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The Effect of Pilates Stable Device with Instability Device Using the Circuit Training Method on Balance, Flexibility, and Abdominal Muscle Strength

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Abstract: The purpose of this study was to analyze the effect of a stable device with an instability device using circuit training method on balance, flexibility, abdominal muscle strength. This research used quasi-experimental design by giving exercises aided instability devices using a gym ball with a circuit training method in six training posts. Trainer used the gym ball instability devices programmed: 1) bridge on stability ball, 2) single leg on stability ball, 3) hip lift on stability ball, 4) single-leg hip lift on stability ball, 5) stability ball leg rotations stability ball leg rotations 6) prone scaption (Y) on stability ball. Total population is 90 male students, age ± 19 years, height ± 164.40 cm, and body weight ± 55.33kg. From the test of each group (paired sample), it was found that there was a significant difference between pretest and posttest on the variable group of stable devices with instability devices (p-value> 0.05), while the control group did not have any difference (p-value <0.05). Meanwhile, ANOVA test results obtained only the average value of the balance variable in the instability device group using gym ball with control (p-value 0.002 <0.05), the stable device using a mattress and control (p-value 0.000 <0.05), the flexibility group of the stable devices using a control mattress (p-value 0.001 <0.05), the abdominal muscle strength device instability using a gym ball with a control (p-value 0.007 <0.05 <0.05) which has a difference.

Keywords: Stable Devices, Instability Devices, Circuit Training, Balance, Flexibility, Abdominal Muscle Strength

Introduction

The participation of people in sports activities is developed related to healthy lifestyles and achievements. Sports activities also contribute to social development,

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social behavior, fair and sporty play and personal responsibility. Physical activity in multilateral sports requires a strong physical condition component to perform a movement, the ability of the muscles of the body to support one another. Therefore, importance of effective training plan is needed for athletes on proper consideration and supervision. Sports activities also have risk of injury. There is a risk of injury at any age, competitively experiences various impacts of injury to soft tissues, bones, ligaments, tendons, and nerves, which are caused by direct trauma or repeated pressure (Caine and Maffulli, 2005; Maffulli et al., 2010). Physical contact sports, such as rugby, for example, were associated with 5.2 injuries per 1000 of the total athletes involved in high school children. The injuries were more common during competition than exercise, whereas fractures accounted for 16% of these injuries, whereas concussions (15.8%) and ligament sprains were almost common (15.7%) (Collins et al., 2008). The highest injuries were in marathon and sprints. Sports trauma usually affects the joints of the extremities (knees, ankles, hips, shoulders, elbows, wrists) or the spine. Knee injuries are the most common. Knee trauma can cause meniscal and chondral lesions, sometimes combined with cruciatum ligament injury. Ankle injuries constitute 21% of all sports injuries (Malliaropoulos et al., 2009). Ankle ligament injuries are more common (83%) diagnosed as ligament sprains, and are common in sports such as basketball and volleyball. Ankle injuries usually occur during competition and in most cases, athletes can do sports within a week (Nelson et al., 2006).

The decreased of balance, skill, coordination and muscle strength have also been found in athletes following lower limb injuries (Zemková and Oddsson, 2015). Balance ability decreased resulting from aging or decreased physical activity can trigger motor skills, which greatly affect mobility in everyday life. Identification of intrinsic risk factors for lower limb muscle injury including previous injury, the influence of age, poor flexibility, and muscle strength decreased or body imbalance (Ekstrand et al., 2011). Every sports movement activities are influenced by the anticipatory ability of the muscles to contract in the torso which is adopted with the demands of the body's instability when doing the movement. Thus, it is very important to maintain physical condition to support functional movement patterns of movement in sports, especially from a perspective related to the ability of balance, strength and flexibility of the body. Other studies have shown that decreased strength of the core muscles of the body can disrupt the balance of the body, thus, instability caused by changes in muscle activation, kinetics and muscle stiffness can have an adverse effect on proprioception and coordination of movements. It was in accordance with (Hrysomallis, 2009), who investigated the relationship between flexibility and injury from hip adductors. The results of this study indicate that flexibility is a parameter affects the risk of injury. Adequate bodily capabilities throughout the body are effective in preventing potential injury.

The right core strengthening exercises for athletes can improve fitness components such as: muscle strength, endurance, agility, speed, balance, and the nervous system, including the vestibular system and the proprioceptive system (Kang, 2015; Yoon et al., 2015) to be more productive and efficient in carrying out movements and less prone to injury. Functionally, the core can be considered very

important as a kinetic sequence that facilitates the transfer of torque and angular momentum between the lower and upper extremities for specific sport and daily activities in different age groups (Kibler et al., 2006).

Pilates is an exercise program that uses instability and stability devices as a core stability approach to augment the neuromuscular system to control and protect the core body or spine. A method of comprehensively codifying body parts, coordinating core stabilization exercises with challenging mind and breath control with flowing movements of the whole body (Penelope, 2002). Since the Pilates approach focuses on core body exercises and breathe control, it facilitates activation of the transverse abdominis, diaphragm, multifidus and pelvic floor muscles. The joining of these muscles contributes to the stability of the lumbopelvic region. Pilate's exercises have been claimed to be a successful program for core muscle enhancement, rehabilitation. The Research by Harrington and Davies supports that Pilates method improves stem control (Standaert et al., 2008).

The advantages of an unstable training environment will be based on neuromuscular adaptations with increased strength. Increased strength can be associated with an increase in the cross-sectional area of muscles to contract withstand the weight of exercise and to improve neuromuscular coordination (Behm et al., 2011). Another advantage of a gym ball is that it prevents excessive pressure and keeps the spine in a balanced position to avoid low back pain. Therefore, there is consensus on core muscle strengthening or resistance building programs that should involve a destabilizing component. Meanwhile, according to (Shelvam and Singh Sekhon, 2014), recommends the benefits of instability devices using gym balls as a form of exercise that effectively targets core muscles for stability and good posture, but is often overlooked when exercising with simple equipment such as those found in fitness centers (Hyun et al., 2014), in the results of his research that Pilates exercises using a mat were found to be an efficient training method with significant changes in the abdomen and strength, posterior trunk flexibility and abdominal muscle strength in adult women.

Zemková and Oddsson, (2015), a jump that is made on an unstable surface, the level of strength generated in the concentric phase is observed to decrease by 10.3%. (Behm et al., 2002), described a loss of 72% strength production rate for foot extensors and 21% for plantar flexxors compared to floor contact and 60% when performing isometric contractions on the chesh press exercise movement, as well as a decrease in strength. Power and speed of 6-10% when doing bench press exercises on the surface of the Swiss ball. There is evidence to suggest that exercise on unstable surfaces results in decreased strength, power, and speed of various movements (Behm et al., 2011). Training to increase flexibility, muscle strength, balance and flexibility has been used mostly as an exercise for the Pilates method. In particular, (Sherrington et al., 2008) emphasizes that balance training, lowering the risk of falling by 17% compared to muscle strength training, balance training should come before other training, an overview of the importance of balance ability.

To improve physical stability, bar stabilization exercises are very helpful for improving balance ability, as the strength of the trunk muscles, among other different factors, is related to balance and functional activity. The activity of the

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trunk muscles maintains balance against gravity, adjusts posture, and prepares for limb movement in daily activities (Verheyden et al., 2006). Most balance exercises are aimed at stabilizing the stem. Pilates workouts also emphasize strengthening the muscles to stabilize the bar through core workouts (Critchley et al., 2011).

Several studies have shown that circuit training are very effective for increasing maximum oxygen consumption, maximum pulmonary ventilation, functional capacity, strength and improving body composition (Brentano et al., 2008). These programs consist of a series, usually 10-15, and resistance training exercises for different parts of the body. For each exercise 12-15 reps, using simple weights (about 40-60% of one repetition maximum (Romero-Arenas, 2013). Therefore, effect of training on a stable and unstable surface by various training methods needs to be studied in depth. To identify the most effective combination of training forms using a mat and gym ball with the circuit training method on balance, flexibility and strength of the abdominal muscles in core exercise training as a starting point for developing and maintaining a quality physical condition.

Methodology

The subjects of this research were students of the Physical Education Study of Program of STKIP PGRI Jombang who had received permission from the leadership of the Institute to conduct the research. Each research process was supervised by an instructor, thus bio-ethically this research could be carried out. The research subjects were divided using Ordinal pairing based on pre-test data with the total population of 90 male students, with the characteristics shown in table 1 below;

Table 1. Total population and the characteristics of the research subject

	Height	**Weight**	**Body Mass Index**	**Age**
Mattress Group				
Mean	166,87	58,70	21,08	18
Max	177	79	28,13	19
Min	156	45	15,76	17
St. Deviation	5,41	7,42	2,53	0,83
Gym ball Group				
Mean	166,40	57,47	20,79	17,87
Max	183	79	27,66	19
Min	157	43	15,23	17
St. Deviation	6,37	7,44	2,68	0,73
Control Group				
Mean	165,67	59,73	21,74	18,07
Max	175	95	32,87	19
Min	153	42	15,39	17
St. Deviation	4,76	11,00	3,63	0,83

This research is quantitative by using a quasi-experimental method. The sample in this study consisted of 3 sample groups, namely the experimental group, which was treated with training on instability devices using a gym ball and stable devices using a mat aided circuit training method and the control group. The total population are 90 male students, with population characteristics aged ± 19 years,

height ± 164.40 cm, and body weight ± 55.33 kg. The research subjects were taken from the population and then divided using ordinal pairing.

This research is an experimental design. The circuit training is done with 6 training posts for the experimental group and one control group. Duration of training is 6 weeks for treatment. Exercise frequency is 3 times per week. Post test measurements were taken 48 hours after the last treatment. While measurement tests: balance beam test, flexibility: Sit and reach test, abdominal muscle strength; partial curl-up.

Program guidelines of stable devices using mats and instability devices using gym ball circuit training methods: total training time ± 45 minutes, 6 weeks of adaptation duration, training volume 40-60%, number of exercises 6 post circuits, 3 sets number of circuit per session, 3 times per week, of frequency by 30 seconds rest interval, 2 minute break between circuits. The training program develops according to the level difficulty by increasing the reps. Participants take a warm up for 6-8 minutes in every exercise. These stages are supervised by the instructor.

Implementation of Training Programs

The implementation of training programs with stable device using the mattress have six exercise, which consisted of; (1) bridge on floor, (2) single leg bridging, (3) windshield wiper, (4) unilateral bridge, (5) reverse pendulum, (6) prone scaption (Y) windshield wiper. Meanwhile, the training program with unstable device using gym ball, are; (1) bridge on stability ball, (2) single leg on stability ball, (3) hip lift on stability ball, (4) single-leg hip lift on stability ball, (5) stability ball leg rotations stability ball leg rotations, (6) prone scaption (Y) on stability ball.

Data Analysis

Data analysis is obtained from the instrument aims to gain conclusions in order to prove whether the stable devices using mattress and instability devices using a gym ball and the circuit training method given has a significant effect on the research subject, using the Z score, Description of data about the research subject (N), Mean (Mean) of the initial and final tests and the difference between the final test scores and the initial test, paired T test (t test), with the rejection rate of the hypothesis at $\alpha = 0.05$. ANOVA (Analysis of Variance), SPSS Statistics 20.

