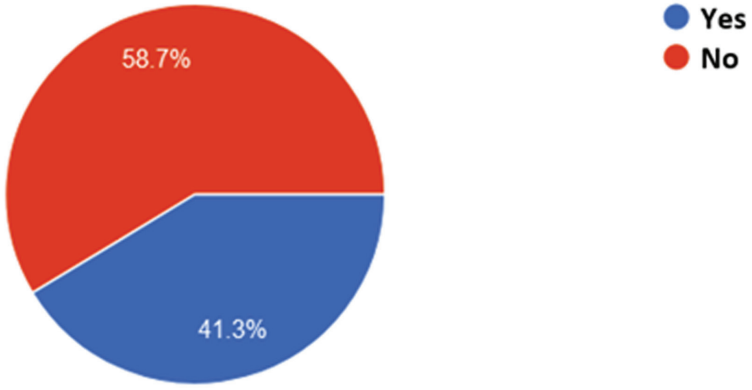

FIGURE 3. Is the person(s) employed in sports organization responsible for innovative activities?

When asked to state how much profit the sport organizations spend annually on innovation, 17.3% of respondents answered that they allocate over 5%, then 20% pointed out that they allocate 3-5%, and 16% to allocate 1-3%, while 13.5% stated that they allocate less than 1%, and as many as 33.3% did not allocate at all (Figure 4). In contrast, when asked to state what share of the sports organization's income is the result of innovative activities in the past financial year, as many as 45.3% of respondents answered that there is no such income, while only 7% of respondents stated that over 50% of income is the result of innovative activities.

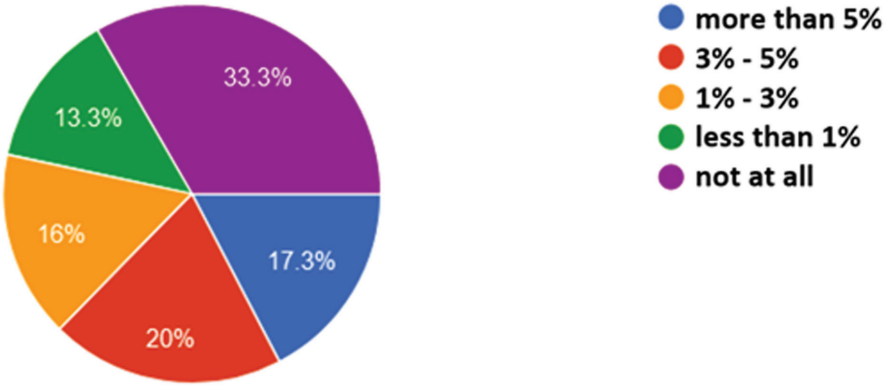

FIGURE 4. How much profit sports organization spends annually on innovation?

It is interesting to note that 33.3% of respondents recognize internal sources as the most important source of knowledge that leads to the development of innovation in the organization, then 32% believe that these are personal and informal contacts with other organizations and colleagues from the region, 20% believe that these are research and development (R&D), 1.3% that these are customers, while 13.3% of respondents did not respond specifically. Finally, it is worth noting that only 26.7% of respondents from sports organizations stated that they had established cooperation with universities, while 88% had never heard of the term "open innovation" (Figure 5), and 86.7% of respondents had not heard the term "innovation platforms". In addition, about half of the respondents believe that there is uncertainty in the market: new competition is emerging, and the sports market is growing in Montenegro.

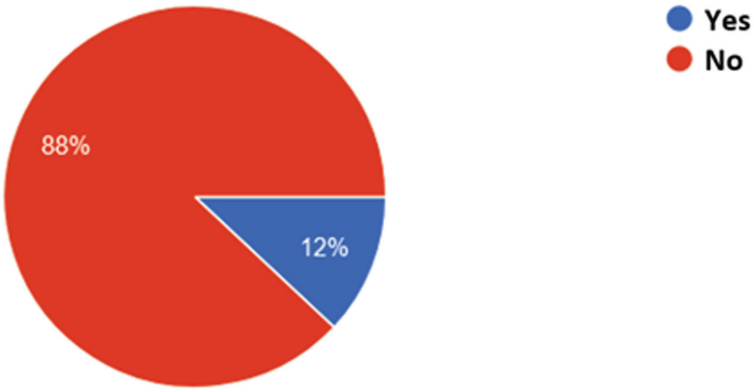

FIGURE 5. Are you familiar with the concept of "Open innovation"?

Discussion

Expert readers of innovation literature increasingly encounter research on innovation and strategies for innovation in sport as a separate academic field of research. Specifically, scientific articles which dealt with the systematic analysis of published publications in the subject area come across an increasing number of original, reviewed, and other articles dealing with the subject area. In addition to scientific and professional articles, increasing numbers of academic networks and associations that support the aforementioned idea are emerging (Tjønndal, 2016). One interesting fact is that the areas of innovation in sport and strategies for innovation in sport also stand out as a separate scientific field in the field of sports sciences, and there is an increasing number of publications analysing the current situation in the field and promoting the idea of creating a crucial multi-disciplinary field and as many professional associations, scientific journals and conferences as possible, which would be held with the subject topics. Thus, they already exist: primarily an association such as the European Platform for Sport Innovation (EPSI), a non-profit organization that aims to provide a suitable environment to encourage the development of sport organizations, and thematic projects primarily reflected in academic networking. One more excellent example of this fact is the COST Action CA18236, entitled "Multi-disciplinary innovation for social change (SHIINE)", approved under the COST programme, in order to show through the adoption of multi-disciplinary innovation methods how to respond to social issues with a design approach that has a problem-oriented ethos, supporting positive social changes and the development of international

public policy discourse (Action CA18236 - COST, 2021).

The results of this study indicate an inadequate situation in the field regarding sport organizations in Montenegro, so it is crucial to point out certain negative results and give clear guidelines on how to overcome weaknesses. First, it a fact of some concern that in the previous three years one third of sports organizations in Montenegro have not had innovative activities, that more than a quarter of sports organizations have not even improved marketing activities, and that 78.8% of sports organizations have not received any form of financial support for innovative activities (Popovic et al., 2021). Also, one third of sports organizations do not have financial allocations for innovations, while almost half do not have any income from such investments (Popovic et al., 2021) at a time of massive expansion of innovation across the EU. These results indicate that sport organizations officials in Montenegro are not adequately trained for innovations in sport and the implementation of strategic management of sport innovations. They are not sufficiently informed about available calls, grants, and funds and ways to apply for financial support for the realization of their projects. However, the interpretation of these results should be considered, including the findings from some authors (Stewart & Smith, 1999; Smith & Shilbury, 2004), which revealed inertness and conservatism of sports organizations in the application of innovations. Also, some authors have noted that the history or tradition of sports organizations can influence deterrence from innovative strategies (Smith & Shilbury, 2004). The situation is somewhat better with the application of innovations that come from sports sciences, given the direct impact on competitive success. Nevertheless, some of the obtained results indicate a significant potential for improving sport innovations in Montenegro. In realizing these potentials, Popovic (2017) suggests that firms should work more on well-known Montenegrin sports product while making a brand.

In order to overcome the aforementioned shortcomings, it is necessary, by following the example of European practice, to form a national laboratory for innovations that would exclusively deal with this issue. However, there has not been a significant impact of market uncertainty on the operations of sport organizations in the previous three years (10.7%), nor on financial resources on investment in innovations (12%), nor on new competitors (20 %); moreover, the impact of human resources on investment in innovation is greater than 50%. All of this supports and justifies the establishment of a national innovation laboratory (Popovic et al., 2021). Policymakers and other interested parties in the field, including sport administrators and other sport leaders, should, with the help of universities and other research institutions, enhance the ability of sport organizations to benefit from innovations in the field.

Furthermore, until the national laboratory sees the light of day, the "Western Balkan Sport Innovation Lab (WBSI Lab)", established on 26 November 2020, could work to overcome the identified shortcomings and recommendations made in this study, especially because the regional organization was founded by five university researchers and experts in the field: two from Montenegro (Sanja Pekovic and Stevo Popovic), two from Serbia (Ivana Milovanovic and Radenko Matic) and one from Bosnia and Herzegovina (Dino Mujkic). The main goal of the WBSI Lab is to build links between sport and related disciplines, industry and knowledge organizations in the field of innovation, through creating business opportunities for its members, coordinating and managing prepared and implemented investments, research and development, organizational and IT projects and through identifying opportunities for innovation that will fulfil the health, social, environmental, and market needs of individuals and legal entities living and working in the Western Balkans, while identifying 18 specific goals that represent the main activities of the organization that are available in the official documents of the organization (Matic et al., 2021).

Although there is no large research database, the available knowledge leads to the conclusion that innovations in sport are mainly focused on various empirical research as well as, in particular, new technologies, sport equipment and products, and still with a significant gap with a focus on innovation in sport in terms of social, historical, and organizational perspectives. The development of new technologies is crucial for the development of contemporary sport, but research examining social innovations in sport, strategies for innovations in sport, effective leadership and management of innovations in sport are no less important.

However, sport branding is not at the desired level in Montenegro, and working on recognizing Montenegrin contemporary sports product and making a brand must be more prominent.

The aforementioned represents areas that have not been sufficiently examined thus far, even in Montenegro. Therefore, it is worth emphasizing that the main limitation of this study is that it did not address these issues. The basic recommendations for future research in this area are to explore new perspectives on innovations in sport, followed by new strategies for sport innovations and implementation, strategic management of innovation in sports. At the same time, the first step in improving the current situation could be reflected in identifying the crucial factors that should influence the improvement of this area and their evaluation and compliance with the methodology that would also be determined by experts in this field.

Acknowledgement

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Conflict of Interest

The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Perceived Barriers to Physical Activity of College Students in Manila, Philippines during the COVID-19 Community Quarantine: An Online Survey

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Abstract

This study aimed to identify the physical activity barriers affecting college students and analyse how they differ between types of schools (private colleges-universities and government-state universities), and to improve schools' online distance learning physical education programmes in the Philippines. One hundred fifty (N=150) officially enrolled students participated in the study, from private and state universities, composed of athletes, non-athletes, and inactive athletes. With the use of the Barriers to Being Active Quiz, comprising seven (7) barriers (Lack of Time (LT), Social Influence (SI), Lack of Energy (LE), Lack of Willpower (LW), Fear of Injury (FI), Lack of Skill (LS) and Lack of Resources (LR)), responses were collected adapted through online administration. After the response collection, results show high mean scores in LR and significantly low scores in FI and LS barriers among private and state university students. Private and State University students differ from each other significantly ($p<0.05$) in the barriers SI, LW and LR, with state university students exhibiting greater mean scores. Active athletes possessed significantly lower scores during quarantine in most barriers (LT, SI, LE, LW, LS and LR), while inactive athletes exhibited the highest in FI. Further studies and examination of online physical education programmes are recommended to help students counter the reduced physical activity during quarantine, aside from strengthening government encouragement to those without access to exercise opportunities.

Keywords: *physical activity, COVID-19, quarantine, barriers*

Introduction

The Philippines was not spared the spread of the Severe Acute Respiratory Syndrome - Corona Virus - 2 (SARS-CoV-2), commonly known as CoViD-19. Its spread was caused initially by individuals from countries with existing infections and then further spread locally through direct contact with these individuals. The spread from person to person may be attributed to transmission of the virus via direct physical contact, droplets, and fomites. When infected individuals talk, sneeze, or cough, they produce droplets containing the SARS-CoV-2 virus. This is then inhaled by other individuals. On the 12th of March 2020, the Philippine government-imposed travel restrictions in Metro Manila to limit the spread of the SARS-CoV-2 virus. This measure was further expanded to cover the whole of Luzon on the 16th of March under the term "Enhanced Community Quarantine" (ECQ). ECQ was enforced in some areas of Luzon, including Metro Manila, until the 15th of May. To facilitate the gradual return to work and to manage mobility concerns, the Inter-Agency Task Force for the Management of Emerging Infectious Diseases (IATF) created quarantine classifications and grouped certain industries under specific

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categories. These quarantine classifications are, beginning with the most restrictive, the Enhanced Community Quarantine (ECQ), Modified Enhanced Community Quarantine (MECQ), General Community Quarantine (GCQ), and Modified General Community Quarantine (MGCQ).

With the implementation of the quarantine classifications, the ability of individuals to participate in physical activity and exercise was affected. Individuals were not allowed to exercise outdoors under ECQ. Under MECQ, limited outdoor activities are allowed provided that the individuals wear masks and observe a two-metre distance between people. Such activities included walking, running, bicycling. Restrictions are then eased for GCQ, allowing non- or limited-contact sports, such as golf and tennis. Contact sports, such as boxing, wrestling, and basketball, remained prohibited under GCQ. Only in MGCQ would sports such as basketball and football be allowed. This situation is further exacerbated by the fact that gyms, fitness studios, and sport facilities will also remain closed in ECQ, MECQ, and GCQ areas as they fall under category 4 of the IATF Omnibus Guidelines on the Implementation of Community Quarantine in the Philippines.

In the absence of such facilities and the limitations of activities one can participate in, individuals were left to what was immediately available to them in their household. This included available equipment, if any, as well as available space that may be allocated or used for exercise. Other considerations that influenced an individual's continued participation to exercise included existing household responsibilities or ones that have emerged because of the quarantine imposed by the government. Emotional considerations resulting from the CoVid pandemic may have also influenced their attitude towards physical activity and exercise.

CoViD-19, Comorbidities, and Physical Activity

Participation in regular physical activity (PA) improves well-being due to physiological adaptation. Previous articles' (Zbinden-Foncea, Francaux, Deldicque, & Hawley, 2020) preliminary data indicated that the eventual outcome of being infected and the severity of symptoms associated with CoVid-19 are related to the health status of the individual. In another study (Pitones-Rubio et al., 2020), shared risk factors including diabetes, hypertension, asthma, and obesity were identified between Periodontal Disease and Covid-19, as well as in the systematic review by Zaki, Alashwal, and Ibrahim (2020). Froldi and Dorigo (2020) found that more than 68.3% of patients in Italy had hypertension, 28.2% had ischemic heart disease, and 30.1% had type-2 diabetes. In the same Italian study, they determined that men show worse outcomes compared to women, hypothesising hormones and lifestyle, as well as endothelial health and control of vascular inflammation, as having driving roles in the severity of CoVid-19.

All studies mentioned are consistent as a meta-analysis was done in which the presence of comorbidities, such as hypertension, diabetes mellitus, cardiovascular disease, COPD and chronic kidney disease, had significant relations with patients with serious CoViD-19 outcomes (Nandy et al., 2020). Among these mentioned, diabetes mellitus significantly impacts the mortality of patients from the disease.

Concerns regarding endothelial function are extensively considered when dealing with lifestyle diseases like the mentioned comorbidities, and exercise likewise impacts health (Bi et al., 2020). Relatedly, this can explain reductions in blood pressure with exercise as it improves the endothelial function of prehypertensive and hypertensive individuals (Pedralli et al., 2020). Also, it is theorized that severe inflammation in the endothelial cells is associated with disease severity and mortality, putting melatonin in the picture as a powerful antioxidant for infected individuals with obesity and diabetes (M.A. El-Missiry, Z.M.A., El-Missiry, & Othman, 2020).

Other positive outcomes of PA have also been associated with CoVid-19. In a study by Damiot, Pinto, Turner, and Gualano (2020), PA impacts immune function by regulating pro-inflammatory and anti-inflammatory cytokines. In another study (Costa et al., 2020), metabolic disorders, which are influenced by PA, greatly affects the development of the disease and is also associated with "worse outcomes". Theories have also surfaced that despite being vaccinated, obese adults were found to be twice as likely to develop influenza illnesses compared to healthy adults (Neidich et al., 2017). This finding is consistent with those of Campbell and Turner (2018) from a human vaccination study in which bacterial and viral antigen responses are heightened following bouts of exercise. These reviews not only strengthen how comorbidity risk and disease severity are connected but also raise the connection of immunization effectiveness with physical activity.

Physical Activity During Quarantine

Participation in PA has been greatly affected by the CoViD-19 pandemic due to quarantine regulations. A study by Constandt et al. (2020) showed self-reports of reduced exercise during a lockdown. Older adults with low education, social influences, and not depending on online tools are highly affected. Stay-at-home orders also affected other forms of physical activity engagement reduction, such as sports participation (Schnitzer, Schöttl, Kopp, & Barth, 2020). It is also seen that post-lockdown increased the participation of less active groups. This observed reduction suggests alleviating the global cardiovascular disease problem (Pecanha, Goessler, Roschel, & Gualano, 2020; Lippi, Henry, & Sanchis-Gomar, 2020), implying that governments and policymakers should consider how can exercise be encouraged during lockdowns and quarantines (Constandt et al., 2020).

With the reduced amount of physical activity, it is expected that total energy expenditure would be affected and found to decrease significantly (Giustino et al., 2020); in the same study, it was found that both sexes were affected by this decrease when measures before and during the quarantine were compared. The ripple effect of this observation may relate to the findings that BMI and weight gains were detected in both male and females (M. He, Xian, Lv, J. He, & Ren, 2020). Along with this are other possible circadian biology disturbances, such as daily patterns, the timing of meals and sleep (King, Burke, Halson, & Hawley, 2020), and imbalances resulting from home-based isolation. Furthermore, health negative effects were not limited to the physical aspect but were also found to negatively impact psychological well-being (Lim, Fong, Hariram, Lee, & Tor, 2020; Thakur, Kumar, & Sharma, 2020). Maintaining physical activity at home is found to be an excellent strategy in addressing physical (Tornese et al., 2020) and mental health issues (Maugeri et al., 2020) during a quarantine. This increase in physi-

cal activity engagement is strongly recommended (Matias, Dominski, & Marks, 2020) to enable reset and recreation of wellbeing while remaining safe at home.

With the recommendations based on evidence, physical activity promotion is as important as how policies on social distancing and physical contacts were disseminated, and the need to explore the nature of engagement decrease is readily apparent. This research aimed to determine what physical activity barriers for college students in Manila look like during community quarantine and to analyse how these barriers differ between types of schools: private colleges-universities and government-state universities. The findings of this research are intended to benefit the development of college physical activity programmes to address the needs of students in quarantine and strengthen schools' distance learning physical education programme, specifically in the Philippines.

Methods

Respondents

The study participants were one hundred fifty (N=150) officially enrolled university college students in Manila during the CoViD-19 quarantine who were undergoing online distance learning from two university types. Ninety (90) of them were from private universities and 60 from a state university with mean±sd age of 19.87±1.30 years. Among the participants were 62 males, 85 females, and three preferred not to say gender. There were 62 athletes and 88 non-athletes. Only those who provided consent response were included in the study.

Barriers to Being Active Quiz

Researchers utilized an online questionnaire adapted from the Barriers to Physical Activity Quiz developed by the U.S. Centers for Disease Control and Prevention, also used in previous physical activity research studies (Call et al., 2020; Mariam & Mazin, 2019; Rosselli et al., 2020). It is composed of 21 statements that encompass seven barriers to being active: Lack of Time (LT), Social Influence (SI), Lack of Energy (LE), Lack of Willpower (LW), Fear of Injury (FI), Lack of Skill (LS), and Lack of Resources (LR). The contents of the questionnaire were administered online using Google Forms. The multiple submissions setting was disabled, using the respondents' e-mail addresses, to minimize the impact of errors.

Study Procedures

The questionnaire was administered through communication platforms used by participants for their online classes, disseminated through a Google Forms link. Questionnaires were answered using respondents' devices at their homes. The responses were collated, documented, and appraised according to the tool's scoring system.

Ethical Considerations and Informed Consent

Participants were oriented orally and in writing using a written consent as a gateway to the questionnaire link. Details of the informed consent include the following. First, the purpose of the study and the reason for being asked to participate were discussed; the scope of duties and amount of time needed in their participation were featured; finally, risks and benefits were declared, and its voluntary nature was emphasized. Contact information of the corresponding researcher was given to all participants for concerns with regards to their rights and/or withdrawal of participation. All was done in conformity with the Declaration of Helsinki.

Statistical analysis

Mann-Whitney U, the analogue counterpart of the T-test, was used in the analysis of means along with figures and tables presented.

Results

Private vs Government Universities

Figure 1 shows that LR for both university types had the highest mean response scores with 4.36 from private and 5.67 from public universities. Among the lowest barriers were LS and FI, with 2.18 and 2.17 for private universities and 2.62 and 2.37 for state universities. State university respondents scored significantly higher ($p<0.05$) in SI, LW and LR in comparison to their private university counterparts, with z-scores of -3.44, -2.56, and -3.1,0, respectively. The state university group still showed higher mean scores in other barriers (LT, LE, FI and LS).

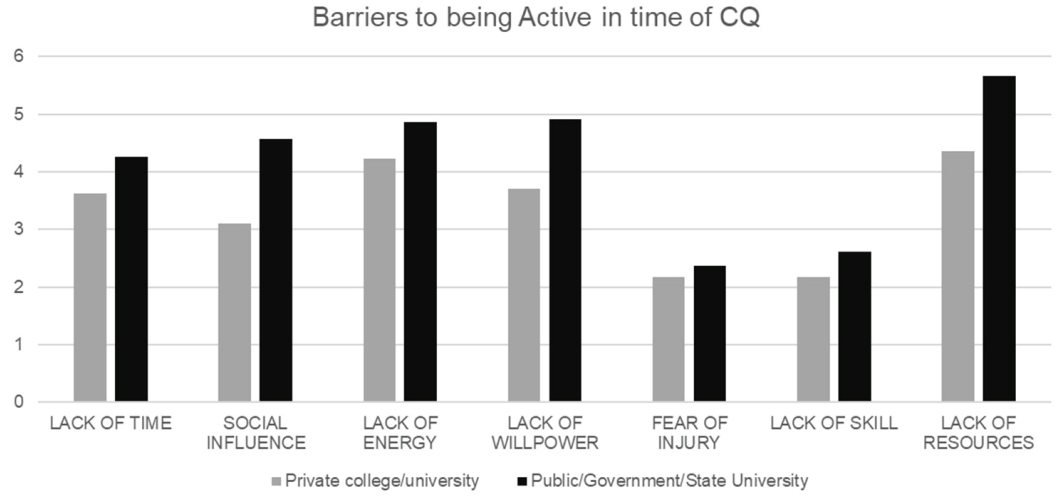

FIGURE 1. Comparing mean barrier scores of college students from private and government universities

Within the barriers of private university students, mean FI and LS showed significantly low scores compared to others (SI, LE, LW & LR). LR and LE were significantly higher compared to most barriers, as shown in Table 1.

Table 1. Inter-barrier analysis using z-scores from Mann-Whitney U of private university students

Inter-barrier Analysis- Private Colleges and University (z-score)						
	SI	**LE**	**LW**	**FI**	**LS**	**LR**
LT	1.23593	-1.54205	-0.21314	-3.67345*	3.7793*	-1.89537
SI	x	-2.71503*	-1.38326	2.38602*	-2.59058*	-3.19853*
LE	x	x	1.21876	5.0653*	5.01809*	-0.27179
LW	x	x	x	3.60335*	3.54184*	-1.5163
FI	x	x	x	x	0.42628	-5.64893*
LS	x	x	x	x	x	-5.55881*
LR	x	x	x	x	x	x

Legend: * - p≤.05

Table 2 presents that respondents' low mean scores from the state university group in FI and LS are evident and significantly different (p<0.05) from the other four barriers. Additionally, LR shows a recognizable difference (p<0.05) with four others: LT, SI, FI and LS.

Gender, Athletic Involvement and Residence

Respondents who prefer not to say their gender (N=3) reported greater mean scores in all barriers. Figure 2 shows that between males and females, male college students outscored females in terms of barriers with a mean LR score of 5.37. Male and female mean scores show close values in LS, with only a 0.06 difference. Mean score differences between LT and LR were the greatest among the barriers of males and females.

Table 2. Inter-barrier analysis using z-scores from Mann-Whitney U of state university students

Inter-barrier Analysis- Public/State University (z-score)						
	SI	**LE**	**LW**	**FI**	**LS**	**LR**
LT	-0.70069	-1.57197	-1.62708	4.70803*	-4.05195*	-3.31189*
SI	x	-0.87652	-0.8844	5.2119*	-4.43248*	2.6112*
LE	x	x	0.01312	5.75251*	4.86286*	-1.78454
LW	x	x	x	5.92571*	5.04657*	-1.7478
FI	x	x	x	x	0.01575	-7.03318*
LS	x	x	x	x	x	-6.11729*
LR	x	x	x	x	x	x

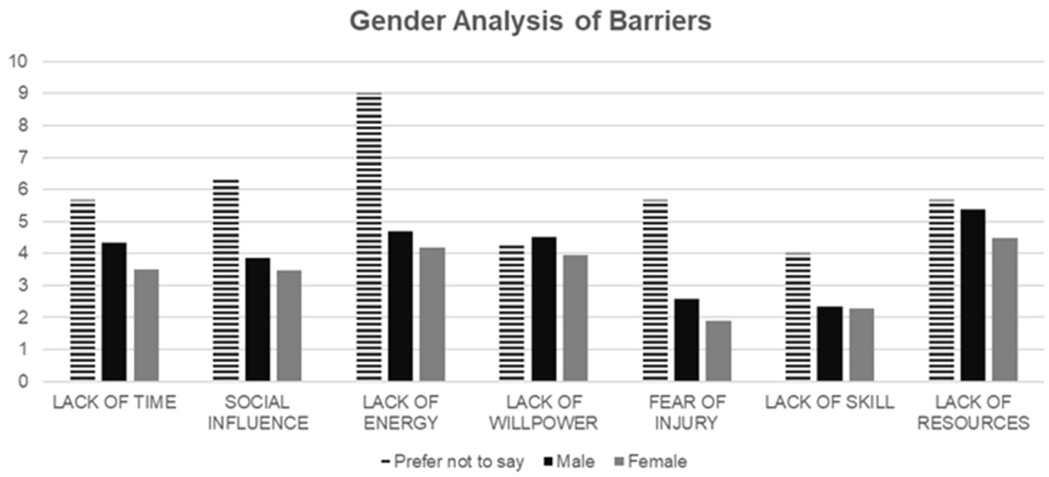

FIGURE 2. Comparing means scores across genders

Figure 3 shows that mean scores of active athletes were significantly lower than the scores of inactive and non-athlete groups in the LT, SI, LE, LW, LS and LR with z-scores of -3.01114, -1.96882, -2.75279, -3.04678, -2.03119 and -3.02005, respectively (p<0.05). In the FI barrier, only active athletes and inactive athletes show significant differences in mean scores. While no significance was found, a notable difference is perceivable between FI mean scores of inactive and non-athlete groups.