Result

Table 2. The result of the study

Variable	Group		N	Mean	St. Deviation
Balance	*Mattress*	*Pretest*	30	45,10	24,23
		Posttest	30	59,57	53,67
	Gym ball	*Pretest*	30	41,73	33,84
		Posttest	30	56,10	54,45
	Control	*Pretest*	30	43,83	27,29
		Posttest	30	40,60	36,73
Flexibility	*Mattress*	*Pretest*	30	32,42	55,68

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Variable	Group		N	Mean	St. Deviation
		Posttest	30	39,35	66,38
	Gym ball	*Pretest*	30	31,93	63,87
		Posttest	30	36,93	60,99
	Control	*Pretest*	30	34,22	61,43
		Posttest	30	37,07	62,06
Abdominal Muscle Strength	*Mattress*	*Pretest*	30	29,37	96,15
		Posttest	30	26,27	99,51
	Gym ball	*Pretest*	30	28,47	70,01
		Posttest	30	26,30	47,28
	Control	*Pretest*	30	27,77	80,12
		Posttest	30	26,37	76,90

Balance

In the instability device group using gymbal, it is obtained a mean pretest data of 41.73 seconds with a standard deviation of ± 33.84 seconds, while the mean posttest data is 56.10 seconds with a standard deviation of ± 54.45 seconds, in the stable group using a mattress it is obtained a mean The pretest data is 45.10 seconds with a standard deviation of ± 24.23 seconds, while the mean posttest data is 59.57 seconds with a standard deviation of ± 53.67 seconds. In control group, the mean pretest data is 43.83 seconds with a standard deviation of ± 27.29 seconds, while the mean posttest data is 40.60 seconds with a standard deviation of ± 36.73.

Flexibility

In the instability device group using gymbal, the pretest data mean is 31.93 with a standard deviation of 66.38, meanwhile, the mean posttest data is 36.93 with a standard deviation of 60.99, in the stable device group using a mattress it is obtained mean pretest data is 32.42 with a standard deviation of 55.68, meanwhile, the mean posttest data is 39.35 with a standard deviation of 66.38. In control group, the mean pretest data is 34.22 with a standard deviation of 61.43, Meanwhile, the mean posttest data is 37.07 with a standard deviation of 62.06.

Abdominal Muscle Strength

In the instability device group using gymbal, the mean pretest data is 28.47 with a standard deviation of 70.01, meanwhile, the mean posttest data is 26.30 with a standard deviation of 47.28, In the stable device group using a mattress the mean data is obtained: pretest is 29.37 with a standard deviation of 96.15, meanwhile, the mean posttest data is 26.27 with a standard deviation of 99.51. In the control group, the mean pretest data is 27.77 with a standard deviation of 80.12. Meanwhile, the mean posttest data is 26.37 with a standard deviation of 76.90.

The Tukey HSD test shows that there is a difference of increasing between the three groups for each variable. This difference can be seen from the mean difference. Based on the mean difference value for the balance variable that the stable device group using the mattress has better improvement than the instability device group using the gym ball with a mean difference of 3.467 and the control group with mean difference of 18.967. For the flexibility variable that stable device group used a

mattress, the increase was better than the instability device group using a gym ball with a mean difference of 2.413 while the control group with a mean difference of 2.277. For the variable of abdominal muscle strength, the increase in the instability group using gym ball was better than the stable device group using a mattress with a mean difference of 0.33, while the mean difference for the control group was 0.67.

Table 3. Multiple Comparisons (Tukey HSD)

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Sig.
Balance	Mattress	Gym ball	3.467	0.959
		Control	18.967	0.296
	Gym ball	Mattress	-3.467	0.959
		Control	15.500	0.441
	Control	Mattress	-18.967	0.296
		Gym ball	-15.500	0.441
Flexibility	Mattress	Gym ball	2.413	0.306
		Control	2.277	0.348
	Gym ball	Mattress	-2.413	0.306
		Control	-0.137	0.996
	Control	Mattress	-2.277	0.348
		Gym ball	0.137	0.996
Muscle Strength	Mattress	Gym ball	-0.033	1.000
		Control	-0.100	0.999
	Gym ball	Mattress	0.033	1.000
		Control	-0.067	0.999
	Control	Mattress	0.100	0.999
		Gym ball	0.067	0.999

Discussion

Analysis of stable devices using a mattress with the circuit training method on balance, flexibility and endurance of the abdominal muscles

The concept of stable device exercise using the mattress itself focuses on the core or force that activates the local muscles, especially the transverses abdominals, internal oblique muscles, diaphragm, lumbar multifidus, and pelvic floor muscles. Currently, scientific data shows that these muscles have a major role in stabilizing the lumbo-pelvic system. The stability of the lumbo-pelvic system also depends on the central nervous system to form a stability response with transverse abdominals contractions that have been programmed to stabilize the spine. With a stable device using a mattress the spine is more compressed when the hips are challenged by internal and external forces, as a result of the reactive forces of moving the upper and lower limbs during each exercise position.

Stable device exercises using a mattress focus on maintaining the 'spine in a neutral position', pelvic and spinal stability, by increasing balance and postural stability, these exercises resemble the weight training theory for optimal strength and endurance. This method is comprehensive body-mind conditioning, which coordinates core stabilization exercises with challenging mind and breath control

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with flowing movements from the rest of the body. Since the Pilates approach focuses on core body exercises and breathe control, it facilitates activation of the transverse abdominals, diaphragm, multifidus and pelvic floor muscles. The joining of these muscles contributes to the stability of the lumbopelvic area. The findings of this study require further investigation into the implications of their effectiveness.

Analysis of stable devices using a mattress with the circuit training method to balance, results of the study show evidence to support the initial hypothesis, with a sig. 0.000 <0.05, which means that there is a significant effect on the ability to balance the position of movement in stable device exercises using a mat to change the activation of the multifidus, gluteus maximus, rectus abdominis, and oblique muscles. TrA primarily stabilize muscle of the lumbopelvic area. TrA continues to contract during the movement of the torso and is responsible for the contraction pattern with the pelvic floor.

The training method using a stable device aided mattress can be used as an appropriate training program to increase flexibility, promote mobility control of the trunk and pelvic segments. It can also help in preventing and reducing injuries and dysfunction of the musculoskeletal system., show that the multifidus and transversus abdominals are more involved with changes in the position of the pelvis and trunk when performing pelvic lifts, whereas the rectus abdominal muscles are primarily responsible for pelvic stability in all knee stretching exercises and for controlling extensor torsion. (Cruz-Ferreira et al., 2011; Freeman et al., 2010; Sherrington et al., 2008), conclude that there is strong evidence to support the use of the Pilates training method at least for increased flexibility, dynamic balance and to increase power, muscle resistance, and reducing the risk of injury by 17%.

Stable devices using a mattress with the circuit training method for flexibility analysis shows that during the 6 week training period contributed to the influence of flexibility ability with sig value of 0.000 <0.05. In the form of a steady exercise device using a matrix to be static and dynamic stretching while the subject is doing exercise at each post circuit (Phrompaet et al., 2011; Segal et al., 2004). Pilates training is a combination of static and dynamic stretching exercises that are appropriate and safe to provide increased hip adductor activation, flexor flexibility, and an increased effect on flexibility abilities (Campos de Oliveira et al., 2015). Pilates training led to a significant increase in body balance and functional mobility, as shown by an increase of 1.81 balance points on the Berg Balance Scale (p: 0.0081) and an increase in balance 1.95 seconds in TUG test (p <0.001). Studies that have used other measures (Tinetti Test and force plate) reported significant results (p <0.05). Kloubec, (2010) significant improvement on post-test in two different measures of hamstring flexibility. In the sit and reach test, the increase in flexibility occurred from 30.68 ± 10.14 centimeters to 33.41 ± 8.86 centimeters, where the supine hamstring flexion test also showed a significant increase in left and right hamstring flexibility from 88.41 ± 13.20 degrees to 99.09 ± 8.57 degrees and 93.14 ± 12.48 degrees to 102.41 ± 10.45 degrees, (Sekendiz et al., 2007) also using sit and reach showed a significant increase (from 23.9 ± 7.5 centimeters to 31.3 ± 6.8 centimeters), after five weeks of Pilates training in adult women.

The results analysis of stable device training using mattress with the circuit training method on the strength of the abdominal muscles shows the significance value of 0.015 <0.05, which means that there is an influence on the strength of the abdominal muscles. In line with the research results of (Queiroz et al., 2010), shows that multifidus and transverse abdominal contractions are more involved with changes in pelvic and body position during pelvic lifts, whereas the rectus abdominal muscles are responsible for pelvic stability in all knee stretching exercises and for controlling extensor torsion. In line with the findings of (Herrington and Davies, 2005) shows the effectiveness of Pilates in increasing transverse abdominal activation and stabilization process compared to conventional abdominal exercises. Pilates training showed an increase of 83%.

This study indicates that circuit training that focuses on the core muscles must do exercises alternately up or down for a different program sequence using the circuit training method to get the same results regarding the total volume of exercise in each session, perceiving intensity. Similar exercises, regardless of the training frame. These results suggest that progressive fatigue throughout a training session affects muscle performance. These training characteristics make the muscles well adapted to endurance activities over 40 minutes. The size or cross-sectional area of type I muscles increases as a result of an increase in the mitochondrial filaments, membranes and in the muscle fibers.

A physiological enhancement of core muscle control is achieved by modifying the pelvic and trunk postures. These exercises are performed pushing (in the hip extension phase) and repelling (in the hip flexion phase). As described in the data analysis, a significant effect was obtained from the value of training for 6 weeks with a frequency of 3 times per week, a stable device using a mattress aided the circuit training method in this study causing a physiological effect. With an average training duration of 45 minutes with low to moderate intensity, it is devoted to improving balance, strength, flexibility and muscle endurance. The application of circuit training in this study uses each of the 6 movement posts, from simple movements to movements with complex complexity. Some researchers have shown that circuit-based training is very effective at increasing maximum oxygen consumption, maximum pulmonary ventilation, functional capacity, and strength, increasing body composition, efficient use of time can lead to proven improvements in physical health and fitness (Brentano et al., 2008; Romero-Arenas, 2013). The study results show that progressive fatigue throughout training sessions with the circuit training method on endurance ability affects muscle performance. (Kloubec, 2010), shows a significant rate of improvement ($p \leq 0.05$), means that Pilates exercise for 12 weeks, for two 60 minute sessions per week significantly increases abdominal endurance, flexibility and upper body muscle endurance.

Stable device using this mattress result is proven to assist the functional stabilization of the spine. In other words, strengthening the transverse abdominal and multifidus muscles, and also increases muscle thickness and improves lumbar stabilization. This increased recruitment and synchronous stimulation of motor units also explains the increase in muscle strength. In addition, the exercises used in this training program can help to avoid the occurrence of excessive loads on the

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bone tissue, protecting the lumbar area from the impact of injury due to movement in training. In a stable device using a mattress using the circuit training method, there was a significant increase in balance, flexibility, and abdominal muscle strength, which was indicated by the result of an increase in data analysis. (Hyun et al., 2014), efficient Pilates training method with significant changes in the improvement of abdominal muscle strength, posterior trunk flexibility and abdominal muscle strength.