Comparing means in terms of the type of residence, the informal-settlement group scored highest in LR, LS and LW. Table 3 shows that they possessed the highest barrier score of 5.92 in LR but low in FI with 1.9166. Respondents from the condominium group scored the lowest barrier of 1.66 in LS while keeping relatively high scores in LR and LE.

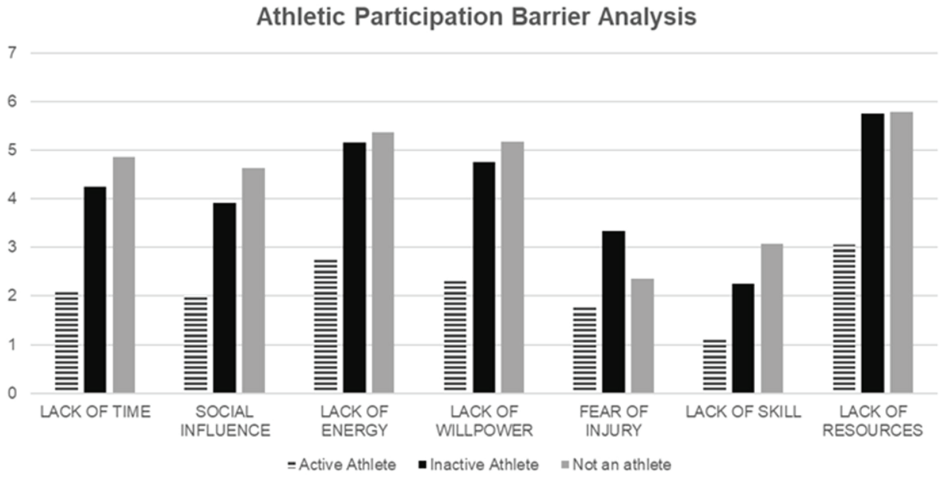

FIGURE 3. Comparing mean scores according to nature of athletic participation

Table 3. Mean scores of each barrier based on type of residence

	LT	SI	LE	LW	FI	LS	LR
Single-detached (in a subdivision)	4.09589	4.013699	4.684932	4.109589	2.219178	2.369863	4.780822
Townhouse	3.5	3.666667	4.208333	3.916667	2.125	2.375	4.625
Condominium	4.5	3.166667	5.166667	4.5	2.416667	1.666667	5.416667
Dormitory	3.4	3.4	3.6	3.9	3.1	2.8	4.1
Informal-settlement Areas	3	3.5	4	4.833333	1.916667	2.583333	5.916667

Discussion

With the encouragement of exercise and physical activity during quarantine and lockdown, as previously reported (Constandt et al., 2020), a review of physical activity designs in schools doing distance education is suggested, and the problem of reduced exercise in students should be addressed. Benefiting mostly the school-age population, the strengthening of physical education models to tackle this concern can be done. Gathering data from a distance may be adopted as done in previous works (Giustino et al., 2020) involving online questionnaires, physical activity, and energy expenditure.

Type of University

The discrepancy of respondents from private and from state university suggests the premise of the difference in internet access of respondents from two university types. The online questionnaire administration poses as a limiting factor to respondents who are challenged by lack of internet access. The difference between the two universities typed in willpower, social influence and resources scores is theorized to be primarily the influence of the difference in economic status. With the additional economic challenges of the pandemic, students and possible influencers focus on their essential needs, such as food. Virtual influencers such as friends from a distance also experience the impact of this focus for the essential.

In terms of inter-barrier differences, fear of injury and lack of skill among respondents from both university types is recognizably lower than other barriers. Students in the private university are hypothesized to engage in exercise for health purposes, outweighing the quality of movement participation, and the risk of injury is seen to be less important. In contrast, respondents from the state university group are posited to participate more for fun and maintaining mental health over the risk of movement execution.

Gender, Athletic Involvement and Residence

The results of previous studies determined between genders and specifically in susceptibility to SARS-CoV-2 appear to be unclear (Froldi & Dorigo, 2020). However, the same study theorized that the "styles of life" play a role and is reflected with the theories of this study. In the Philippines, societal expectations differ between men and women. The fact that Filipinos are likely to be more active physically influences how they perceive these barriers. The same is valid for women: they are still expected to stay domestic and less adventurous physically, even at present.

The athletic involvement of respondents also varies and affects how they cope in maintaining physical activity during quarantine. Active athletes, or those who are currently preparing for possible competitions, can handle the barriers, with the factor of knowing different training methods even at home. Furthermore, active athlete respondents were identified as being locked down inside university dormitories where sports facilities are accessible. While non-athletes are understandably hindered by skill, inactive athletes are prevented because of fear of injury, a known stressor due to return-to-play concerns, as found by Sutcliffe and Greenberger (2020).

Lastly, the type of residence is theorized to affect access to space and dedicated facilities where the opportunity to become physically active is found. This is seen in the high resources barrier among respondents residing in condominiums, where living spaces range from 20 to 30 square metres and where amenities and sports facilities are temporarily closed to the public. This factor is in addition to the possible fear for congregating, unlike those in informal settlements who seemingly possess no fear from life threats or even injuries from physical activities.

Conclusion

In conclusion, the researchers found the highest mean scores in lack of resources as a barrier to physical activity participation for both private and state university groups. The high mean score in Lack of Time for private university respondents is comparable to their Resources barrier score. There are also significantly low scores in Fear of Injury and Lack of Skill barriers for both types of universities. Private and state university respondents significantly differ in Social Influence, Lack of Willpower and Lack of Resources barriers, with the state university group showing greater values. The results support the recommendation of Constandt et al. (2020) that the government holds a great impact in maintaining physical activity levels of the population during quarantine by providing encouragement programmes, especially to those who have difficulty accessing other means of doing so. The study also recommends designing higher education physical education programmes according to how private and state university students perceive the instances that prevent them from becoming more active physically. Further studies are recommended due to the limitations of online surveys and additional control to varying factors that might influence sample responses.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

The Physical Characteristics of Elite and Qualified Female Canoe Paddlers in China

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Abstract

The main objective of this research was to determine the physical characteristics of elite and qualified female canoe paddlers in China. Seventeen paddlers, leading athletes of Shandong and Jiangxi provinces, winners, prize winners and participants of the final races of the China Canoe Racing Championship took part (age 21±2; height=167±2 cm; mass 53.5±1.1 kg). The article shows that female canoe paddlers have superior aerobic and anaerobic qualities and have reported maximal oxygen consumptions of around 56.8 ml·kg-1·min-1 and lactate values of around 12.01 mmol·l-1 during laboratory testing. The range of individual differences of as in the range of 107.00–116.00 for elite female canoe paddlers, 99.5–103.5 for female canoe paddlers (province team) and 85.0–91.0 for female canoe paddlers (reserve team) ($p<0.05$). The range of individual differences of La max, mmol·l-1 as in the range of 9.55–12.01 for elite female canoe paddlers, 9.67–11.11 for female canoe paddlers (province team) and 6.36–10.69 for female canoe paddlers (reserve team) ($p<0.05$). The research has shown that all physiological characteristics are reduced in relation to the model characteristics of sports (competitions), similar in duration and intensity of work in the canoe. There is no normative basis for outstanding operability in the process of modelling competitive activity and in implementing the components of the energy supply structure.

Keywords: *female canoe paddlers, aerobic power supply capacity, functionality testing, VO_2 measurement max, working capacity*

Introduction

Women's canoe is a new kind of rowing competition. The popularity of it, the high level of competition, and as a consequence, the intensity of the competition requires a certain level of functional readiness of female athletes, in particular for the effective energy supply of work at a distance of 200 m (single) and 500 m (two) (Borges, Dascombe, Bullock, & Coutts, 2015).

Traditionally, the determination of a physical profile in a given sport involves the use of predictive testing as a measure of power and strength (Cronin & Hansen, 2005), speed, aerobic fitness or flexibility (Simoneau, 1998).

Traditionally, research in kayaking is primarily focused on athletes' physiological testing in order to determine fitness levels and then designing training programs to optimize physiological fitness (Aitken & Neal, 1992). Early studies only analysed VO_{2max} to monitor and assess the physiological capacity of elite kayakers (Tesch, 1983). However, this is not the only possible determinant of performance. While characteristics of the sport require that kayakers paddle most of the race at or around peak VO_2 (Bishop, Bonetti, & Dawson, 2002), requiring high aerobic power, the anaerobic aspects should not be overlooked (Fry & Morton, 1991; Tesch, 1983).

The previous research had significantly indicated higher VO_{2max} levels than those observed here in both ergometer and treadmill tests, reporting values not lower than 54 $ml \cdot kg^{-1} \cdot min^{-1}$ in either case (Fry & Morton, 1991; Shephard,

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1987). However, any comparison between studies must be carefully regarded due to the different protocols applied to estimate Oxygen uptake.

Elite kayakers demonstrate superior aerobic and anaerobic quantities and have reported maximal oxygen consumptions of around 58 ml·kg^{-1}·min^{-1} (4.7 L·min^{-1}) and lactate values of around 12 mM during laboratory and on-water testing (Michael, Rooney, & Smith, 2008).

The literature on functional preparedness comprises little information on the specificity of energy supply and performance characteristics in women's canoe (Borges et al., 2015, Hagner-Derengowska et al., 2014, Hartmann, 2015, López-Plaza et al., 2018, Paquette, Bieuzen, & Billaut, 2018, Sheykhlouvand et al., 2018).

All this does not enable evaluating and interpreting indicators as model characteristics of preparedness and use in the process of managing rowers' physical fitness.

The primary objective of this research was to determine the physical characteristics of elite and qualified women in canoeing in China.

Methods

Subject

Seventeen elite and qualified female canoe paddlers (female canoe paddlers of reserve team n=4; female canoe paddlers of province team, n=6; elite female canoe paddlers, n=7), leading athletes of Shandong and Jiangxi provinces, winners and participants of the final races of the China Canoe Racing Championship took part (age=21±2; height 167±2 cm; mass 53.5±1.1 kg). The reserve team includes female athletes who have a track record of rowing 1.5–2 years, and before they had been engaged in other sports.

All participants were informed of the requirements prior to the study, and their parents and coaches gave their informed written consent for them to participate. The local research ethics committee approved all procedures in the spirit of the Declaration of Helsinki.

Research protocol

For standardizing the measurements of special performance, the Dansprint canoe ergometer was used. $VO_{2\ max}$, the blood lactate concentration (La), and ergometric power (EP) of work were recorded. The specialists of the Scientific Sports Management Research Centers in Shandong Province (Jinan) and Jiangxi (Nanchang) carried out the measurements of the reaction of the cardiorespiratory system and blood sampling for lactate measurement.

Physical Characteristics

Gas exchange, HR, and blood lactate measurements. Oxygen consumption (V˙O2), CO2 production (V˙ CO2), minute ventilation (V˙E), and respiratory exchange ratio (RER) were determined on a breath-by-breath basis using an Oxycon mobile (Jaeger) metabolimeter. The metabolic unit was calibrated a gas of known composition (16.00% O_2, 4.00% CO_2), respectively.

The heart rate (HR) was recorded every 5 s with an HR monitor (S610 Polar Electro, Kempele, Finland).

The blood lactate concentration ([La]b) was determined using a portable lactate analyser (Biosen S. line lab +) on a blood sample obtained from the ear lobe at the end of the submaximal test and at three to five minutes of recovery after the maximal 120 s test (100% of the race speed).

All the women in canoeing performed an incremental exercise test on a canoe ergometer (Dansprint, I Bergmann A/S, Hvidovre, Denmark) on separate days, with at least 24 hours and no longer than 3 days between tests. The incremental exercise test was designed to establish the linear relationship between the work intensity (power in W) and the VO_2 for each individual.

It was important to preserve the individual maximum parameters of the ergometric power of work and the length of the rest intervals. The rest interval between 10 and 30 s work was one minute, between 30 s and 120 s work (i.e., five minutes), which provided a full recovery and diagnostics of the structure of the reaction of sprint rowers' anaerobic energy supply (i.e., anaerobic alacate and lactate (glycolytic) power, and anaerobic capacity). The test program also created the conditions for the display of the cardiorespiratory system reactive properties and the power of aerobic energy supply for the work.

To assess the power of the aerobic energy supply, we analysed the highest VO_2 values in the steady state period within ± 0.1 l / min ($VO_{2\ max}$ / kg) with a duration of at least 20 s.

Statistical Analysis

In order to assess and analyse the data received, the Statistical Package (SPSS 10.0)(SPSS 10.0) was used. Descriptive statistics suggested defining arithmetical average M standard deviation SD, as well as median (Me), maximal (Max) and minimal (Min) indices, 25% and 75% indices. The data were verified in accordance with the normal probability law (applying the Shapiro-Wilk criteria). If the data allocation complied with the normal probability law, then in order to define the statistical validity of discrepancies, the student criteria were applied. If the data did not comply with the normal probability law, non-parametric criteria of Wilkinson were applied to define the statistical validity of discrepancies. The error probability during the statistical analysis was set at the level of p=0.05 (significance level).

Results

The energy and powers indicators in the 30- and 120-second time trials are presented in Table 1.

Significant differences in female athletes' performance indicators were established, which is indicated by the average values of the rowers' from a homogeneous group performance indicators, as well as by the data characterizing the functional abilities of female canoe paddlers who have the best results in the Chinese national arena.

Female canoe paddlers demonstrate superior aerobic and anaerobic quantities and have reported maximal oxygen consumptions of around 56.8 ml·kg^{-1}·min^{-1} and lactate values of around 12.01 mmol·l^{-1} during laboratory testing.

The range of individual differences of as in the range of 107.00–116.00 for elite female canoe paddlers, 99.5–103.5 for female canoe paddlers (province team), and 85.0–91.0 for female canoe paddlers (reserve team) ($p<0.05$).

The range of individual differences of La max, mmol·l^{-1} as in the range of 9.55–12.01 for elite female canoe paddlers, 9.67–11.11 for female canoe paddlers (province team) and 6.36–10.69 for female canoe paddlers (reserve team) ($p<0.05$).

Table 1. The energy and powers indicators in the 30- and 120-second time trials

The energy and powers indicators	Statistic indicators					
	M±SD	Me	Min	Max	25%	75%
Female canoe paddlers (reserve team), n=4						
$\overline{W}$ mean 10 s,W	116.33±17.69	117.00	86.00	137.00	111.00	130.00
$\overline{W}$ mean 30 s,W	112.17±17.14	115.00	87.00	137.00	100.00	119.00
$\overline{W}$ mean 120 s,W	86.67±5.61*	87.50	77.00	92.00	85.00	91.00
VO_2 peak, l·min^{-1}	3.02±0.16*	3.00	2.80	3.20	2.90	3.20
VO_2peak, ml·min^{-1}·kg^{-1}	44.47±5.25	44.70	36.60	53.00	42.80	45.00
La max, mmol·l^{-1}	8.81±2.49*	9.61	5.17	11.42	6.36	10.69
Female canoe paddlers (province team), n=6						
$\overline{W}$ mean 10 s,W	139.25±6.70	140.50	130.00	146.00	135.00	143.50
$\overline{W}$ mean 30 s,W	131.25±11.24	133.00	116.00	143.00	124.00	138.50
$\overline{W}$ mean 120 s,W	101.50±2.65*	102.00	98.00	104.00	99.50	103.50
VO_2 peak, l·min^{-1}	3.33±0.34	3.25	3.00	3.80	3.10	3.55
VO_2peak, ml·min--1·kg^{-1}	50.58±4.52	49.30	46.90	56.80	47.25	53.90
La max, mmol·l^{-1}	10.39±1.02*	10.27	9.30	11.72	9.67	11.11
Elite female canoe paddlers, n=7						
$\overline{W}$ mean 10 s,W	162.00±27.20	160.00	123.00	200.00	138.00	191.00
$\overline{W}$ mean 30 s,W	147.29±18.14	150.00	120.00	167.00	126.00	166.00
$\overline{W}$ mean 120 s,W	113.43±8.54*	111.00	106.00	131.00	107.00	116.00
VO_2 peak, l·min^{-1}	3.29±0.17	3.30	3.00	3.50	3.20	3.40
VO_2peak, ml·min^{-1}·kg^{-1}	46.66±4.29	47.40	41.30	52.80	43.00	50.30
La max, mmol·l^{-1}	11.30±1.81*	11.25	9.47	14.67	9.55	12.01

Legend: *Significant difference from the 120-s trial (p<0.05).

Discussion

The primary objective of this research was to determine the physical characteristics of elite and qualified women-canoers in China. It should be highlighted that this is the first comparative, interdisciplinary study in women in canoeing. The main result was the significantly greater physical fitness level by the elite women canoeing in China. These results provide normative data about the status of women canoeing in China competing at a high level, which enables identifying an optimal profile for each discipline.

The majority of studies in canoe and kayak paddlers has been focused on upper body aerobic capacity and its development because the paddlers spend the majority of their race at or around their VO_{2peak} (Fernandez & Terrados, 1995). Methods and testing protocols to determine valid VO_{2peak} values using kayak and canoe ergometer protocols and/or arm cranking protocols are frequently discussed (Forbes & Chilibeck, 2007; Michael & Smith, 2008).

The differences in physical performance capacity have been investigated more extensively for lower body performance, and less is known about the sex- and age-related differences in aerobic and anaerobic capacity as regards upper body exercise. In aerobic upper body exercise, untrained females attain at about 60 to 70% and specifically trained females at about 80 to 85% of the performances (related to kg of body mass) of their male untrained and/or trained counterparts (Heller, Vodicka, & Pribanova, 2002).

The maximum oxygen uptake has been the main physiological variable studied in the kayak literature due to its relationship with race times (Shephard, 1987; Tesch et al., 1976). However, in young athletes, it seems that VO_{2max} values and performance in a given sport are not significantly related. Unsurprisingly, the kayakers exhibited significantly larger estimated VO_{2max} values that confirm their greater aerobic capacity. Expressing VO_{2max} relative to body mass has also revealed superior aerobic endurance of the kayakers regardless of their size and higher maturity levels. The previous research had indicated significantly higher VO_{2max} levels than those observed here in both ergometer and treadmill tests, reporting values not lower than 54ml•kg-1•min-1 in either case (Fry & Morton, 1991; Shephard, 1987). However, any comparison between studies must be carefully undertaken due to the different protocols applied to estimate Oxygen uptake.

This study Borges and Coutts (2015) aimed to profile the physiological characteristics of junior sprint kayak athletes (n=21, VO_{2max} 4.1±0.7 L/min, training experience 2.7±1.2 y) and to establish the relationship between physiological variables (VO_{2max}, VO_2 kinetics, muscle-oxygen kinetics, paddling efficiency) and sprint kayak performance. VO_{2max}, power at VO_{2max}, power, weight ratio, paddling efficiency, VO_2 at lactate threshold, and whole-body and muscle oxygen kinetics were determined on a kayak ergometer in the laboratory. Multiple regression showed that 88% of the unadjusted variance for the 200-m TT performance was explained by $VO2_{max}$, peripheral muscle deoxygenation, and maximal aerobic power (p<.001), whereas 85% of the unadjusted variance in 1000-m TT performance was explained by VO_{2max} and deoxyhemoglobin (p<.001).

However, in contrast to aerobic exercise testing, there is an inconsistency in the modes and protocols and test duration of anaerobic tests used in canoe and kayak paddlers. For example, Fry and Morton (1991) used a 60-s lasting all-out test, while Bishop et al. (2002) and van Someren and Palmer (2003) have studied maximum accumulated oxygen deficit in a 2-min lasting all-out test, whereas Sitkowski has tested kayak paddlers by a 40-s upper body exercise test, and/or van Someren and Dunbar and Heller et al. (1997) used a 30-s lasting supramaximal test.

The research has shown that all female canoe paddlers' (reserve team) physiological characteristics are reduced in relation to the characteristics of elite female canoe paddlers, similar in duration and intensity of work in the canoe. There is no normative basis for female canoe paddlers' special operability in the process of modelling competitive activity and in implementing the components of the energy supply structure if the different protocols are applied to estimate Oxygen uptake.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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SportMont

ORIGINAL SCIENTIFIC PAPER

Return to Sport of Male Judokas who have Various Surgical Treatments of Lumbar Disk Herniation

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Abstract

Lower back pain is one of the most common sources of pain in professional athletes. Regarding flexion pain in athletes, lumbar disk herniation is the most common disorder. The limited evidence on the effectiveness of surgical treatment does not allow conclusions to be drawn about the relative effectiveness of various surgery treatments for facilitating a rapid return to sport. The present paper aimed to search for objective data on the period return to sport of elite male judokas with various surgical treatment modalities of lumbar disk herniation. Participants: elite male judokas (n=8). All athletes had complaints of lower back pain. All judokas were recommended surgery: removal of lumbar disk herniation (L5-S1). Two methods of surgical treatment were used: Group 1 (n=4): total resection of the intervertebral disc and installation of the functional endoprosthesis and Group 2 (n=4): spinal fusion. Athletes' pain level using Visual Analogue Scale (VAS) and Russian Oswestry Disability Index (RODI) was assessed for 3, 6, and 9 months after surgery. Athletes' personal diary data to estimate the period return to sport was used. Group 1 VAS and RODI indicators were significantly ($p<0.01$) lower 6 and 9 months after surgery. The daily training time of Group 1 was significantly ($p<0.01$) longer in 6 and 9 months after surgery. A special judo performance test (60 Ippon-seoi-nage) showed a significant ($p<0.01$) advantage of Group 1 9 months after surgery. Research shows that Group 1 judokas returned to sport after 6-9 months, and Group 2 judokas after more than 9 months.

Keywords: *lower back pain, lumbar disk herniation, elite athletes, judo, rehabilitation, return to sport*

Introduction

Lower back pain (LBP) is one of the most common medical presentations in the human population. It is a common source of pain in athletes, leading to significant time missed and disability (Petering & Webb, 2011). Research has revealed that lumbar motion that induces specific pain would be a clue to the exact diagnosis. For the flexion pain of athletes, lumbar disk herniated (LDH) nucleus pulposus is the most common disorder (Sairyo & Nagamachi, 2016). Researchers note that the prevalence of LBP in professional athletes across a variety of time frames and sports is not known (Farahbakhsh et al., 2018). Reviews show that the lifetime prevalence of LBP in wrestlers is not high compared to other sports, specifically rowing and cross-country skiing (Trompeter, Fett, & Platen, 2017).

Triki, Koubaa, Masmoudi, Fellmann, and Tabka (2015) indicate that judo was identified as a high-risk sport for causing LBP. Judo is an acyclic and high-intensity intermittent Olympic sport, which requires complex technical and tactical skills and puts high physiological, neuromuscular and power demands on athletes (Kons, Da Silva, Fischer, & Detanico, 2018). As elite judokas have to perform a great number of actions during

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each match, the physical performance of a single match is high (Eken, Özkol, & Varol, 2020). The most recent changes in competition rules demand higher standards of judokas' distinct physical fitness level: high-speed and muscle-strength level (Osipov, Kudryavtsev, Iermakov, & Jagiello, 2018). Judo training involves multiple repetitions of rapid movements, short maximal muscle contractions, usually with heavy external loads, and frequent training bouts with a partner. This type of training is associated with a significantly increased risk of injuries and overloads of the lumbar spine (Ahmetov et al., 2017). Vertebral disc prolapses were the most severe injuries concerning time loss and sporting performance reduction in judo (Akoto et al., 2018). Sakai, Sairyo, Suzue, Kosaka, and Yasui (2010) indicate that Japanese judo athletes were prone to suffer lumbar spondylolysis, at an incidence of about 20%.

Spondylolysis and spondylosis is a common cause of LBP in professional athletes. It remains unclear whether professional athletes with spondylolysis who undergo surgical repair are able to return to sports as effectively or faster than if they had conservative treatment (Scheepers, Streak Gomersall, & Munn, 2015). Reiman, Sylvain, Loudon, & Goode (2016) indicate that comparing surgical versus conservative treatment found no significant difference between athletes regarding return to sport. Surgical interventions have been recommended for athletes who have had persistent LBP for more than six months with no relief from rest and bracing (Lawrence, Elser, & Stromberg, 2016). It is known that the recovery period of athletes after some surgical interventions (lumbar discectomy) ranged from 2 to 8 months (Nair, Kahlenberg, and Hsu, 2015).

Yamaguchi and Hsu (2019) indicate that more robust and objective research on operative and non-operative treatment modalities for elite athletes with LBP and LDH are needed. Experts' point out two operative treatment modalities athletes with LDH: spinal fusion (Fusion) and total resection of the lumbar disk (TDR) with the installation of the functional endoprosthesis (Botov, Shnyakin, Osipov, & Zhavner, 2018). Scheepers et al. (2015) indicate that the limited evidence on the effectiveness of surgical treatment versus conservative treatment for spondylolysis in professional athletes does not allow any conclusions to be drawn about the relative effectiveness of surgery versus conservative treatment for facilitating a rapid return to sport or a high level of post-injury sporting level/performance. Further research is required to compare conservative therapy to surgical therapy and to compare the various surgical techniques to each other (Tawfik, Phan, Mobbs, & Rao, 2020).