Stable devices using a mattress with the circuit training method can be used as a reference of exercise program to improve balance, flexibility, abdominal muscle strength, additional training programs to increase flexibility, improve control-mobility of the trunk and pelvic segments. It is also able to help in preventing and reducing injuries. A coach can consider core stability as the foundation from which his athlete can generate strength. Core stability, in terms of the musculoskeletal system, may be precisely defined as the endurance capacity of a group of core muscles, which work in harmony to stabilize the trunk and provide a framework for good posture and functional movement.

Analysis of instability devices using a gym ball with the circuit training method for balance, flexibility and endurance of the abdominal muscles

Significant effect of the training value for 6 weeks with a frequency of 3 times per week, the instability device using the gym ball aided circuit training method using 6 forms of exercise by using the gymball. With duration of about 45 minutes with low to moderate intensity specifically in this study, it causes physiological effects of increasing balance, flexibility, back muscle strength, leg muscle strength, abdominal muscle strength, abdominal muscle endurance and leg muscle endurance. The main purpose of training with instability devices is to reduce the area of contact with the ground by forming unstable conditions. By increasing dynamic postural control and balance, and producing a more coordinated and consistent pattern of movement during movement, the possibility of injury can be prevented (Verhagen, 2005). Gymball exercises can also improve core muscle activation and physical function, because it improves a sense of balance and stimulates the ability of proprioceptors (Behm et al., 2002; Kim et al., 2014). In training, the core muscles are usually not trained or activated during training. In the use of gym ball, activation of the core muscles is maximized, which requires more strength, balance and increased joint stability and can activate muscles according to their functions such as the abdominal muscles and intervertebral muscles.

From the results of data analysis, it is known that the significance 0.000 <0.05, which means that there is a significant effect on balance. The greater instability due to the influence of the gym ball results in the body automatically spurring the neuromuscular system to work bigger, increasing activation of the external obliques, transversus abdominals, internal oblique, erector spinae and rectus abdominals, increasing disturbances to the center of mass of the body. Efforts are required to counter the destabilizing effects of gravity and distraction during exercise movement. Determine the position of the body's center point of gravity relative to the gravitational force and instability device, and then carry out a coordinated

motion to correct the deviation of the center of gravity in the body. Physiological systems and processes used in visual, vestibular and somatosensory balance, muscle and joint proprioception. in line with the research of (Behm et al., 2002), state that the main purpose of instability training is to increase core stability. The main objective of a training program with the physioball is not necessarily to increase strength but to gain stability, improve balance, and increase proprioceptive abilities.

The main benefit is that when the body is challenged to stabilize the position when doing movements in an unstable position on the gym ball, this system will work harder and more activity in an unstable environment where the stimulation of the stabilizers is reduced, the instability of the ball itself is considered to quickly activate the small muscles. It is not often used and stimulates proprioception and somato sensory systems to maintain balance, proprioceptive systems rely on information from joints and muscles to coordinate subconscious reflexes to maintain balance, contributing to an increase in static and dynamic balance abilities (Behm et al., 2002; Lee, 2008; Sundstrup et al., 2012), Elastic resistance can provide adequate additional weight when making movements on the ball become an effective global muscle strengthening exercise

Results of data analysis of flexibility ability, it is known that the sig value. 0.000 <0.05, which means that there is a significant effect. Gym ball provides a variety of motion combinations that function to expand the range of motion of joints and the level of difficulty of movement. Improvements in flexibility in ability can be associated with dynamic exercises performed. These exercises increases joint stability where gym ball exercises lead to activation of the abdominal and intervertebral muscles and improvement of motor control. Most attempts to increase flexibility are aimed at reducing the resistance that occurs from the connective tissue around the joint. As a muscle has the most elastic tissue, most of the efforts to increase flexibility are aimed at the muscles, the improvement in flexibility in the ability to be associated with dynamic exercises performed on a gymball that provide a wide range of joint ranges of motion as well as levels of movement difficulty.

The greatest enhancement contribution of gym ball exercise improves balance and flexibility. The results of research by (Sekendiz et al., 2007), using gym ball with a training duration of 45 minutes, 3 days / week, for 12 weeks. The results of multivariate analysis revealed significant differences ($p \leq 0.05$) abdominal endurance (curl-up test), lower back muscle endurance (modified Sorensen test), lower leg endurance (repetitive squat test), lower back flexibility (sit and reach test), and dynamic balance (functional reach test). (Stathokostas et al., 2012), also revealed that the results of a 12-week training program significantly improved lower body flexibility, dynamic balance, and strength in adults, static balance significantly increased joint mobility (22.5% in goniometer) and section flexibility. Lower body (25.73% in the sit and reach test).

The results of the data analysis of strength of the abdominal muscles show the sig value. 0.000 <0.05, shows that there is a significant effect on. Analysis on the use of gym ball has the property of causing greater muscle activation. The advantages of an unstable training environment will be based on neuromuscular adaptations with

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increased strength. Increased strength can be associated with an increase in the cross-sectional area of the muscles to contract with the weight of exercise and improved neuromuscular coordination, an increase in instability at the fulcrum during gym ball training resulting in increased activation of the external obliques, transversus abdominus, internal obliques, erector spinae and rectus abdominus, possibly an associated increase. With neural adaptations, to carry out constant motion requires efforts to counter the destabilizing effects of gravity and disturbances during movement.

The activation rate of these muscles is high in the rectus abdominis (RA), transversus abdominis (TA), lumbar multifidus (MUL), erector spinae (ES), and the internal (IO) or external oblique (EO) during exercise, which is in line with our previous definition. It is a "local stabilizer" that provides stability to the pelvis when performing hip extension movements. Consequently, this exercise is highly recommended for strengthening purposes, given the high activity levels observed not only in the core muscles, but also in the chest and lower limbs. Rectus abdominis activity ranging from 30-60% has been reported in studies for abdominal exercises over the gymball (Ratamess et al., 2009).

The instability device can place a lower load on the extremities, but results in higher activation of the core muscles. The erector spinae, external oblique, rectus abdominis and quadratus lumborum have long levers and the arm when large is responsible for producing force, producing power over a greater range of motion. Agreeing with the results of the study of (Behm et al., 2011), increased strength can be associated with an increase in the cross-sectional area of muscles in contracting withstand exercise loads and improving neuromuscular coordination. Whereas (Granacher et al., 2013), in his study doing 9 weeks of core strength training on unstable surfaces in adults (age: 63-80 years). The experimental group had significantly increased torsion muscle strength, spinal mobility, functional mobility, and dynamic balance. These exercises induce greater muscle activity than the stability device on the floor, which suggests that adding a ball achieves the instability needed to increase muscle strength (Youdas et al., 2018).

This result of study analysis can be concluded that the gym ball causes instability when a body segment away from the center of the ball is sufficient to increase the prime mover activity associated with muscle activation according to the form of the movement. Muscle recruitment tends to be greater during the eccentric phase compared to the isometric phase; this may explain the increased muscle activity. The lower ball placement not only requires a greater proportion of the hips to be lifted during the crunch movement but also requires greater stabilization of the torso in a horizontal position because there is no support from either the floor or the ball.

Greater degree of muscle stress on the instability device using this gymball, this may form the basis for an enhanced balancing effect after training. Improvements in flexibility can be attributed to dynamic exercises performed on gymballs that provide an increased range of motion. The instability in a gymball leads to muscle activation and improved motor control, which ultimately leads to the use of large muscle strength during training and leads to increased strength and balance abilities as a result of the

instability of the ball. Gymball exercises that involve isometric actions of muscles, small weights, prolonged tension and repetitions of circuit training alone lead to increased strength in the abdominal muscles and leg muscles.

The instability device using a gym ball with the circuit training method can be used as a reference training program to improve balance, flexibility, abdominal muscle strength, abdominal muscle endurance and leg muscle endurance, additional exercise programs to increase flexibility, increase control-mobility of the torso and pelvic segments. The greatest contribution of gymball exercise allows for improved core stability and muscle balance, strength, flexibility and endurance. This study has shown that no single muscle can be identified as more important for spinal stability during various body movements during exercise. The ability of muscle groups, especially weak core muscles, is believed to interfere with energy transfer, reduce inefficiency in movement during exercise and reduce the increased risk of injury. In training research results it is necessary to evaluate clear evidence for a clear muscle recruitment pattern associated with muscle performance.

Conclusions

This study concern on the adaptation caused by the instability device program using a gym ball and a stability device using a mattress. This study states that it is widely assumed that the ability of muscle groups, especially weak core muscles, is believed to interfere with energy transfer, reduce inefficiencies in sports movements and contribute to an increased risk of injury.

Muscles with balance, strength, flexibility and joints with greater integrity are less prone to injury, means that the muscles around the joint tend to prioritize stability over power production. There is a significant increase in the instability device using a gym ball compared to the stability using a conventional mat and group, for the following reasons: reduced contact area, increased disturbance of activity due to unstable surfaces, and control of center of gravity at body points with limited support from the ground of gym ball instability. Progressive fatigue throughout training sessions with the ciruit training method affects muscle performance resulting in a greater level of physiological ability to control core muscles.

This research review provides a selection of exercises for muscle activation, especially the larger core muscles based on six different types of exercise (stable device using a mat and instability device using a gym ball) to improve physical condition abilities.

Comment: Regarding the subject of this research, the subject is male students not female, the average weight and height of Indonesian male student is shorter than most of other country.