Unfortunately, the literature review does not provide robust and complete data on effective treatment modalities providing a quick return to sport of elite judokas with spondylolysis, spondylosis, and LDH. The purpose of the research is to search for objective data on the period return to sport of elite male judokas with LDH various surgical treatment modalities.

Methods

The elite male athletes (n=8) practising judo for 9–12 years. The average age of judokas was 25.22±2.49 year. All judokas had complaints of LBP and lower limb pain. All judokas went to the clinic complaining of continuing and increasing LBP and lower limbs pain after non-effective conservative therapy lasting from 4 to 8 weeks. All athletes were diagnosed with dorsopathy with painful radicular syndrome of the disc herniation and a decrease in the height of the L5-S1 disc. All judokas were recommended surgical intervention: LDH removal (L5-S1). All athletes gave voluntary informed consent to participate in research. The research was approved by the local ethics expert committee of the Institute of Physical Culture, Sports and Tourism (Siberian Federal University) and local ethics expert committee of the Voyno-Yasenetsky Krasnoyarsk State Medical University.

The research was conducted in the neurosurgical department of the regional clinical hospital (Krasnoyarsk), Voyno-Yasenetsky Krasnoyarsk State Medical University and Sports wrestling, academy named D.G. Mindiashvili (Krasnoyarsk). The overall research period was four years (2015–2018). All judokas underwent surgery: LDH removal (L5-S1) during 2015-2017. Participants were divided into two groups. Group 1 (n=4) underwent surgical intervention with total resection of the intervertebral disc at the level of the lumbar spine (TDR) with decompression of the dural sac and the subsequent installation of the functional endoprosthesis (M6-L Artificial Lumbar Disc). Group 2 (n=4) underwent surgical intervention with spinal fusion (Fusion) with transpedicular screws after LDH removal (L5-S1). The overall rehabilitation period for athletes was three months after surgery. All athletes used daily physical exercise sets (30 minutes per day) and electro-neuromyostimulation in the lower back (20–30 minutes per day). The daily physical rehabilitation course included a light weight-training programme, avoiding exercises that inappropriately load the lumbar spine. Phase I (5–7 days after surgery): warm-up (10 min); extension the knee while lying supine with the spine in a neutral position and the hip flexed to a 90° angle (2 sets of 20–30 reps); abdominal bracing (25–30 reps); hip flexors stretching (20–30 reps). Phase II (2 weeks after surgery): warm-up (10 min); hip hinge drill (2 sets of 20–30 reps); superman (2 sets of 20–30 reps); wall squats and sit to stand (30–40 reps); half lunges (30–40 reps). Phase III (4 weeks after surgery): warm-up (10 min); bridging and heel lifts (2 sets of 20–30 reps); lateral pulls with light weights (3.5–5.5 kg; 3 sets of 20–30 reps); hip hinge drill (3 sets of 20–30 reps); seated upright rowing machine (2–3 min). The electro-neuromyostimulation course consisted of electroneuromyostimulation to the area of low back muscles tow times a day (each session took 10–15 minutes). The neuromuscular stimulation device "Mercury" (Russia) was used during the athletes' rehabilitation. Electro-neuromyostimulation characteristics of device: pulse frequency 50 Hz, pulse duration 350 μs, synchronous waveform. All judokas began sport training after a rehabilitation period.

To assess participants' pain syndrome magnitude, the Visual Analogue Scale (VAS) was used. Assessment of participants' quality of life to the Russian Oswestry Disability Index (RODI) was carried. The magnetic resonance tomographies (MRI) of the lumbar spine were also performed in the research period: after surgery, as well as three, six, and nine months in the research period. Athletes' personal diary data to estimate the period of return to sport were used. The personal special fitness performance level of judokas using a special test (60 Ippon-seoi-nage; throws two partners in rapid succession) was determined.

Statistical programme SPSS17 was used for statistical processing and analysis of the research results. The Pearson test ($\chi 2$) and Mann-Whitney U-test to compare the research results were used.

Results

No significant differences in VAS and RODI indicators between athletes groups before surgery were found. MRI data of all judokas did not reveal the appearance of new pathologies during the research period. Significant differences in VAS and RODI athletes' indicators in the rehabilitation period (3 months after surgery) were not found. Significant differences in VAS and RODI indicators of judokas groups were found six months after surgery. Group 1 VAS and RODI indicators were significantly ($p<0.01$) lower. A similar trend in a later research period (9 months after surgery) was revealed. The VAS and RODI indicators of Group 1 were significantly ($p<0.01$) different from the indicators of group 2.

Training time indicators (minutes per day) for judokas of both groups did not have significant differences after the end of the rehabilitation period (3 months after surgery). In the next research period (6 months after surgery), significant differences in the indicators of daily training time were revealed. It was found that the daily training time of Group 1 was significantly ($p<0.01$) longer than that of Group 2. A similar trend in the next research period (9 months after surgery) was revealed. Group 1 judokas had almost 18.85±1.07 minutes more daily training time.

The performance of both athletes groups in performing a special test (60 Ippon-seoi-nage) did not differ significantly three and six months after surgery. A special test revealed a significant ($p<0.01$) advantage of Group 1 judokas nine months after surgical intervention. The positive dynamics of testing, reducing execution time in both athlete groups during the period of the research, was revealed. Complete data of the research are presented in Table 1.

Table 1. The overall data of the research

	Research period			
Athletes (n=8)	**Before surgery**	**3 months**	**6 months**	**9 months**
		VAS		
Group 1 (TDR)	8.47±2.34	4.69±2.18	3.43±1.54*	2.73±1.19*
Group 2 (Fusion)	8.51±2.41	4.83±2.27	5.26±1.12	4.87±1.46
		RODI		
Group 1 (TDR)	56.22±7.46	18.76±4.39	10.34±3.07*	6.42±2.15*
Group 2 (Fusion)	58.18±6.73	19.52±5.21	13.58±4.25	10.79±3.46
		Daily training time (minutes per day)		
Group 1 (TDR)	-	47.09±11.42	119.46±14.15*	174.24±17.32*
Group 2 (Fusion)	-	45.51±9.34	104.33±18.41	155.39±16.25
		60 Ippon-seoi-nage (minutes)		
Group 1 (TDR)	-	2.45±0.21	2.29±0.26	2.11±0.09*
Group 2 (Fusion)	-	2.47±0.15	2.32±0.22	2.29±0.15

Legend: * (reliability of results differences) – $p<0.01$.

Discussion

There is a lack of useful data on the prevalence and mechanism of LBP in some popular sports. Researchers need to recruit a large sample population of the athletes for the standard and acceptable definitions for LBP treatment (Farahbakhsh et al., 2018). However, experts note that carrying out such studies is associated with significant difficulties. Botov et al. (2018) point out that surgery (TDR) is estimated to cost the equivalent of USD 6,000-7,000 and surgery (Fusion) is estimated at USD 2,000-3,000 in the Russian Federation. Lack of money has a significant impact on the number of cases of certain surgical treatments for athletes. Difficulties finding similar participants of the research also exist. It took us about four years to select eight similar male judokas and conduct a complete research study. It should be recognized that the conduct of such studies will face the problem of recruiting a sufficient number of similar participants.

Nair et al. (2015) point out that the recovery period after lumbar discectomy ranged from two to eight months. Our research shows that the full recovery period of judokas lasts nine months and more. The recovery period for athletes was found to be related to the surgical treatment modality. Group 1 (TDR) show higher recovery indicators nine months after surgical treatment. Not all judokas forced themselves to return to competition. Perhaps a longer recovery period for athletes is associated with medical advice.

Akoto et al. (2018) indicate that about 30% of judokas with vertebral disk injuries after return to sport had strongly reduced of sporting performance or stopped judo. Studies of the Russian male judokas' superior performance fitness level show that the average time for completion of the special test (60 Ippon-seoi-nage) is about 2.15–2.20 minutes (Osipov et al., 2018). It was revealed that Group 1 athletes exceeded this indicator nine months after surgical intervention. Judokas (Fusion) showed lower indicators on the special performance test (60 Ippon-seoi-nage) nine months after surgery. These results allow us to conclude that the end of the rehabilitation period and full return to sport occurred with the Group 1 athletes (TDR).

The scientific literature provides some data on the number of athletes who successfully returned to sport after surgical treatment (TDR or Fusion). Botov et al. (2018) indicate that the higher percentage of athletes' number successfully returned to sport after TDR. Athletes (Fusion) had pain complaints and sport performance problems. Some athletes (Fusion) were not able to successfully return to sports and ended their sports career. Experts believe that the increased LBP during training loads in athletes (Fusion) is associated with an increased load

on the intervertebral discs and degenerative changes (the appearance of lumbar disc protrusions and degenerative changes in facet joints) at adjacent levels of the spine. Experts attribute the lack of significant LBP in athletes (TDR) to quality endoprosthesis. The presence of an endoprosthesis can significantly reduce the load on adjacent intervertebral discs (Botov et al., 2018). However, most of the athletes studied were not involved in martial arts. Our research revealed a similar tendency for higher back pain syndromes among judokas in six and nine months after surgery (Fusion). The daily training time for athletes (Fusion) was also significantly ($p<0.01$) lower than that of athletes (TDR). However, complaints of severe back pain and the inability to continue sport training were not received. Possibly a longer research period and a greater number of participants are required to obtain robust and objective data.

More objective and robust research on alternative treatment modalities is needed for athletes with LBP and LDH (Yamaguchi & Hsu, 2019). The limited evidence on the effectiveness of surgical treatment does not allow any conclusions to be drawn about the relative effectiveness of surgery for facilitating a rapid return to sport or athletes' performance level post-treatment (Scheepers et al., 2015). The objective data on the recovery period duration and return to sport of judokas after various LDH removal surgical treatments are presented in our study. We found that Group 1 (TDR) showed much better recovery rates, as reflected in VAS, RODI, and daily training time, six months after surgery. A similar trend nine months after surgery was determined. The small number of participants does not allow making a general conclusion about a higher level of effectiveness of surgical treatment (TDR) of male judokas with LDH. However, it was found that male judokas (TDR) have fewer pain symptoms and have more daily training time in practice during the period of returning to sport in comparison judokas (Fusion).

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Conflict of Interest

The authors declare that there are no conflicts of interest.

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SportMont

SHORT REPORT

Anthropometric Characteristics of Kosovo Superleague Footballers

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Abstract

The aimed of study is analyse the differences in some anthropometric characteristics and body composition between footballers of two clubs in Kosovo, FC Feronikeli and SC Gjilani. The first sample consisted of 21 footballers of FC Feronikeli (22.62±3.46 years), current champion, cup and super cup winner in Kosovo at the time of the measurement in January 2020. The second sample consisted of 24 footballers of SC Gjilani (26.38±5.62 years), who was the leader of the Superleague of Kosovo at the time of the measurement in February 2020. Anthropometric characteristics were evaluated with following variables: body height, body weight, triceps skinfold, biceps skinfold, skinfold of the back, abdominal skinfold, upper leg skinfold and lower leg skinfold. The body composition was evaluated with following variables: body mass index, fat percentage and muscle mass. The parameters of descriptive statistics all variables were calculated. The differences between the footballers of FC Feronikeli and SC Gjilani in the following variables were determined using a t-test. It was found that the footballers of the FC Feronikeli and SC Gjilani don't have statistically significant differences by the variables.

Keywords: *footballers, Kosovar superleague, anthropometric characteristics, body composition*

Introduction

Football is the most popular sport in the world (Masanovic, 2019). It belongs to the category of polystructural sports, with numerous cyclical and cyclical movements, with or without ball (Arifi, Bjelica, & Masanovic, 2019). In football, the best results can be scored only under conditions of well-programmed training process (Masanovic, T. Bavcevic, & I. Bavcevic, 2019). Various studies are confirmed significance of anthropometric characteristics and body composition of athletes for better quality of their game (Gardasevic, Bjelica, Bajramovic, Masanovic, & Popo, 2021). Many studies indicates that athletes of different sports have different anthropometric characteristics and body composition (Masanovic, Gardasevic, & Bjelica, 2021; Gusic, Popovic, Molnar, Masanovic, & Radakovic, 2017). Required level of anthropometric characteristics and body composition of footballers is very importance for that sport. As in the Balkan, football is the number one sport in Kosovo. This research was conducted on the footballers of two successful clubs of the Superleague, the highest quality league in Kosovo.

The aimed of study is analyse the differences in some anthropometric characteristics and body composition between footballers of FC Feronikeli and SC Gjilani.

Methods

A sample of a total of 45 football players was included in this study. The first sample consisted of 21 footballers of FC Feronikeli (22.62±3.46 years), current champion, cup and super cup winner in Kosovo at the time of the measurement in January 2020. The second sample consisted of 24 footballers of SC Gjilani (26.38±5.62 years), who was the leader of the Superleague of Kosovo at the time of the measurement in

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February 2020. Football club Feronikeli was the champion of Kosovo three times. Six months before the measurement, FC Feronikeli won the third title, the Cup and Supercup of Kosovo, and competed in the qualifications for the UEFA Champions League in the 2019/20 season, entering at the preliminary round. Football Club Gjilani has never been the champion of Kosovo, but in the middle of the 2019/20 season, at the time of the measurement, it was leading in the table of the Kosovo Supereague and fought for the title of champion.

Anthropometric measurement has been carried in accordance with the International Biological Program guidelines. Anthropometric characteristics were evaluated with following variables: body height, body weight, triceps skinfold, biceps skinfold, skinfold of the back, abdominal skinfold, upper leg skinfold and lower leg skinfold. The body composition was evaluated with following variables: body mass index, fat percentage, and muscle mass. An anthropometer and calliper were used for anthropometric measurement. The Tanita MC 980 model was used to assess body composition.

The differences between the footballers of FC Feronikeli and SC Gjilani in the following variables were determined using a t-test, with statistical significance of $p < 0.05$.

Results

Before t-test the standard central and dispersion parameters and skewness and kurtosis of all variables of footballers of both clubs were calculated. The results showed the normal distribution. T-test results (Table 1) showed that the footballers of FC Feronikeli and SC Gjilani didn't have statistically significant differences by the variables.

Table 1. T-test results of the footballers of FC Feronikeli (N=21) and SC Gjilani (N=24)

Variables	Club	Mean±S.D.	Mean Difference	t-test	Sig.
body height	FC Feronikeli	180.16±6.57	1.15	.600	.552
	SC Gjilani	179.01±6.31			
body weight	FC Feronikeli	76.51±6.08	-.62	-.369	.714
	SC Gjilani	77.13±5.19			
triceps skinfold	FC Feronikeli	6.50±2.77	.30	.437	.664
	SC Gjilani	6.20±1.62			
biceps skinfold	FC Feronikeli	5.18±2.63	.52	.680	.500
	SC Gjilani	4.66±2.43			
skinfold of the back	FC Feronikeli	9.35±1.94	-.03	-.046	.964
	SC Gjilani	9.38±2.59			
abdominal skinfold	FC Feronikeli	11.28±3.41	.03	.022	.983
	SC Gjilani	11.25±3.34			
upper leg skinfold	FC Feronikeli	9.01±2.70	-.60	-.795	.431
	SC Gjilani	9.61±2.35			
lower leg skinfold	FC Feronikeli	4.64±1.22	-.39	-.958	.343
	SC Gjilani	5.03±1.47			
body mass index	FC Feronikeli	23.56±1.39	-.54	-1.418	.163
	SC Gjilani	24.10±1.15			
fat percentage	FC Feronikeli	11.90±3.27	-.38	-.416	.679
	SC Gjilani	12.28±2.84			
muscle mass	FC Feronikeli	39.07±4.95	.79	.689	.495
	SC Gjilani	38.28±2.59			

Discussion

It can be concluded that the footballers of FC Feronikeli and SC Gjilani had similar mean values of the variables analysed. These results were expected if we look at their results in Superleague of Kosovo over the last six months. Similar results were found on a footballers from the best clubs of Montenegro (Gardasevic, Bjelica, & Vasiljevic, 2019) and Bosnia and Herzegovina (Gardasevic et al., 2020). It can be noticed very similar mean values of anthropometric characteristics and body composition of top footballers from the region (Gardasevic, & Bjelica, 2020; Gardasevic, Bjelica, Vasiljevic, Arifi, & Sermaxhaj, 2019). In this research the t-test results didn't show a statistically significant difference between variables. Some values of variables are higher for footballers of FC Feronikeli and some for footballers of SC Gjilani, but, didn't find significant diferences. First of all the results of this research can be significant for coaches of both clubs. These variables can be improved with good training and right nutrition. However, it can be concluded that all tested footballers have average values of parameters that are in very good for professional footballers. It means that their coaches are doing a good job. This is just one segment of testing needed to check the complete status of the footballers. Motorical, functional, psychological and tactical status and analyse should be included and check if there is space for their improvement.

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1.6. After Acceptance

After the manuscript has been accepted, authors will receive a PDF version of the manuscripts for authorization, as it should look in printed version of SM. Authors should carefully check for omissions. Reporting errors after this point will not be possible and the Editorial Board will not be eligible for them.

Should there be any errors, authors should report them to the Office e-mail address **sportmont@ucg.ac.me**. If there are not any errors authors should also write a short e-mail stating that they agree with the received version.

1.7. Code of Conduct Ethics Committee of Publications

SM is hosting the Code of Conduct Ethics Committee of Publications of the **COPE** (the Committee on Publication Ethics), which provides a forum for publishers and Editors of scientific journals to discuss issues relating to the integrity of the work submitted to or published in their journals.

2. MANUSCRIPT STRUCTURE

2.1. Title Page

The first page of the manuscripts should be the title page, containing: title, type of publication, running head, authors, affiliations, corresponding author, and manuscript information. *See* example:

Body Composition of Elite Soccer Players from Montenegro

Original Scientific Paper

Elite Soccer Players from Montenegro

Jovan Gardasevic[1]

[1]Univeristy of Montenegro, Faculty for Sport an Physical Education, Niksic, Montenegro

Corresponding author:

J. Gardasevic

University of Montenegro

Faculty for Sport and Physical Education

Narodne omladine bb, 81400 Niksic, Montenegro

E-mail: jovan@ucg.ac.me

Word count: 2,946

Abstract word count: 236

Number of Tables: 3

Number of Figures: 0

2.1.1. Title

Title should be short and informative and the recommended length is no more than 20 words. The title should be in Title Case, written in uppercase and lowercase letters (initial uppercase for all words except articles, conjunctions, short prepositions no longer than four letters etc.) so that first letters of the words in the title are capitalized. Exceptions are words like: "and", "or", "between" etc. The word following a colon (:) or a hyphen (-) in the title is always capitalized.

2.1.2. Type of publication

Authors should suggest the type of their submission.

2.1.3. Running head

Short running title should not exceed 50 characters including spaces.

2.1.4. Authors

The form of an author's name is first name, middle initial(s), and last name. In one line list all authors with full names separated by a comma (and space). Avoid any abbreviations of academic or professional titles. If authors belong to different institutions, following a family name of the author there should be a number in superscript designating affiliation.

2.1.5. Affiliations

Affiliation consists of the name of an institution, department, city, country/territory (in this order) to which the author(s) belong and to which the presented / submitted work should be attributed. List all affiliations (each in a separate line) in the order corresponding to the list of authors. Affiliations must be written in English, so carefully check the official English translation of the names of institutions and departments.

Only if there is more than one affiliation, should a number be given to each affiliation in order of appearance. This number should be written in superscript at the beginning of the line, separated from corresponding affiliation with a space. This number should also be put after corresponding name of the author, in superscript with no space in between.

If an author belongs to more than one institution, all corresponding superscript digits, separated with a comma with no space in between, should be present behind the family name of this author.

In case all authors belong to the same institution affiliation numbering is not needed.

Whenever possible expand your authors' affiliations with departments, or some other, specific and lower levels of organization.

2.1.6. Corresponding author

Corresponding author's name with full postal address in English and e-mail address should appear, after the affiliations. It is preferred that submitted address is institutional and not private. Corresponding author's name should include only initials of the first and middle names separated by a full stop (and a space) and the last name. Postal address should be written in the following line in sentence case. Parts of the address should be separated by a comma instead of a line break. E-mail (if possible) should be placed in the line following the postal address. Author should clearly state whether or not the e-mail should be published.

2.1.7. Manuscript information

All authors are required to provide word count (excluding title page, abstract, tables/figures, figure legends, Acknowledgements, Conflict of Interest, and References), the Abstract word count, the number of Tables, and the number of Figures.

2.2. Abstract

The second page of the manuscripts should be the abstract and key words. It should be placed on second page of the manuscripts after the standard title written in upper and lower case letters, bold.

Since abstract is independent part of your paper, all abbreviations used in the abstract should also be explained in it. If an abbreviation is used, the term should always be first written in full with the abbreviation in parentheses immediately after it. Abstract should not have any special headings (e.g., Aim, Results…).

Authors should provide up to six key words that capture the main topics of the article. Terms from the Medical Subject Headings (MeSH) list of Index Medicus are recommended to be used.

Key words should be placed on the second page of the manuscript right below the abstract, written in italic. Separate each key word by a comma (and a space). Do not put a full stop after the last key word. *See* example:

Abstract

Results of the analysis of

Key words: *spatial memory, blind, transfer of learning, feedback*

2.3. Main Chapters

Starting from the third page of the manuscripts, it should be the main chapters. Depending on the type of publication main manuscript chapters may vary. The general outline is: Introduction, Methods, Results, Discussion, Acknowledgements

(optional), Conflict of Interest (optional). However, this scheme may not be suitable for reviews or publications from some areas and authors should then adjust their chapters accordingly but use the general outline as much as possible.

2.3.1. Headings

Main chapter headings: written in bold and in Title Case. *See* example:

- ✓ **Methods**

Sub-headings: written in italic and in normal sentence case. Do not put a full stop or any other sign at the end of the title. Do not create more than one level of sub-heading. *See* example:

- ✓ *Table position of the research football team*

2.3.2 Ethics

When reporting experiments on human subjects, there must be a declaration of Ethics compliance. Inclusion of a statement such as follow in Methods section will be understood by the Editor as authors' affirmation of compliance: "This study was approved in advance by [name of committee and/or its institutional sponsor]. Each participant voluntarily provided written informed consent before participating." Authors that fail to submit an Ethics statement will be asked to resubmit the manuscripts, which may delay publication.

2.3.3 Statistics reporting

SM encourages authors to report precise p-values. When possible, quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Use normal text (i.e., non-capitalized, non-italic) for statistical term "p".

2.3.4. 'Acknowledgements' and 'Conflict of Interest' (optional)

All contributors who do not meet the criteria for authorship should be listed in the 'Acknowledgements' section. If applicable, in 'Conflict of Interest' section, authors must clearly disclose any grants, financial or material supports, or any sort of technical assistances from an institution, organization, group or an individual that might be perceived as leading to a conflict of interest.

2.4. References

References should be placed on a new page after the standard title written in upper and lower case letters, bold.

All information needed for each type of must be present as specified in guidelines. Authors are solely responsible for accuracy of each reference. Use authoritative source for information such as Web of Science, Medline, or PubMed to check the validity of citations.

2.4.1. References style

SM adheres to the American Psychological Association 6th Edition reference style. Check "American Psychological Association. (2009). Concise rules of APA style. American Psychological Association." to ensure the manuscripts conform to this reference style. Authors using EndNote® to organize the references must convert the citations and bibliography to plain text before submission.

2.4.2. Examples for Reference citations

One work by one author

- ✓ In one study (Reilly, 1997), soccer players
- ✓ In the study by Reilly (1997), soccer players
- ✓ In 1997, Reilly's study of soccer players

Works by two authors

- ✓ Duffield and Marino (2007) studied
- ✓ In one study (Duffield & Marino, 2007), soccer players
- ✓ In 2007, Duffield and Marino's study of soccer players

Works by three to five authors: cite all the author names the first time the reference occurs and then subsequently include only the first author followed by et al.

- ✓ First citation: Bangsbo, Iaia, and Krustrup (2008) stated that
- ✓ Subséquent citation: Bangsbo et al. (2008) stated that

Works by six or more authors: cite only the name of the first author followed by et al. and the year

- ✓ Krustrup et al. (2003) studied
- ✓ In one study (Krustrup et al., 2003), soccer players

Two or more works in the same parenthetical citation: Citation of two or more works in the same parentheses should be listed in the order they appear in the reference list (i.e., alphabetically, then chronologically)

- ✓ Several studies (Bangsbo et al., 2008; Duffield & Marino, 2007; Reilly, 1997) suggest that

2.4.3. Examples for Reference list

Journal article (print):

Nepocatych, S., Balilionis, G., & O'Neal, E. K. (2017). Analysis of dietary intake and body composition of female athletes over a competitive season. *Montenegrin Journal of Sports Science and Medicine, 6*(2), 57-65. doi: 10.26773/mjssm.2017.09.008

Duffield, R., & Marino, F. E. (2007). Effects of pre-cooling procedures on intermittent-sprint exercise performance in warm conditions. *European Journal of Applied Physiology, 100*(6), 727-735. doi: 10.1007/s00421-007-0468-x

Krustrup, P., Mohr, M., Amstrup, T., Rysgaard, T., Johansen, J., Steensberg, A., Bangsbo, J. (2003). The yo-yo intermittent recovery test: physiological response, reliability, and validity. *Medicine and Science in Sports and Exercise, 35*(4), 697-705. doi: 10.1249/01.MSS.0000058441.94520.32

Journal article (online; electronic version of print source):

Williams, R. (2016). Krishna's Neglected Responsibilities: Religious devotion and social critique in eighteenth-century North India [Electronic version]. *Modern Asian Studies, 50*(5), 1403-1440. doi:10.1017/S0026749X14000444

Journal article (online; electronic only):

Chantavanich, S. (2003, October). Recent research on human trafficking. *Kyoto Review of Southeast Asia, 4*. Retrieved November 15, 2005, from http://kyotoreview.cseas.kyoto-u.ac.jp/issue/issue3/index.html

Conference paper:

Pasadilla, G. O., & Milo, M. (2005, June 27). *Effect of liberalization on banking competition*. Paper presented at the conference on Policies to Strengthen Productivity in the Philippines, Manila, Philippines. Retrieved August 23, 2006, from http://siteresources.worldbank.org/INTPHILIPPINES/Resources/Pasadilla.pdf

Encyclopedia entry (print, with author):

Pittau, J. (1983). Meiji constitution. In *Kodansha encyclopedia of Japan* (Vol. 2, pp. 1-3). Tokyo: Kodansha.