References

Behm, D. G., Anderson, K., & Curnew, R. S. (2002). Muscle Force and Activation Under Stable and Unstable Conditions. *Journal of Strength and Conditioning Research*, 16(3), 416–422. https://doi.org/10.1519/1533-4287(2002)016<0416:MFAAUS>2.0.CO;2

DOI 10.30892/gss.1501-069

Behm, D. G., Drinkwater, E. J., Willardson, J. M., & Cowley, P. M. (2011). The Role of Instability Rehabilitative Resistance Training for the Core Musculature. *Strength & Conditioning Journal*, 33(3), 72–81. https://doi.org/10.1519/SSC.0b013e318213af91

Brentano, M. A., Cadore, E. L., Da Silva, E. M., Ambrosini, A. B., Coertjens, M., Petkowicz, R., Viero, I., & Kruel, L. F. M. (2008). Physiological Adaptations to Strength and Circuit Training in Postmenopausal Women With Bone Loss. *Journal of Strength and Conditioning Research*, 22(6), 1816–1825. https://doi.org/10.1519/JSC.0b013e31817ae3f1

Campos de Oliveira, L., Gonçalves de Oliveira, R., & Pires-Oliveira, D. A. de A. (2015). Effects of Pilates on Muscle Strength, Postural Balance and Quality of Life of Older Adults: a Randomized, Controlled, Clinical Trial. *Journal of Physical Therapy Science*, 27(3), 871–876. https://doi.org/10.1589/jpts.27.871

Cruz-Ferreira, A., Fernandes, J., Laranjo, L., Bernardo, L. M., & Silva, A. (2011). A Systematic Review of the Effects of Pilates Method of Exercise in Healthy People. *Archives of Physical Medicine and Rehabilitation*, 92(12), 2071–2081. https://doi.org/10.1016/j.apmr.2011.06.018

Freeman, J., Gear, M., Pauli, A., Cowan, P., Finnigan, C., Hunter, H., Mobberley, C., Nock, A., Sims, R., & Thain, J. (2010). The Effect of Core Stability Training on Balance and Mobility in Ambulant Individuals with Multiple Sclerosis: A Multi-Centre Series of Single Case studies. *Multiple Sclerosis Journal*, 16(11), 1377–1384. https://doi.org/10.1177/1352458510378126

Granacher, U., Gollhofer, A., Hortobágyi, T., Kressig, R. W., & Muehlbauer, T. (2013). The Importance of Trunk Muscle Strength for Balance, Functional Performance, and Fall Prevention in Seniors: A Systematic Review. *Sports Medicine*, 43(7), 627–641. https://doi.org/10.1007/s40279-013-0041-1

Herrington, L., & Davies, R. (2005). The Influence of Pilates Training on The Ability to Contract The Transversus Abdominis Muscle in Asymptomatic Individuals. *Journal of Bodywork and Movement Therapies*, 9(1), 52–57. https://doi.org/10.1016/j.jbmt.2003.12.005

Hyun, J., Hwangbo, K., & Lee, C.-W. (2014). The Effects of Pilates Mat Exercise on the Balance Ability of Elderly Females. *Journal of Physical Therapy Science*, 26(2), 291–293. https://doi.org/10.1589/jpts.26.291

Kim, S. G., Yong, M. S., & Na, S. S. (2014). The Effect of Trunk Stabilization Exercises with a Swiss Ball on Core Muscle Activation in the Elderly. *Journal of Physical Therapy Science*, 26(9), 1473–1474. https://doi.org/10.1589/jpts.26.1473

Kloubec, J. A. (2010). Pilates for Improvement of Muscle Endurance, Flexibility, Balance, and Posture. *Journal of Strength and Conditioning Research*, 24(3), 661–667. https://doi.org/10.1519/JSC.0b013e3181c277a6

Lee, S. (2008). *Effect Of 12 Week Gymball Exercise Physical Fitness And Balance In Elderly*. Kook-Min University.

Phrompaet, S., Paungmali, A., Pirunsan, U., & Sitilertpisan, P. (2011). Effects of Pilates Training on Lumbo-Pelvic Stability and Flexibility. *Asian Journal of Sports Medicine*, 2(1). https://doi.org/10.5812/asjsm.34822

Queiroz, B. C., Cagliari, M. F., Amorim, C. F., & Sacco, I. C. (2010). Muscle Activation During Four Pilates Core Stability Exercises in Quadruped Position. *Archives of Physical Medicine and Rehabilitation*, 91(1), 86–92. https://doi.org/10.1016/j.apmr.2009.09.016

Ratamess, N., Alvar, B. A., Evetoch, T. K., & Housh, T. J. (2009). Progression Models in Resistance Training for Healthy Adults. *Medicine & Science in Sports & Exercise*, 41(3), 687–708. https://doi.org/10.1249/MSS.0b013e3181915670

Romero-Arenas, S. (2013). Impact of Resistance Circuit Training on Neuromuscular, Cardiorespiratory and Body Composition Adaptations in the Elderly. *Aging and Disease*, 04(05), 256–263. https://doi.org/10.14336/AD.2013.0400256

Segal, N. A., Hein, J., & Basford, J. R. (2004). The Effects of Pilates Training on Flexibility and Body Composition: An Observational study 11 No commercial party having a direct financial interest in the results of the research supporting this article has or will confer a benefit upon the authors(s) o. *Archives of Physical Medicine and Rehabilitation*, 85(12), 1977–1981. https://doi.org/10.1016/j.apmr.2004.01.036

Sekendiz, B., Altun, Ö., Korkusuz, F., & Akın, S. (2007). Effects of Pilates Exercise on Trunk Strength, Endurance and Flexibility in Sedentary Adult Females. *Journal of Bodywork and Movement Therapies*, 11(4), 318–326. https://doi.org/10.1016/j.jbmt.2006.12.002

Sherrington, C., Whitney, J. C., Lord, S. R., Herbert, R. D., Cumming, R. G., & Close, J. C. T. (2008). Effective Exercise for the Prevention of Falls: A Systematic Review and Meta-Analysis. *Journal of the American Geriatrics Society*, 56(12), 2234–2243. https://doi.org/10.1111/j.1532-5415.2008.02014.x

Stathokostas, L., Little, R. M. D., Vandervoort, A. A., & Paterson, D. H. (2012). Flexibility training and functional ability in older adults: A systematic review. *Journal of Aging Research*, 8(1), 1–30. https://doi.org/10.1155/2012/306818

Sundstrup, E., Jakobsen, M. D., Andersen, C. H., Jay, K., & Andersen, L. L. (2012). Swiss Ball Abdominal Crunch with Added Elastic Resistance is an Effective Alternative to Training Machines. *International Journal of Sports Physical Therapy*, 7(4), 372–380.

Verhagen, E. A. L. M. (2005). An Economic Evaluation of a Proprioceptive Balance Board Training Programme for The Prevention of Ankle Sprains in Volleyball. *British Journal of Sports Medicine*, 39(2), 111–115. https://doi.org/10.1136/bjsm.2003.011031

Youdas, J. W., Coleman, K. C., Holstad, E. E., Long, S. D., Veldkamp, N. L., & Hollman, J. H. (2018). Magnitudes of Muscle Activation of Spine Stabilizers in Healthy Adults During Prone on Elbow Planking Exercises with and Without a Fitness Ball. *Physiotherapy Theory and Practice*, 34(3), 212–222. https://doi.org/10.1080/09593985.2017.1377792

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A Systematic Review of the Impact of COVID-19 on Global Sporting Events in 2020: The Tokyo 2020 Summer Olympics

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Abstract: The Corona virus disease 2019 (COVID-19), like no other pandemic has taken the world by storm, affecting all and any spheres of life. This effect has also impacted global sporting events such as the 2020 Summer Olympics that were scheduled for the 24th of July 2020 to the 9th of July 2020 in Tokyo, Japan. Historically, the Summer Olympics have been cancelled 3 times due to war but the postponement that occurred in 2020 is unprecedented. The socio-economic implications are still yet to be fully explored and realised. The purpose of this research is to therefore examine the impact of COVID-19 on the Tokyo 2020 Summer Olympics. The study will adopt a systematic literature review of material on the COVID-19 pandemic in relation to sporting events and statistical inferences will be conducted based on publicly accessible secondary data sources. Considering that the pandemic is still an ongoing phenomenon the findings and analysis cannot be conclusive, a snapshot based on current data and scientific predictions will be provided on what COVID-19 meant to global sporting events. A broad analysis of the pandemic's impact on sport will be provided despite the focus being on the Tokyo 2020 Summer Olympics. Last, this study serves as a template for further research on COVID-19's impact on sporting events in general, preferably studies conducted post the pandemic for reflection purposes based on more conclusive data.

Keywords: COVID-19, 2020 Summer Olympics, Tokyo, Sports, Impact

Introduction

The COVID-19 pandemic resulted in the postponement and rescheduling of the 2020 Tokyo Olympics for the 23rd of July to 8th of Aug 2021 (James, 2020). Across the globe and to different extents, sporting events were either cancelled or postponed due to the COVID-19 pandemic (James, 2020). The devastating impact of

Coronavirus on socio-economic activities including sporting events is beyond imagination (Kyung-Hoon, 2020). Coronavirus, a virus that causes a respiratory disease known as COVID-19 began at a wet animal market in the industrial City of Wuhan within the Hubei province in China (Craven et al., 2020). The World Health Organisation (WHO) declared Coronavirus a world pandemic on 30 January 2020 resulting in a chain of events (i.e. social distancing, quarantining, national lockdown) to save lives (Nicola et al., 2020). By 19 June 2020, Coronavirus infections had risen to 8 629 294 with 457 609 deaths across the world (Worldometer, 2020).

As human lives took precedence, the 2020 Summer Olympics were postponed by a year to start from 23 July to 8 August 2021 (Binner, 2020). After Tokyo won the bid to host the 2020 Summer Olympics on 7 September 2013 at the 125th International Olympics Committee (IOC) session in Buenos Aires, megaprojects costing multi-million dollars were triggered in preparation of the world event (Gibson, 2013). However, the postponement of the 2020 Summer Olympics to 2021 due to the outbreak of COVID-19 came at a time when preparation projects were at an advanced stage (Thomas, 2020).

The excruciating decision to postpone the 2020 Summer Olympics has far-reaching consequences for individuals and companies involved. Thomas (2020) points out that athletes across the world are living with a feeling of uncertainty ever since the outbreak of COVID-19. United Nations (2020) reports that the closure of sporting facilities (i.e. Olympic training centre in Colorado) to stop the spread of COVID-19 has disrupted the training schedule of Olympics athletes across the world. Social distancing prohibits the opportunity for athletes to train in groups diminishing the opportunity for motivation and support among themselves (Genesis Fitness, 2016). As already mentioned, the Tokyo 2020 Summer Olympics had presented business opportunities for companies and many had spent multi-million dollars to partner with the IOC (Thomas, 2020). The broadcast payments of the Summer Olympics are valued at approximately 169 million dollars (The Sunday Morning Herald, 2020). Venues had been secured and some had been built in advance to accommodate athletes, spectators, and officials across the world (Thomas, 2020; Chappell, 2020). Thomas (2020) also reports that television schedules for the 2020 Summer Olympics had been set and cleared. With billions of dollars at stake, no insurance company is willing to recoup the cost (Thomas, 2020). The following section explores paper's review of literature and supporting theory.

Literature Review and Theory

Emergency Management Theory

Emergency management is a field of study in operations and investigation. An immense transformation has been occurring in emergency management (McEntire, 2005). In emergency management, researchers have been fascinated in accidents, crises, emergencies, disasters, catastrophes, and calamities over the years (McEntire, 2005). Emergency responders operate in an increasingly volatile and uncertain environment (Elbanna et al., 2019; McEntire, 2004; McGuire and Silvia, 2010; Pangarkar, 2016). They rely on intense communication and planning and structured procedures that are closely and professionally regulated (Elbanna et al., 2019). They

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work under varoius types of pressures such as time, uncertainty and unexpected developments of situations, unfolding effects and heavy political and societal examination (Elbanna et al., 2019). Emergency management involves theoretical contributions from the sciences, manufacturing, and the social sciences (Drabek, 2005). The review of the emergency management theory was deemed necessary as the present study was focused on how a global pandemic such as the COVID-19 impacted international events that included the Tokyo 2020 Summer Olympics.

Table 1. Key terms in the Emergency Management Theory
Source: Adapted from (Elbanna et al., 2019)

Business Continuity	This is the ability of an organisation to continue providing of products or services at acceptable predefined levels following a disruptive occurrence. This could mean a sporting event such as the Olympics continuing under difficult circumstances.
Disaster	A catastrophic disruption of the functioning of a community concerning extensive human, material, economic or environmental losses, which hinder that community's ability to cope.
Emergency Management also referred to as (disaster management)	The structuring and allocation of resources and responsibilities for addressing all aspects of emergencies, specifically in terms of preparedness, response and initial recovery steps.
Resilience	The ability of a system, community or society exposed to dangers to effectively resist, absorb, accommodate to and pull through from the effects of the risks faced.

Decade for Natural Disaster Reduction (IDNDR), reflecting the growing interest in the evolving field of emergency management and planning. It is natural that emergency management should take on a higher level of prominence as the world's level of connectivity increases (Elbanna et al., 2019). The focus on emergency management received an added impetus through the events of 9/11 and these events were a catalyst for change, accelerating interest in emergency management (Elbanna et al., 2019; McEntire, 2004).

The Impact of COVID-19 of the Global Economy

The COVID-19 pandemic has activated the harshest and deepest contraction of GDP (Gross Domestic Product) in the existence of capitalism as globalisation has digressed (Siddiqui, 2020). International supply chains, which were once the pillars of organised production and the foundations of trade, have failed giving rise to a national economy approach (Siddiqui, 2020). Furthermore, overseas travel and tourism have almost closed entirely (Siddiqui, 2020). In 2019, anxiety emerged over the impact of a US-China trade war, the United States presidential elections, the United Kingdom's exit from the European Union and on the global economy (Ozili and Arun, 2020). Looking at the above mentioned causes for potential anxiety, the International Monetary Fund had anticipated moderate global growth of 3.4 %. (Ozili and Arun, 2020). However, COVID-19 – the disease caused by SARS-CoV-2, a novel strain of coronavirus from the SARS species – altered the outlook unpredictably (Ozili and Arun, 2020). Due to fear and insecurity, and to rational assessment that company profits will potentially be lower due to the effects of the

COVID-19 pandemic, global stock markets lost about $6 trillion United States dollars in wealth in one week from the 24th to 28th of February 2020 (Ozili and Arun, 2020). Labour force performance was significantly impacted by the COVID-19 pandemic (Rukuni et al., 2020). The financial fragility of many business organisations was exposed by the COVID-19 pandemic with the median firm with monthly expenses exceeding $10,000 United States dollars having only cash in hand to last two weeks (Bartik et al., 2020).

The Impact of the COVID-19 on Sport

Evans et al. (2020) investigated the impact of sport in the COVID-19 era and suggested that this was an extraordinary time. Furthermore, Evans et al. (2020) acknowledged that, despite the influx of information on the pandemic, the future remained uncertain and this included the future of sport. The COVID-19 pandemic that spread across the world rapidly in a few months resulting in a significant impact on public health, society, and the global economy in general, wreaking havoc to the sporting calendar (Gough, 2019). Sports leagues and federations across the world addressed the COVID-19 pandemic by suspending seasons and stopping activity, for example the cancellation of Wimbledon, tennis' oldest tournament (James, 2020). It has been suggested that in the future, sport will have to be reviewed; this includes establishing who really needs sport, what format changes will be taken and how will these changes affect the professional sports personalities and the fans? (Evans et al., 2020).

It has already been established that the global shut-down or postponement of professional sport at the elite levels is based on the understanding that such 'mass gatherings' significantly exacerbate the dangers of the spread of the virus due to the widespread networks they are based upon (Evans et al., 2020; Widdop et al., 2020). Some sources, Bremmer (2020) and Evans et al. (2020) have explored the closure of globalisation, citing the collective effects of the virus, nationalist and populist agendas in politics and environmental concerns. Sport in the face of the COVID-19 pandemic: towards an agenda for research in the sociology of sport.

Research Method and Data

A qualitative approach, utilising secondary data sources was adopted. This was through published academic sources from popular databases that include Science Direct and popular mainstream media that claim to use scientific sources. For the most current scientific data on the COVID-19 epidemic, the National Institute of Allergy and Infectious Diseases (NIAID), Centers for Disease Control and Prevention (CDC) and the World Health Organisation (WHO) were consulted for relevant trends and statistics. This research was published between 2014 and 2020 which was then examined and systematically presented and discussed. Selected publications were reviewed and critiqued for their suitability, relevance and contribution. In order to obtain the most relevant research key words were entered in search engines mainly "COVID-19", "Olympic Games" and "Sports" during the time of COVID-19". Based on the above mentioned research method this study generated its own unique findings and conclusions.

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Ethics Statement

Prior to conducting the research, an ethical clearance certificate was obtained by the researchers from the authorising institution of higher learning. The protocol number is UFS-HSD2020/0797/1206. All stipulated ethical guidelines were followed accordingly. No conflict of interest arose. The following section explores the findings from the systematic review.

Findings

Research Theme: Loss of Sport-Related Revenue

One of the most commonly recurring themes that resulted from COVID-19's impact on sport is the wide-spread loss of sport related revenue. Table 2 below presents the loss of revenue in the sporting as a result of COVID-19 as of May 2020.

Table 2. Loss of revenue in the sports industry due to the (COVID-19) pandemic as of Source: Gough (2019)

	Revenue loss in billion U.S dollars
Fan Spending on pro-sports	3.25
Tourism relation to youth sports	2.4
National TV Revenue	2.2
Wages for ticket takers, beer vendors and other stadium and arena employees	0.37

The following section discusses the implications of the findings and the study's contribution thereafter.

Implications and Recommendations

The implications of the COVID-19 pandemic are universal. Every aspect of life as it is known was affected. The global economy took massive set-backs. In terms of the pandemic's impact on the 2020 Tokyo Summer Olympics a significant amount of investment was lost; this refers to money that was ploughed-in to develop critical infrastructure as well as funds allocated to support the event during the activities. The first implication is that alternative funding sources are to be secured in the event that the event is hosted in 2021 as proposed. The other implication is that the event organisers would have to prioritise saving funds and potentially scale down their original plans. As it stands, sporting events like any other set-up that brings together large masses of people will have to change due to the impact of the COVID-19 pandemic. This implies that the World Health Organisation guidelines aimed at preventing the spread of the virus will have to be implemented for the Olympic Games to be successfully hosted. This therefore means that the Olympic Games would potentially become more expensive than initially budget for because of extra hygiene measures that might be imposed. Logistically there are also concerns, for example; Olympic Games organisers will have to answer the following questions:

- Will the stadiums be operating at "full audience capacity"?
- Will the stadiums be fully fumigated and sanitised prior to each day of games?
- Will it be possible to effectively screen all the audience in attendance for COVID-19?

- Even if COVID-19 is not detected immediately on either the athletes or fans, symptoms can still show after 2 weeks, what will happen if these symptoms appear?
- It is assumed that in 2021 the outbreak will be over, what if opening-up Japan's border for the Olympics will lead to a spike in infections?
- If there is an outbreak of COVID-19 cases in Japan, specifically Tokyo, will the nation be able to manage it?

The questions above would potentially arise as it should be expected. The following sections explore the potential contribution to be made by the present research followed by its conclusion.

Contribution

The potential contribution of this research is to provide an analysis of COVID-19's impact on global sport with specific attention to the 2020 Tokyo Summer Olympics. This was done through a systematic review that could also be used in comparison with prior research on Olympics and sporting events in general that had to be cancelled or postponed. This research uniquely utilised theories that could aid in explaining the impact of such a pandemic on sport. As for practitioners, specifically organisers of massive sporting events such as the Olympics they serve to benefit from recommendations that emerged from the review. Academics and researchers alike will now understand the proposed frameworks and theories in relation to major sporting events being cancelled due to a global health pandemic. Research on COVID-19 is relatively limited considering that it is a new pandemic that is still being comprehended. This therefore suggests that significant contributions in research are still being developed making this paper one of the first attempts to conduct a systematic review of the pandemic's impact on the 2020 Tokyo Summer Olympics.

Conclusion

The purpose of this research is to therefore examine the impact of the COVID-19 on the Tokyo 2020 Summer Olympics. Based on the publicly accessible information regarding the pandemic's impact on sports is undeniably significant. However, its full impact is yet to be fully realised in the years to come as this is still an active crisis and it is unknown when it will end.

Suggestions for Further Research

The present research like any other research was not immune to its own set of limitations. First, the study relied solely on publicly available information. This could have led to critical details being omitted from the review and comprising the ability to fully examine the COVID-19 impact on the 2020 Tokyo Summer Olympics. It would therefore be recommended that future research be conducted through support of large medical bodies or associations that have the legal and moral authority to research such details. For instance, it could be inferred that certain details pertaining to the COVID-19 cannot be released, such as details that could cause political, economic and social crises. Having such details classified as confidential

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by governments or international bodies restricts the full extent to which any research can provide a clear, unbiased and complete picture of the pandemic's impact.

This research was a systematic review which attempted to provide a fair examination of the pandemic as much as possible. However, this was and can never be exhaustive. Further, research could be more comprehensive. For example, conducting an empirical study involving human subjects that are knowledgeable about Olympic Games and requesting them to complete a comprehensive questionnaire allowing the researchers to have primary data. The advantage of having primary data is that the data would have been collected through specific questions related to the problem under investigation.

Aside from conducting a quantitative study on the COVID-19's impact on the 2020 Tokyo Summer Olympics, qualitative in-depth interviews can be conducted with key players or experts on such events. This could be local Olympic Games Organising Committee officials from the author(s) country as this does not necessarily have to be an official from the host nation's official Olympic Games Organising Committee. Last, due to the global COVID-19 guidelines that include, social distancing, self-isolation as well as most nations imposing lockdowns, it is believed that post-COVID-19 research can be more informative, refined and potential build of the idea that this research was founded upon.

References

Bartik, A. W., Bertrand, M., Cullen, Z., Glaeser, E. L., Luca, M., & Stanton, C. (2020). The impact of COVID-19 on small business outcomes and expectations. *Proceedings of the National Academy of Sciences*, *117*(30), 17656-17666.

Binner, A. (2020). *New Tokyo 2020 Olympic* dates will be 23 July to 08 August 2021.

Chappell, B. (2020). *IOC Will Devote $800 Million To Postponed Tokyo Olympics, COVID-19 Costs*. Retrieved from: https://www.npr.org/sections/coronavirus-live-updates/2020/05/15/857080028/ioc-will-devote-800-million-to-postponed-tokyo-olympics-covid-19-costs, accessed: 19/06/2020.

Craven, M., Liu, L., Mysore, M., & Wilson, M. (2020). *COVID-19: Implications for business*. McKinsey & Company, 1-8.

Drabek, T. E. (2005). Theories relevant to emergency management versus a theory of emergency management. *Journal of Emergency Management*, *3*(4), 49-54.

Genesis Fitness. (2016). *Five benefits of group training*. [Online] Available on: https://www.genesisfitness.com.au/blog/5-benefits-group-training#:~:text=Combining%20group%20training%20sessions%20into,weight%20or%20tone%20your%20body.&text=Just%20like%20personal%20training%2C%20group,100%25%20effort%20into%20your%20workout, accessed: 19/06/2020.