Encyclopedia entry (online, no author):

Ethnology. (2005, July). In *The Columbia encyclopedia* (6th ed.). New York: Columbia University Press. Retrieved November 21, 2005, from http://www.bartleby.com/65/et/ethnolog.html

Thesis and dissertation:

Pyun, D. Y. (2006). *The proposed model of attitude toward advertising through sport.* Unpublished Doctoral Dissertation. Tallahassee, FL: The Florida State University.

Book:

Borg, G. (1998). *Borg's perceived exertion and pain scales*: Human kinetics.

Chapter of a book:

Kellmann, M. (2012). Chapter 31-Overtraining and recovery: Chapter taken from Routledge Handbook of Applied Sport Psychology ISBN: 978-0-203-85104-3 *Routledge Online Studies on the Olympic and Paralympic Games* (Vol. 1, pp. 292-302).

Reference to an internet source:

Agency. (2007). Water for Health: Hydration Best Practice Toolkit for Hospitals and Healthcare. Retrieved 10/29, 2013, from www.rcn.org.uk/newsevents/hydration

2.5. Tables

All tables should be included in the main manuscript file, each on a separate page right after the Reference section.

Tables should be presented as standard MS Word tables.

Number (Arabic) tables consecutively in the order of their first citation in the text.

Tables and table headings should be completely intelligible without reference to the text. Give each column a short or abbreviated heading. Authors should place explanatory matter in footnotes, not in the heading. All abbreviations appearing in a table and not considered standard must be explained in a footnote of that table. Avoid any shading or coloring in your tables and be sure that each table is cited in the text.

If you use data from another published or unpublished source, it is the authors' responsibility to obtain permission and acknowledge them fully.

2.5.1. Table heading

Table heading should be written above the table, in Title Case, and without a full stop at the end of the heading. Do not use suffix letters (e.g., Table 1a, 1b, 1c); instead, combine the related tables. *See* example:

- ✓ **Table 1.** Repeated Sprint Time Following Ingestion of Carbohydrate-Electrolyte Beverage

2.5.2. Table sub-heading

All text appearing in tables should be written beginning only with first letter of the first word in all capitals, i.e., all words for variable names, column headings etc. in tables should start with the first letter in all capitals. Avoid any formatting (e.g., bold, italic, underline) in tables.

2.5.3. Table footnotes

Table footnotes should be written below the table.

General notes explain, qualify or provide information about the table as a whole. Put explanations of abbreviations, symbols, etc. here. General notes are designated by the word *Note* (italicized) followed by a period.

- ✓ *Note.* CI: confidence interval; Con: control group; CE: carbohydrate-electrolyte group.

Specific notes explain, qualify or provide information about a particular column, row, or individual entry. To indicate specific notes, use superscript lowercase letters (e.g. $^{a, b, c}$), and order the superscripts from left to right, top to bottom. Each table's first footnote must be the superscript ^{a}.

- ✓ ^{a}One participant was diagnosed with heat illness and n = 19.^{b}n =20.

Probability notes provide the reader with the results of the texts for statistical significance. Probability notes must be indicated with consecutive use of the following symbols: * † ‡ § ¶ || etc.

- ✓ *P<0.05,†p<0.01.

2.5.4. Table citation

In the text, tables should be cited as full words. *See* example:

- ✓ Table 1 (first letter in all capitals and no full stop)
- ✓ ...as shown in Tables 1 and 3. (citing more tables at once)
- ✓ ...result has shown (Tables 1-3) that... (citing more tables at once)
- ✓ ....in our results (Tables 1, 2 and 5)... (citing more tables at once)

2.6. Figures

On the last separate page of the main manuscript file, authors should place the legends of all the figures submitted separately.

All graphic materials should be of sufficient quality for print with a minimum resolution of 600 dpi. SM prefers TIFF, EPS and PNG formats.

If a figure has been published previously, acknowledge the original source and submit a written permission from the copyright holder to reproduce the material. Permission is required irrespective of authorship or publisher except for documents in the public domain. If photographs of people are used, either the subjects must not be identifiable or their pictures must be accompanied by written permission to use the photograph whenever possible permission for publication should be obtained.

Figures and figure legends should be completely intelligible without reference to the text.

The price of printing in color is 50 EUR per page as printed in an issue of SM.

2.6.1. Figure legends

Figures should not contain footnotes. All information, including explanations of abbreviations must be present in figure legends. Figure legends should be written bellow the figure, in sentence case. *See* example:

- ✓ **Figure 1.** Changes in accuracy of instep football kick measured before and after fatigued. SR – resting state, SF – state of fatigue, *p>0.01, †p>0.05.

2.6.2. Figure citation

All graphic materials should be referred to as Figures in the text. Figures are cited in the text as full words. *See* example:

- ✓ Figure 1
  - × figure 1
  - × Figure 1.
  - ✓ ….exhibit greater variance than the year before (Figure 2). Therefore…
  - ✓ ….as shown in Figures 1 and 3. (citing more figures at once)
  - ✓ ….result has shown (Figures 1-3) that... (citing more figures at once)
  - ✓ ….in our results (Figures 1, 2 and 5)... (citing more figures at once)

2.6.3. Sub-figures

If there is a figure divided in several sub-figures, each sub-figure should be marked with a small letter, starting with a, b, c etc. The letter should be marked for each subfigure in a logical and consistent way. *See* example:

- ✓ Figure 1a
- ✓ …in Figures 1a and b we can…
- ✓ …data represent (Figures 1a-d)…

2.7. Scientific Terminology

All units of measures should conform to the International System of Units (SI).

Measurements of length, height, weight, and volume should be reported in metric units (meter, kilogram, or liter) or their decimal multiples.

Decimal places in English language are separated with a full stop and not with a comma. Thousands are separated with a comma.

Percentage	Degrees	All other units of measure	Ratios	Decimal numbers
✓ 10%	✓ 10º	✓ 10 kg	✓ 12:2	✓ 0.056
× 10 %	× 10 º	× 10kg	× 12 : 2	× .056

Signs should be placed immediately preceding the relevant number.		
✓ 45±3.4	✓ p<0.01	✓ males >30 years of age
× 45 ± 3.4	× p < 0.01	× males > 30 years of age

2.8. Latin Names

Latin names of species, families etc. should be written in italics (even in titles). If you mention Latin names in your abstract they should be written in non-italic since the rest of the text in abstract is in italic. The first time the name of a species appears in the text both genus and species must be present; later on in the text it is possible to use genus abbreviations. *See* example:

- ✓ First time appearing: *musculus biceps brachii*

Abbreviated: *m. biceps brachii*

ISSN 1451-7485 eISSN 2337-0351
SportMont
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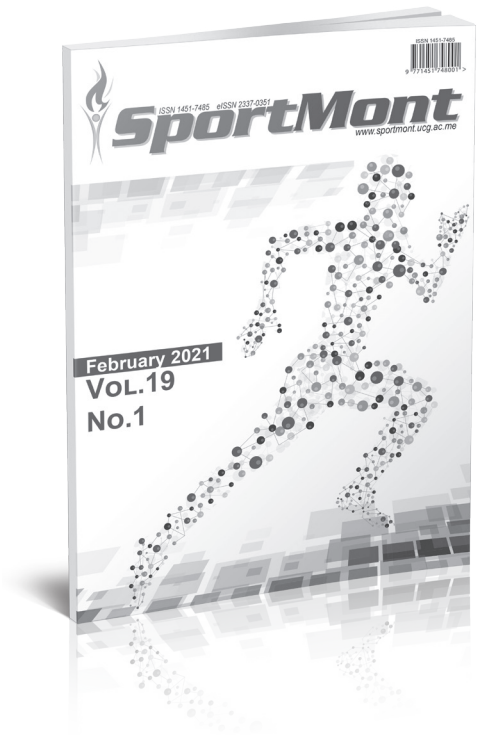

ISSN 1451-7485

Sport Mont (SM) is a print (ISSN 1451-7485) and electronic scientific journal (eISSN 2337-0351) aims to present easy access to the scientific knowledge for sport-conscious individuals using contemporary methods. The purpose is to minimize the problems like the delays in publishing process of the articles or to acquire previous issues by drawing advantage from electronic medium. Hence, it provides:

- Open-access and freely accessible online;
- Fast publication time;
- Peer review by expert, practicing researchers;
- Post-publication tools to indicate quality and impact;
- Community-based dialogue on articles;
- Worldwide media coverage.

SM is published three times a year, in February, June and October of each year. SM publishes original scientific papers, review papers, editorials, short reports, peer review - fair review, as well as invited papers and award papers in the fields of Sports Science and Medicine, as well as it can function as an open discussion forum on significant issues of current interest.

SM covers all aspects of sports science and medicine; all clinical aspects of exercise, health, and sport; exercise physiology and biophysical investigation of sports performance; sport biomechanics; sports nutrition; rehabilitation, physiotherapy; sports psychology; sport pedagogy, sport history, sport philosophy, sport sociology, sport management; and all aspects of scientific support of the sports coaches from the natural, social and humanistic side.

Prospective authors should submit manuscripts for consideration in Microsoft Word-compatible format. For more complete descriptions and submission instructions, please access the Guidelines for Authors pages at the SM website: http://www.sportmont.ucg.ac.me/?sekcija=page&p=51. Contributors are urged to read SM's guidelines for the authors carefully before submitting manuscripts. Manuscripts submissions should be sent in electronic format to sportmont@ucg.ac.me or contact following Editors:

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Zoran MILOSEVIC, *Editor-in Chief – zoranais@eunet.rs*
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Autumn issue – October 2021
Winter issue – February 2022

MONTENEGRIN SPORTS ACADEMY

Founded in 2003 in Podgorica (Montenegro), the Montenegrin Sports Academy (MSA) is a sports scientific society dedicated to the collection, generation and dissemination of scientific knowledge at the Montenegrin level and beyond.

The Montenegrin Sports Academy (MSA) is the leading association of sports scientists at the Montenegrin level, which maintains extensive co-operation with the corresponding associations from abroad. The purpose of the MSA is the promotion of science and research, with special attention to sports science across Montenegro and beyond. Its topics include motivation, attitudes, values and responses, adaptation, performance and health aspects of people engaged in physical activity and the relation of physical activity and lifestyle to health, prevention and aging. These topics are investigated on an interdisciplinary basis and they bring together scientists from all areas of sports science, such as adapted physical activity, biochemistry, biomechanics, chronic disease and exercise, coaching and performance, doping, education, engineering and technology, environmental physiology, ethics, exercise and health, exercise, lifestyle and fitness, gender in sports, growth and development, human performance and aging, management and sports law, molecular biology and genetics, motor control and learning, muscle mechanics and neuromuscular control, muscle metabolism and hemodynamics, nutrition and exercise, overtraining, physiology, physiotherapy, rehabilitation, sports history, sports medicine, sports pedagogy, sports philosophy, sports psychology, sports sociology, training and testing.

The MSA is a non-profit organization. It supports Montenegrin institutions, such as the Ministry of Education and Sports, the Ministry of Science and the Montenegrin Olympic Committee, by offering scientific advice and assistance for carrying out coordinated national and European research projects defined by these bodies. In addition, the MSA serves as the most important Montenegrin and regional network of sports scientists from all relevant subdisciplines.

Over the years the Montenegrin Sports Academy (MSA) has established a productive pool of vital partnerships within the sports science related industry. Apart from two-way visibility, these partnerships provide mutual exchange of scientific research and competence.

Most of the MSA activities and services it provides would not be possible without the continuous support of its partners.

The Montenegrin Sports Academy very much appreciates the support of:

Ministry of Science of Montenegro
Ministry of Education of Montenegro
Ministry of Health of Montenegro
University of Montenegro
Montenegrin Olympic Committee
Institute of Public Health of Montenegro
European College of Sports Science
Volleyball Federation of Montenegro
Faculty for Sport and Physical Education a University of Montenegro
Athletic Federation of Montenegro
Regional Diving Center
Karate Federation of Montenegro
Karate club "Budućnost"
Football Club "Sutjeska"
Football Club "Mladost"
Water Polo and Swimming Association of Montenegro

The main scientific event organized by the Montenegrin Sports Academy (MSA) is the annual conference held in the first week of April.

Annual conferences have been organized since the inauguration of the MSA in 2003. Today the MSA conference ranks among the leading sports scientific congresses in the Western Balkans. The conference comprises a range of invited lecturers, oral and poster presentations from multi- and mono-disciplinary areas, as well as various types of workshops. The MSA conference is attended by national, regional and international sports scientists with academic careers. The MSA conference now welcomes up to 200 participants from all over the world.

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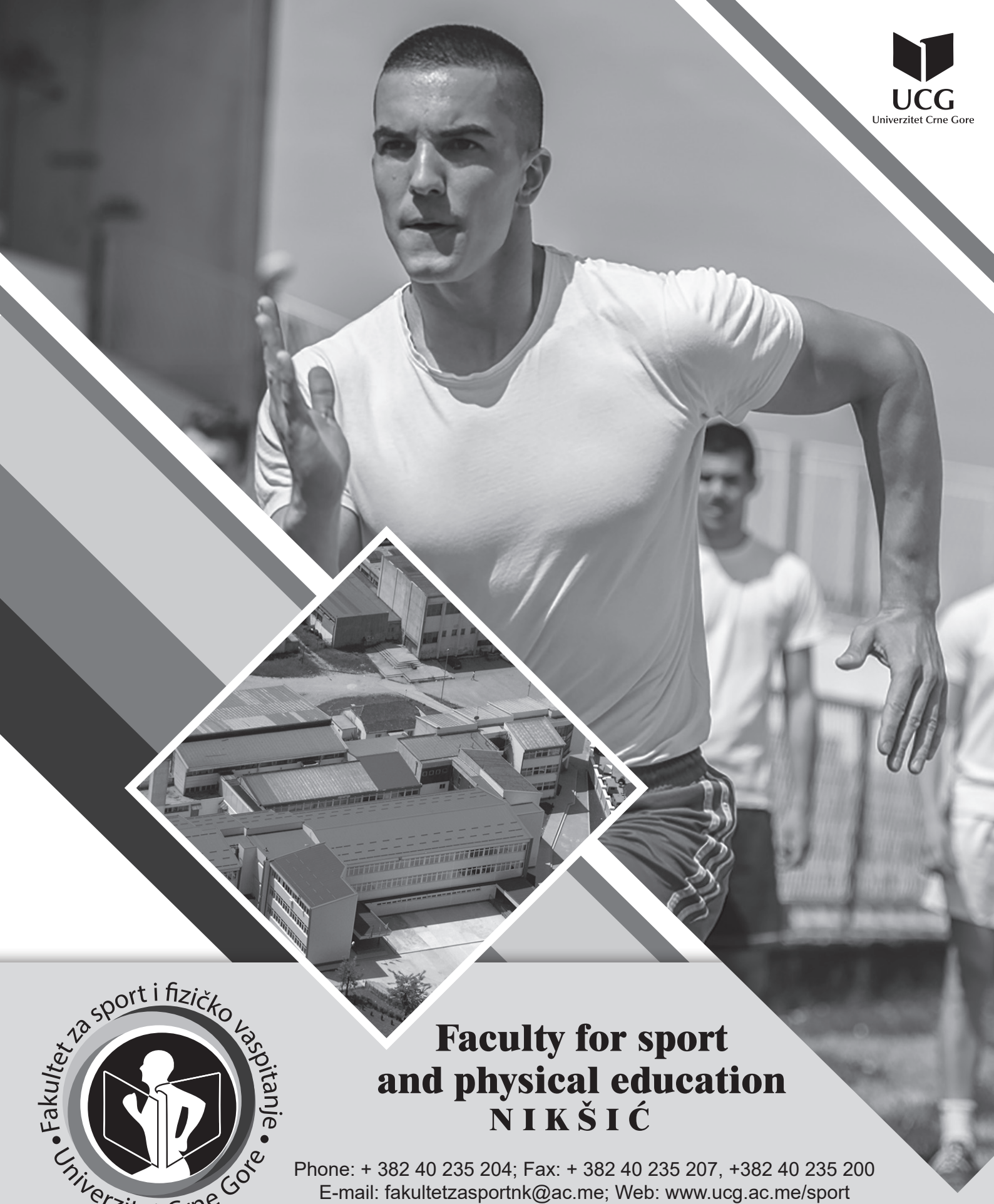
MONTENEGRIN OLYMPIC COMMITTEE



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Montenegrin Journal of Sports Science and Medicine

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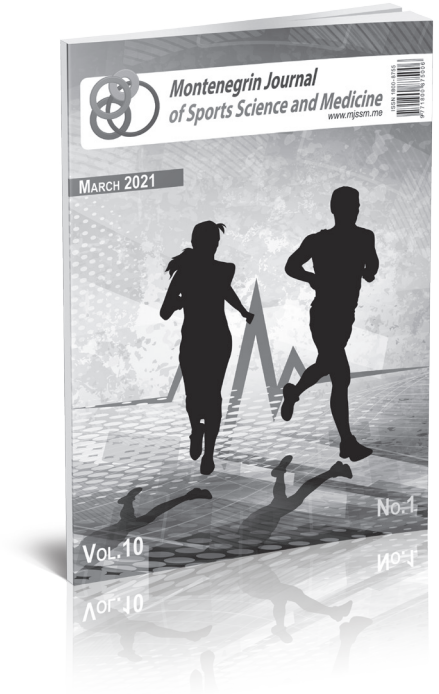

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CALL FOR CONTRIBUTIONS

Montenegrin Journal of Sports Science and Medicine (MJSSM) is a print (ISSN 1800-8755) and electronic scientific journal (eISSN 1800-8763) aims to present easy access to the scientific knowledge for sport-conscious individuals using contemporary methods. The purpose is to minimize the problems like the delays in publishing process of the articles or to acquire previous issues by drawing advantage from electronic medium. Hence, it provides:

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- Fast publication time;
- Peer review by expert, practicing researchers;
- Post-publication tools to indicate quality and impact;
- Community-based dialogue on articles;
- Worldwide media coverage.

MJSSM is published biannually, in September and March of each year. MJSSM publishes original scientific papers, review papers, editorials, short reports, peer review - fair review, as well as invited papers and award papers in the fields of Sports Science and Medicine, as well as it can function as an open discussion forum on significant issues of current interest.

MJSSM covers all aspects of sports science and medicine; all clinical aspects of exercise, health, and sport; exercise physiology and biophysical investigation of sports performance; sport biomechanics; sports nutrition; rehabilitation, physiotherapy; sports psychology; sport pedagogy, sport history, sport philosophy, sport sociology, sport management; and all aspects of scientific support of the sports coaches from the natural, social and humanistic side.

Prospective authors should submit manuscripts for consideration in Microsoft Word-compatible format. For more complete descriptions and submission instructions, please access the Guidelines for Authors pages at the MJSSM website: http://www.mjssm.me/?sekcija=page&p=51. Contributors are urged to read MJSSM's guidelines for the authors carefully before submitting manuscripts. Manuscripts submissions should be sent in electronic format to office@mjssm.me or contact following Editors:

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Stevo POPOVIC, Editor-in Chief – stevop@ucg.ac.me
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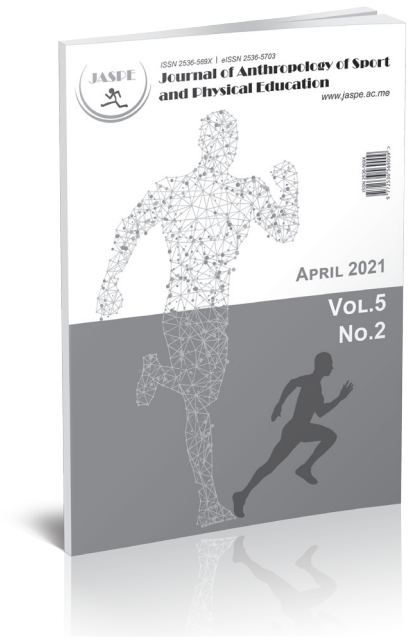
Publication date: Autumn issue – September 2021
Spring issue – March 2022

Journal of Anthropology of Sport and Physical Education



ISSN 2536-569X

Journal of Anthropology of Sport and Physical Education (JASPE) is a print (ISSN 2536-569X) and electronic scientific journal (eISSN 2536-5703) aims to present easy access to the scientific knowledge for sport-conscious individuals using contemporary methods. The purpose is to minimize the problems like the delays in publishing process of the articles or to acquire previous issues by drawing advantage from electronic medium. Hence, it provides:

- Open-access and freely accessible online;
- Fast publication time;
- Peer review by expert, practicing researchers;
- Post-publication tools to indicate quality and impact;
- Community-based dialogue on articles;
- Worldwide media coverage.

JASPE is published four times a year, in January, April, July and October of each year. JASPE publishes original scientific papers, review papers, editorials, short reports, peer review - fair review, as well as invited papers and award papers in the fields of Anthropology of Sport and Physical Education, as well as it can function as an open discussion forum on significant issues of current interest.

JASPE covers all aspects of anthropology of sport and physical education from five major fields of anthropology: cultural, global, biological, linguistic and medical.

Prospective authors should submit manuscripts for consideration in Microsoft Word-compatible format. For more complete descriptions and submission instructions, please access the Guidelines for Authors pages at the JASPE website: http://www.jaspe.ac.me/?sekcija=page&p=51. Contributors are urged to read JASPE's guidelines for the authors carefully before submitting manuscripts. Manuscripts submissions should be sent in electronic format to jaspe@ucg.ac.me or contact JASPE's Editor:

Bojan MASANOVIC, *Editor-in Chief – bojanma@ucg.ac.me*

Publication date: Summer issue – July 2021
Autumn issue – October 2021
Winter issue – January 2022
Spring issue – April 2022

EAPA-BCH

SCIENTIFIC PROJECT

Efekti autofagije i fizičke aktivnosti na tjelesnu kompoziciju, indeks tjelesne mase, stres, zdravstveno ponašanje, kognitivne sposobnosti i društvenu uključenost starijih osoba

(Projekat finansiran od strane Ministarstva nauke, direktorijata za mlade, a koji sprovodi Fakultet za sport i fizičko vaspitanje Univerziteta Crne Gore)

Glavni cilj projekta je da se primjenom naprednih praksi utvrde efekti autofagije i fizičke aktivnosti na tjelesnu kompoziciju, indeks tjelesne mase, trenutni nivo doživljaja stresa, zdravstveno ponašanje, kognitivne sposobnosti i nivo društvene uključenosti starijih osoba.

Projekat ima i svoj radni dio koji podrazumijeva organizovanje besplatnog vježbanja starijim osobama 3 puta nedeljno u trajanju od 6 mjeseci.

Učesnici mogu biti sve osobe iznad 50 godina a prijave se primaju na mail adresu fakultetzasportnk@ucg.ac.me i telefon fakulteta +38240235207. Svi su koji žele da uzmu aktivno učešće u ovom projektu koji njima može unaprijediti život, a naučnoj zajednici Crne Gore može donijeti značajna teorijska znanja koja će se u budućnosti koristiti u praktične svrhe su dobrodošli.

Svim učesnicim će na početku biti ponuđena najsavremenija dijagnostika, koja će im pružiti uvid u vlastito zdravstveno stanje, kako fizičko tako i kada su neki psihološki parametri u pitanju. Nakon toga će učesnici biti prema sopstvenim interesovanjima podijeljeni u grupe koje će raditi prema različitim programima.

1. Prva grupa će vježbati 3 puta nedeljno 6 mjeseci u prostorijama Fakulteta za sport i fizičko vaspitanje.

2. Druga će samo primjenjivati izmijenjeni način ishrane i voditi tačnu evidenciju o stepenu poštovanja zadataka koji im se postave. Ishrana će biti takva da se napravi pauza u unošenju hrane u trajanju 16 sati između poslednjeg dnevnog obroka i prvoga obroka u sledećem danu, a sve u cilju pokretanja procesa Autofagije koji ima blagotvorno dejstvo na organiza.

3. Treća grupa će kombinovati vježbanje i izmijenjenu ishranu, tj. biće kombinacija prethodno pomenutih zadataka.

4. Četvrta grupa će biti kontrolna. Njeni članovi će proći dijagnostiku i pomoći da se utvrdi kakve su prirodne promjene u organizmu za pomenuti šestomjesečni period, odnosno da li ih ima.

Svim prijavljenim osobama, koje imaju interesovanje za to, će prije poćetka rada biti održana dva predavanja o pomenutom izmijenjenom načinu ishrane koji danas postaje sve popularniji u svijetu pa ga primjenjuju i vrhunski sportisti poput Novaka Đokovića.

Još jednom treba napomenuti da će svaka od 4 grupe na poklon dobiti najsavremeniju dijagnostiku kompletnog psihofizičkog stanja koja je inače i nedostupna i skupa.

Prijavljivanje može da počne odmah, broj učesnika za grupe koje bi vježbale u prostorijama fakulteta je ograničen.

VLADA CRNE GORE
MINISTARSTVO NAUKE

Fakultet za sport i fizičko vaspitanje • Univerzitet Crne Gore •

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