Gibson, O. (2013). *Tokyo wins the race to host 2020 Olympic Games: Japanese capital beats Madrid and Istanbul after prime minister Shinzo Abe flew in to reassure voters over Fukushima*. Retrieved from https://www.theguardian.com/sport/2013/sep/07/tokyo-host-2020-olympic-games, accessed 27/04/2021.

Elbanna, A., Bunker, D., Levine, L., & Sleigh, A. (2019). Emergency management in the changing world of social media: Framing the research agenda with the stakeholders through engaged scholarship. *International Journal of Information Management*, *47*, 112-120.

Evans, A. B., Blackwell, J., Dolan, P., Fahlén, J., Hoekman, R., Lenneis, V., McNarry, G., Farazmand, A. (2014). *Crisis and emergency management: Theory and practice.* Crisis and emergency management. Routledge 25–34.

Gough, C. (2019). *Coronavirus (COVID-19) disease pandemic effect on the sports industry - Statistics & Facts.* Statista Retrieved from:https://www.statista.com/topics/6098/impact-of-the-coronavirus-on-sport, accessed on: 03/07/2020.

James, W. (2020). *Looking for a Full Sports Calendar?* Try Nicaragua. The New York Times. Retrieved from: https://www.nytimes.com/2020/04/14/sports/coronavirus-nicaragua-sports-events.html, accessed: 03/07/2020.

Kyung-Hoon, K. (2020). *Major sports events around the world that are in the process of re-starting or which have been rescheduled due to the Covid-19 pandemic*. Reuters. Retrieved from: https://mobile.reuters.com/article/amp/idUSKBN22X2LL, accessed: 18/06 /2020.

McEntire, D. A. (2004). *The status of emergency management theory: Issues, barriers, and recommendations for improved scholarship*. University of North Texas. Department of Public Administration. Emergency Administration and Planning.

McEntire, D. A. (2005). Emergency management theory: Issues, barriers, and recommendations for improvement. *Journal of Emergency Management*, 3(3), 44-54.

McGuire, M., & Silvia, C. (2010). The effect of problem severity, managerial and organizational capacity, and agency structure on intergovernmental collaboration: Evidence from local emergency management. *Public Administration Review*, 70, 279–288.

Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., Agha, M. & Aghaf, R. (2020). The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International Journal of Surgery*, 78, 185-193.

Olympic Channel. Retrieved from: https://www.olympicchannel.com/en/stories/news/amp/new-tokyo-2020-olympics-2021-dates-revealed, accessed: 19/06/2020.

Ozili, P. K., & Arun, T. (2020). *Spillover of COVID-19: impact on the Global Economy*. Available at SSRN 3562570.

Pangarkar, N. (2016). A framework for effective crisis response. *Journal of Organizational Change Management*, 29, 464–483.

Rukuni, T. F., Maziriri, E. T., & Chuchu, T. (2020). *Data on occupational health and safety strategies influencing the reduction of coronavirus in South Africa*. Data in brief, 32, (October), 1-7. https://doi.org/10.1016/j.dib.2020.106300

Siddiqui, K. (2020). *The Impact of Covid-19 on the Global Economy*. The World Financial Review, May-June, 25-31.

The Sunday Morning Herald. (2020). *The eye-watering cost of Tokyo 2020 Olympics postponement*. Retrieved from: https://www.smh.com.au/sport/the-eye-watering-cost-of-tokyo-2020-olympics-postponement-20200515-p54t8n.html, accessed: 19/06/2020.

Thomas, L. (2020). *Covid-19 is a threat to the 2020 games. The I.O.C is a threat to the Olympic project*. New Yorker. Retrieved from: https://www.newyorker.com/sports/sporting-scene/covid-19-is-a-threat-to-the-2020-games-the-ioc-is-a-threat-to-the-olympic-project/amp, accessed: 19/06/2020.

United Nations (2020). *The impact of COVID-19 on sport, physical activity and well-being and its effects on social development*. United Nations Retrieved from: https://www.un.org/development/desa/dspd/2020/05/covid-19-sport, accessed: 19/06/2020.

Worldometer (2020). *COVID-19 coronavirus outbreak*. Retrieved from: https://www.worldometers.info/coronavirus, accessed: 19/06/2020.

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Fundamentals of beach volleyball blocking actions

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Abstract: Beach volleyball is spectacular with many rapid actions, agility moves, and high jumping. One of the key elements present in high-performance beach volleyball, having a decisive role in the defensive apparatus, is the blocking movements. This action is done mainly by the tallest player or with the most considerable jumping ability. A high blocking ability can facilitate the defensive movement of the player that is positioned in the back of the court. Blocking ability is facilitated by anticipation capacity, good sight, agility movement, and high jumping ability generated by solid legs. This paper analyses the fundamentals of blocking actions in beach volleyball, giving critical elements in executing a good and efficient block.

Keywords: blocking actions, beach volleyball, technique, training in beach volleyball

Introduction

In recent years, an increasing number of participants and tournaments have led to several studies on beach volleyball. In most cases, these studies analyzed the amount of energy used (Zetou et al., 2008), epidemiology, and lesion rehabilitation (Pfirrmann et al., 2008; Lajtai et al., 2009), kinematic analyzes of movement models (Tilp et al., 2008), physical performance (Sheppard et al., 2008; Riggs and Sheppard, 2009; Lidor and Ziv, 2010), body composition (Palao et al., 2008) and technical-tactical characteristics of the game (Koch and Tilp, 2009; López-Martínez and Palao, 2009).

The FIVB regulation describes blocking as "the action of players closes to the net to intercept the ball coming from opponents, reaching above the top edge of the net, regardless of the height of the point of contact of the ball. When in contact with the ball, part of the body must be above the upper edge of the net".

Blocking skill is a key technical element in beach volleyball which, together with the serve skill effectiveness, is directly related to obtaining the advantage in beach

volleyball (Busca and Febrer, 2012; Jimenez-Olmedo et al., 2012; Marcelino et al., 2010; Peña et al., 2013). A challenging and consistent blocking action hinders the opposing team's attack (Castro et al., 2011). Blocking ability can also be improved by passing anxiety of competition and being bold; also, a psychologist can help every sport participant reach his or her potential as an athlete (Sopa, 2021; Popa et al., 2020).

In beach volleyball over the years, with its changes to the rules, the athlete should have an excellent physical condition, such as good speed (reaction and movement), agility, explosive power, and maximum strength (Bizzocchi, 2008; Lehnert et al., 2009; Pereira et al., 2015; Pastore et al., 2015). Scientists also discovered that group cohesion has a considerable influence on the performance and other fundamental factors in team sports life (Pomohaci and Sopa, 2018).

Sand impedes the movement of players (Smith, 2006), but due to this, players have developed specific movement patterns for beach volleyball (Cortell-Tormo et al., 2011; Perez-Turpin et al., 2009). Also, sand can remove the apparition of the spine, knee, and feet deficiency in the youth population (Szabo and Sopa, 2018).

Many studies analyze the anthropometrical characteristics of beach volleyball sportive regarding their playing position, in pro elite players (Jimenez-Olmedo et al., 2017; Palao et al., 2014) and other categories like youth (Ciccarone et al., 2005). Some of these analyses prove that players specialized in blocking actions have specific differences in body composition and somatotype; the research proved that they have superior height and weight and as well as a higher jumping ability and well-developed leg muscle system (Ciccarone et al., 2008; Marques et al., 2009). In the game of beach volleyball, players specialized in blocking actions present an increase in their weight and height, characteristics that are not as preeminent as for players specialized in defense actions (Palao et al., 2008). Also crucial in discovering the efficiency of volleyball actions is the statistical analysis of the game (Szabo and Sopa, 2020; Szabo et al., 2019; Sopa and Szabo, 2019).

It was noticed by each of us that in the game of beach volleyball, there is close communication and a certain automatism formed between the two players. Thus, before serving one of the team members, the other shows behind him sure signs that represent how the player who jumps to the block will defend himself against the opponent's attack. Under no circumstances is the blocking player allowed to return to the signs shown to his partner during the dispute before returning the ball to the game. This would confuse his teammate a lot, and he would not make his defense phase.

The purpose of the attack is to pass over or past the block, a quality that reflects the number of blocked attacks, the time of their blocking, and whether multiple blocks form a consistent barrier or, conversely, whether there are gaps or height differences that can be exploited by attackers (Afonso et al., 2008). Good jumping ability and static and dynamic balance can ease the block and give many other opportunities (Sopa, 2021; Sopa and Pomohaci, 2021).

The most important aspect is related to how the block will work on the defensive phase because depending on it, his back colleague builds his defense strategy. As for his physical stature, usually, the one who jumps to the block is the tallest player in the team but a little slower in moving on the sand, while the

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defensive phase behind the field is performed by a slightly shorter player who in turn benefits from an excellent move on the sand.

The signs that players repeatedly and usually make would be the following: both hands on the back, the left hand, and the right hand point the finger at each colleague at work. This indicates that the blocking player will jump and defend along the line where he is blocking, while his colleague will defend the diagonals.

If the blocking player points two fingers at each side, it means that he will jump on the block and try to defend the diagonals while his colleague has straight lines. If with the left hand he shows a finger and with the right, he shows two fingers, it means that the player on the left side will jump to the block and defend the right line, and on the right one, he will defend diagonally. If the sign made shows with the left hand the open palm and with the right hand the closed fist, it means most of the time that the player on the left will not jump to the block and will resort to a retreat along the line and the one on the right will jump to block and try to block the ball - this leaves the defender alone to decide where to defend depending on the opponent. There are also situations of advanced players where each technical element has another difficulty implemented, the 3-finger and 4-finger sign, on the right block; however, he concentrates his jump and will stretch his arms diagonally in the hope that his opponent will fall into the trap. The sign-in in which four fingers are shown means that the player from the block will decide that he will no longer jump straight and will jump diagonally in the last second.

These signs are relatively standard and are used by players worldwide, but there are also cases where the two partners establish their signs known only to them that can be done in any way, without a rule in this regard.

An essential aspect is related to how the blocking player manages to mislead his opponents. Thus, if a player decides not to jump to the block, he must not show this too early in the course of the point. He must guard the net until he has noticed where the ball will go after the second contact of the opposing team, implicitly from the hand of the setter. If he is far from the net and it is considered that he can no longer carry out a force attack, he starts from the block, and each partner will defend half of the court from the back area of the court. This can be the key to success against many teams.

At a high level, even if many would be tempted to leave the net, as it was established that if the opponent failed to make a good reception, the setter could bring the ball in a favorable attacking position from any position on the court. That is why the blocking player has to stay on guard until he is one hundred percent convinced that his opponents will no longer attack by force and can retreat behind the court to the place before his teammate.

The primary data of modern volleyball is obtained through statistical procedures, which can identify the strengths and weaknesses of the opponent team. Coaches use these data to train other teams and achieve expected results (Szabo and Magdas, 2014; Szabo, 2015a; Szabo, 2015b; Szabo and Sopa, 2015; Szabo et al., 2019; Szabo and Sopa, 2018). From an interdisciplinary perspective, we want to emphasize proprioception (Szabo et al., 2020; Szabo et al., 2020b; Szabo and Sopa 2020), strength motor skills (Tulbure et al., 2020), biomechanics, and Psychomotor

skills (Szabo et al., 2020c; Szabo et al., 2020d), and modern smart methods in beach volleyball matches (Szabo et al., 2019b).

The reason the block is used

The block is fundamental in the game of beach volleyball from a certain level of play. When the level of officially or unofficially games reaches a reasonable level where the two teams manage to quickly bring their ball around the net in a clear attacking position, and their physical and motor qualities allow them to perform this type of action, then it is clear that the defensive team needs to use its entire arsenal of procedures and technical elements in order to obtain the point. One of them is blocking, which can be performed in several ways. The defense must differ almost every time at the professional level, so opponents never know what to expect from the player on the block.

Most of the time, players start by designating their order at the block so that the player performing the block is close to the net. Team strategies are usually established before the start of the match, but often players choose the option in which in the first points played until the teams get to know each other, the player from the block will jump and defend the straight line against the opponent's attack. The blocking player must be conscientious and watch the ball from the moment it passes the net and is in the opponent's court. This aspect is essential as opponents can return the ball after any contact, not necessarily after the third. In this sense, the blocking player must constantly move in front of the net, usually using the move with added steps and permanently in front of the ball circulates between the two opponents. Thus, even if the opposing team has excellent reception and manages to send the ball in the attacking position from the first touch, the block is ready and can intervene very quickly, and if it does not move in the direction from where the player who made the reception, will be in the attacking position.

The decision strategies of the defensive players have been investigated recently. Kredel et al. (2011) demonstrated that in a training situation, elite male defense players initiate their movement at 250 ms after contact of the ball with the opponent's hand. Elite female defensive players start their movement earlier, about 110 ms after the ball contacts their hand. Amateur players initiate their movement even earlier. The decision correction was 95% for male elite players and 81% for female elite players. In the training situation, only visual stimuli could be processed. Kredel et al. (2011) did not consider any auditory stimulus as an appeal. However, in a qualitative study, Schläppi-Lienhard and Hossner (2014) interviewed world-class athletes about their decision-making process in defense situations. Only one of the 19 athletes interviewed mentioned that the opponent's call influenced his decision. Schläppi-Lienhard and Hossner (2014) concluded that, for the defending player, the opponent's call played a minor role at best. However, some internationally successful teams avoid their call being used by opponents by calling codes in their native (non-English) language, which opponents cannot decode in time. It is essential that the player from the net jumps to the block as high as possible and tries to block the ball on a wide aisle so that the player behind is much helped by the area covered by his partner and can position himself to defend the free surface. Blocking

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as high as possible forces the opponent to send the ball with much height over the block, and the defender increases the chances of reaching the ball, as the time the ball spends in the air before contact with the ground is longer.

The blocking player needs to make a slight pivot to the center of the ground when it comes off the ground so that, if hit by the ball, it bounces in the opponent's court, not out of bounds. Also, the person performing the block must coordinate his jump very well from a material point of view so that it takes place a fraction of a second later than that of the opposing attacker. His hands must be perfectly stretched and held as rigid as possible, rises above the opponent's net, and, eventually, according to the rules, passes beyond the upper lane in an attempt to close as much as possible, the opponent's angle of attack.

Detachment from the sand in the execution of the block is done in the same way as in the attacking momentum, using the technique described above, heel-sole-toe, which makes the player from the block not move horizontally and touch the net, thus granting a point unworked to his opponents.

The movement of feet in the technique of blocking

Unlike indoor volleyball, where the movement is done almost every time by sidestepping and then detaching from the floor as high as possible, in technical beach volleyball, blocking movement differs because it is not always done by side stepping because it is not always done by sidestepping slower.

The player from the block to gain time often moves in a straight line, parallel to the net, performs the detachment beat by the technique mentioned heel-sole-toe, and when he is in the air, turns his shoulders to the net, the line described by them being at the moment of contact with the ball parallel to the net. If the blocking player waits for the ball somewhere at a distance of 3 meters, when he will hurry to reach the net to perform the blocking, it is more than sure that the detachment will not be done only vertically and horizontally, and the effect it will be the unwanted contact with the net.

Determination at the block

Any defensive player who executes the block must first be very determined when he has committed to block a particular area of the field; that aspect must be clear in his task and in no way remain uncovered. Otherwise, the defense mechanism between the two partners will suffer severe damage, and the match will fail. Karch Kiraly, one of the greatest American champions in the history of this beautiful sport, managed to win countless AVP Pro tournaments with several partners because, being the blocking player, he performed this technical procedure so correctly and efficiently that the players who activated behind him knew exactly what exposed areas he needed to defend. Karch Kiraly was given a chance to change things around. It was about how Karch jumped to the block, knowing that he had to defend the straight line, and when he was sure that area was secure, he lowered his arms to the inside of the field, covering a large part of the field diagonals left to the defender. Thus, his teammate in the back had very few chances left to receive the

ball, and if he managed to place himself where his defensive zone was, most of the time, they recovered that ball.

Figure 1. Blocking line [1]

False block

In this regard, perhaps more than in the others, we must insist on communication between partners who strive to be perfect. This aspect can distinguish between winning or not confident balanced partied where the difference is made at a regular minimum of 2 points. For players who block in their team, the false block jump is significant.

If a player jumps to the block several times in a row and fails to be effective, he must communicate with his partner and understand as well as possible how the one in the net will retreat backward, either in a straight line or diagonally. Once the opposing team starts to place balls to the detriment of the attacking shots, it is clear that the defenders must change their strategy and not jump to the block and defend against the balls placed on the field.

It is imperative when the net will trigger the retreat backward to maximize the effect against the opponents. This is done at the last moment when the opponent is already near the moment of hitting the ball. It does not have to retract after the reception of the other, even if it is not as perfect as after the setting step.

The player from the block retires when the opponent takes his eyes off the defensive team, and his peripheral gaze no longer helps him to realize where the players are positioned. This can be misleading, as opposing players may already be in a position to wait for a placed ball, and the point will return to them. A false block is used when the blocking efficiency is low; the opponents manage to attack almost any ball next to the defender, or on the contrary, they place the balls with serenity in

[1] *https://jvavolleyball.org/7-keys-blocking-beach-volleyball/*

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the defenders' court. No matter how good is the blocking in a beach volleyball match, the strategy cannot be maintained from the start of the match until the end. Alternatives are needed, and false blocking is very effective.

The "v" block

This particular type of blocking is performed when the opposing attacker is in a position to attack from the middle of the field, a position in which the defender from the back of the court has 90% of the court compared to 70% in most cases when the attacker hits the ball either to the left or to the right of the net.

The ability to jump can be considered a determining factor of performance in the game of beach volleyball (Palao et al., 2014). Therefore, monitoring tools and methods to accurately measure and control biomechanical jump variables are essential to improve training and performance. Inertial measurement units (IMUs) offer a promising alternative for court diagnosis and have already been used to determine the height of jumps in indoor volleyball (e.g., Charlton et al., 2017). On the beach, players are forced to adapt their movement patterns and produce different movement dynamics (Schmidt et al., 2019).

Given that the opening field for the attacker is vast, the defender who jumps to the block opens both arms wide in a V-shape, leaving a space above the head. That is the area that the back defender should defend first, and then if the ball is placed to try to reach the mouth where it tends to touch the sand.

Figure 2. The V block [2]

Misleading the opponent

A very effective strategy in managing decisive blocks is not to let opponents get used to how the block is executed in the sense of executing a simple routine on each ball attacked by opponents. This will lead one hundred percent to an advantage on the opposing team that will know precisely how to defend and implicitly will find multiple ways to avoid blocking. This can be counteracted in several ways, but one of the most effective ways would be to mislead opponents. Thus, if the agreement

[2] *https://beachmajorseries.com/en/3028/the-five-best-male-blockers-of-the-major-series*

between the defenders is that the block defends the line, the rear defender will make some slots trying to mislead opponents about the location where he will position himself for the defense phase, but each time it will be positioned diagonally, the area assigned to him on the defensive phase. This will have to be done by the block, namely, to give the impression that he will choose to jump to the block, appearing diagonally and jump and defend the line. This is done as follows: it is agreed that the player who jumps to the block must detach a fraction of a second later than the attacker on the sand.

When the attacker detaches himself from the sand and performs the "bow and arrow" movement to hit the ball, the defender is in front of him as if defending diagonally but taking advantage of the split-second available until the moment of detachment. Of sand, it will at the last moment take a lateral step towards the line that it will defend by jumping and will detach itself strongly from the sand by the mentioned technique "heel-sole-toe" and will block that area. Thus, the opposing attacker will be misled because, at the time of his detachment from the sand, the defender was able to defend diagonally, and later, he defends the line. In this strategy, it is imperative to communicate with the two teammates and not to change the way of defense in any form as they will wake up in the position of both defending the same area of the field, thus giving half of the field accessible to opponents.

Conclusion

As we speak about beach volleyball the scoreboard is influenced primarily by the attack phase of the game, which grants points and also generate the show so loved by the audience, but we must be aware that before this offensive aspect of the game, its defensive side has an essential role for the subsequent construction of the attack phase. It is practically impossible to reach the attack phase if a good serve receive is not easy playable or if a ball is not recovered in the transition phase.

Defensive strategies are based primarily on a very good communication between the two partners, this aspect being essential in their path to success as a team.

These strategic aspects of the beach volleyball game are based primarily on a solid defense. It is based on the execution of specific technical procedures in a way executed as correctly as possible, the first and perhaps the most important of these being the block. If this technical element is executed correctly and efficiently, the chances of success of the defensive phase increase significantly because this is the element that coordinates all the others: the transition, the dive of the defender, the moving skills in the field done by the defensive player and the field orientation and positioning behind the block.

References

Afonso, J., Mesquita, I., Marcelino, R., & Coutinho, P. (2008). The effect of the zone and tempo of attack in the block opposition, in elite female volleyball. In *Book of Proceedings of the World Congress of Performance Analysis of Sport VIII, Magdeburg* (pp. 412-415).

Bizzocchi, C. (2008). *O voleibol a alto nível: da iniciação à competição*. 2ed. Barueri, SP: Manole.

Busca, B., & Febrer, J. (2012). Temporal fight between the middle blocker and the setter in high level volleyball. *Revista Internacional de Medicina y Ciencias de la Actividad Física y del Deporte*, *12*(46), 313-327.

DOI 10.30892/gss.1503-075

Castro, J., Souza, A., & Mesquita, I. (2011). Attack efficacy in volleyball: elite male teams. *Perceptual and Motor Skills*, 113(2), 395–408.

Ciccarone, G., Croisier, J.L., Fontani, G., Martelli, G., Albert, A., Zhang, L., & Cloes, M. (2008). Comparison between player specialization, anthropometric characteristics and jumping ability in top-level volleyball players. *Medicina Dello Sport*, 61(1), 29–43.

Ciccarone, G., Fontani, G., Albert, A., Zhang, L., & Cloes, M. (2005). Analysis of anthropometrics characteristics and jumping ability in junior top level volleyball athletes. *Medicina Dello Sport*, 58(1), 1–15.

Cortell-Tormo, J.M., Perez-Turpin, J.A., Chinchilla-Mira, J.J., Cejuela, R., & Suarez, C. (2011). Analysis of movement patterns byelite male players of beach volleyball. *Perceptual and Motor Skills*, 112(1), 21–28.

FIVB (2016). Official Beach Volleyball Rules 2017-2020.

Jimenez Olmedo, J.M., Penichet Tomas, A., Saiz Colomina, S., Martinez Carbonell, J.A., & Jove Tossi, M.A. (2012). Serve analysis of professional players in beach volleyball. *Journal of Human Sport and Exercise*, 7(3), 706 – 713.

Jimenez-Olmedo, J.M., Pueo, B., Penichet-Tomás, A., Chinchilla-Mira, J.J., & Perez-Turpin, J.A. (2017). Physiological work areas in professional beach volleyball: A case study. Retos. *Nuevas Tendencias en Educación Fisica, Deporte y Recreación*, 31, 94–97.

Koch, C., & Tilp, M. (2009). Beach volleyball techniques and tactics: a comparison of male and female playing characteristics. *Kinesiology*, 41(1), 52-59.

Kredel, R., Klostermann, A., Lienhard, O., Koedijker, J., Michel, K., & Hossner, E.J. (2011). Perceptual skill identification in a complex sport setting. In *BIO Web of Conferences* (Vol. 1, p. 00051). EDP sciences.

Lajtai, G., Pfirrmann, C.W., Aitzetmuller, G., Pirkl, C., Gerber, C., & Jost, B. (2009). The Shoulders of Fully Competitive Professional Beach Volleyball Players: High Prevalence of Infraspinatus Atrophy. *The American Journal of Sports Medicine*, 37(7), 1375-1383.

Lehnert, M., Lamrova, I., & Elfmark, M. (2009). Changes in speed and strength in female volleyball players during and after a plyometric training program. *Acta Universitatis Palackianae Olomucensis Gymnica*, 39, 59-66.

Lidor, R., & Ziv, G. (2010). Physical and physiological attributes of female volleyball players-a review. *Journal of Strength and Conditioning Research*, 24(7), 1963-1973.

López-Martinez, A.B., & Palao, J.M. (2009). Effect of serve execution on serve efficacy in men's and women's beach volleyball. *International Journal of Applied Sports Sciences*, 21(1), 1-16.

Marcelino, R., Mesquita, I., Sampaio, J., & Moraes, J. C. (2010). Estudo dos indicadores de rendimento em voleibol em função do resultado do set. *Revista Brasileira de Educação Física e Esporte*, 24(1), 69–78.

Marques, M.C., van den Tillaar, R., Gabbett, T.J., Reis, V.M., & González-Badillo, J.J. (2009). Physical fitness qualities of professional volleyball players: determination of positional differences. *Journal of Strength and Conditioning Research,* 23(4), 1106–11.

Palao, J.M., Gutierrez, D., & Frideres, J.E. (2008). Height, weight, Body Mass Index, and age in beach volleyball players in relation to level and position. *Journal of Sports Medicine and Physical Fitness*, 48(4), 466–471.

Palao, J.M., Valadés, D., Manzanares, P., & Ortega, E. (2014). Physical actions and work-rest time in men's beach volleyball. Motriz: *Revista de Educação Física*, 20(3), 257–261.

Pastore, J.C.F., Ferreira, C.A.A., Costa, F.C.H., & Joao, P.V. (2015). Case study: Proposal for training in combined plyometrics and muscular strength in improved vertical jump in beach volley. *International Journal of New Technology and Research (IJNTR),* 2(5), 30-33.

Peña, J., Rodríguez-Guerra, J., Buscà, B., & Serra, N. (2013). Which skills and factors better predict winning and losing in high-level men's volleyball? *Journal of Strength and Conditioning Research*, 27(9), 2487–2493.

Pereira, A., Costa, A.M., Santos, P., Figueiredo, T., & João, P.V. (2015). Training strategy of explosive strength in young female volleyball players. *Revista Medicina*, 51, 26–131.

Perez-Turpin, J.A., Cortell-Tormo, J.M., Chinchilla-Mira, J.J., Cejuela-Anta, R., & Suarez-Llorca, C. (2009). Performance analysis through the use of temporal activity patterns of elite players inbeach volleyball. Retos. *Nuevas Tendencias En Educación Fisica, Deporte y Recreación*, 16, 67–69.

Pfirrmann, C.W., Jost, B., Pirkl, C., Aitzetmuller, G., & Lajtai, G. (2008). Quadriceps tendinosis and patellar tendinosis in professional beach volleyball players: sonographic findings in correlation with clinical symptoms. *European Radiology*, 18(8), 1703-1709.

Pomohaci, M., & Sopa, I.S. (2018). Discovering the cohesion of a volleyball team and finding the right leader of the group. *Revista Academiei Fortelor Terestre*, *23*(1), 58-64.

Popa, C.O., Schenk, A., Rus, A., Szasz, S., Suciu, N., Szabo, D.A., & Cojocaru, C. (2020). The Role of Acceptance and Planning in Stress Management for Medical Students. Acta Marisiensis-Seria Medica, 66(3), 101-105.

Riggs, M.P., & Sheppard, J.M. (2009). The relative importance of strength and power qualities to vertical jump height of elite beach volleyball players during the counter-movement and squat jump. *Journal of Human Sport and Exercise*, 4(3), 221-236.

Schläppi-Lienhard, O., & Hossner, E.J. (2015). Decision making in beach volleyball defense: Crucial factors derived from interviews with top-level experts. *Psychology of sport and exercise*, *16*, 60-73.

Sheppard, J.M., Cronin, J.B., Gabbett, T.J., McGuigan, M.R., Etxebarria, N., & Newton, R.U. (2008). Relative importance of strength, power, and anthropometric measures to jump performance of elite volleyball players. *Journal of Strength and Conditioning Research*, 22(3), 758-765.

Smith, R. (2006). Movement in the sand: training implications for beach volleyball. Strength and Conditioning Journal, 28(5), 19-21.

Sopa, I.S. (2019). Developing attack point in volleyball game using plyometric exercises at 13-14 years old volleyball players. *Bulletin of the Transilvania University of Brasov. Series IX, Sciences of Human Kinetics*, *12*(2), 67-76.

Sopa, I.S. (2021). Assessing the anxiety level of a volleyball team. *Geosport for Society*, 14(1), 47-55.

Sopa, I.S., & Pomohaci, M. (2018). Discovering the leader of a volleyball team using the sociometric survey method. *Timisoara Physical Education and Rehabilitation Journal*, 11(20), 27-33.

Sopa, I.S., & Pomohaci, M. (2021). Using coaching techniques in assessing and developing the static and dynamic balance level of young volleyball players. *Bulletin of the Transilvania University Brasov*, 14(63), 89-100.

Sopa, I.S., & Szabo, D. A. (2019). Statistical comparison related to service and reception of volleyball team CSM Volei Alba Blaj in the CEV Champions League Final Four 2018. *Timisoara Physical Education and Rehabilitation Journal*, 12(23), 16-25.

Sopa, I.S., & Szabo, D.A. (2020). Comparison between statistical parameters of attack and defense in high volleyball performance (CSM Volei Alba Blaj in the CEV Champions League Final Four 2018). *Bulletin of the Transilvania University of Braşov*, 13(1), 93-102.

Szabo, D.A. (2015a). Modalities of using the information provided by the statistical program click and scout for improving the outside hitters' service efficiency in volleyball game. *The European Proceeding of Social & Behavioral Sciences EpSBS*, 341-347.

Szabo, D.A. (2015b). Study on improving the service unforced errors in volleyball game by using a statistical software. In *Conference proceedings of» eLearning and Software for Education «(eLSE)* (No. 03, pp. 320-326). " Carol I" National Defence University Publishing House.

Szabo, D.A., & Magdaş, L. (2014). Increasing the defensive efficiency in volleyball using the statistical program "Click&Scout". *Conference proceedings of eLearning and Software for Education (eLSE),* Issue 1, 223-228.

Szabo, D.A., & Sopa, I.S. (2015). Study on the Interpretation of the Results in a Volleyball Game by Using a Specific Program of Statistics. *Procedia Social and Behavioral Sciences*, Elsevier Publication, Volume 180C, p. 1357-1363.

Szabo, D.A., & Sopa, I.S. (2018). Preventing shoulder injuries using prophylactic programs for volleyball players. *Discobolul - Physical Education, Sport and Kinetotherapy Journal*, 14(53), 49-57.

Szabo, D.A., & Sopa, I.S. (2020). Study regarding the level of physical and functional development of children from primary school level. *Journal of Physical Education and Sport*, *20*(3), 1497-1504.

Szabo, D.A., Neagu, N., & Sopa, I.S. (2020). Research regarding the development and evaluation of agility (balance, coordination and speed) in children aged 9-10 years. *Health, Sports & Rehabilitation Medicine,* 21(1), 33-40.

Szabo, D.A., Neagu, N., Teodorescu, S., & Sopa, I.S. (2020b). Eye-hand relationship of proprioceptive motor control and coordination in children 10–11 years old. *Health Sports Rehabil. Med*, *21*, 185-191.

Szabo, D.A., Neagu, N., & Sopa, I.S. (2020c). Kinematic angular analysis of cinematic biomechanics in forearm flexion: a case study. *Geosport for Society*, *13*(2), 140-148.

Szabo, D.A., Neagu, N., Ardelean, M., & Sopa, I. S (2020d). Psychomotor evaluation of athlete and non-athlete children. *Discobolul – Physical Education, Sport and Kinetotherapy Journal*, 59, 56-69.

DOI 10.30892/gss.1503-075

Szabo, D.A., Neagu, N., Teodorescu, S., Pomohaci, M., & Sopa, I.S. (2019). Modalities of Exploitation the Information Provided by the Click&Scout Statistical Program in Preparing Volleyball Attack Players. *International Journal of Applied Exercise Physiology*, 8(2.1), 804-811.

Szabo, D.A., Neagu, N., Teodorescu, S., Pomohaci, M., & Sopa, I.S. (2019b). Does Smart Electronic Devices Influence the Body Deficiencies Development at Kids Who Practice Swimming?. *International Journal of Applied Exercise Physiology*, 8(2.1), 845-851.

Szabo, D.A., Sopa, I.S., Stoica, R.S., & Ivănescu, A. (2018). The effectiveness of physiotherapeutic treatment in the recovery of the collateral ligament lesion. *Discobolul – Physical Education, Sport and Kinetotherapy Journal*, 14(52), 16-24.

Tilp, M., Wagner, H., & Muller, E. (2008). Differences in 3D kinematics between volleyball and beach volleyball spike movements. *Sports Biomechanics*, 7(3), 386-397.

Tulbure R.E., Neagu N., & Szabo, D.A. (2020). Comparative study on the development of the motor skill (strength) through the circuit method versus dynamic games in physical education classes. *Health, Sports & Rehabilitation Medicine*, 21(4), 223-230.

Zetou, E., Giatsis, G., Mountaki, F., & Komninakidou, A. (2008). Body weight changes and voluntary fluid intakes of beach volleyball players during an official tournament. *Journal of Science and Medicine Sport*, 11, 139–145.

https://jvavolleyball.org/7-keys-blocking-beach-volleyball/

https://beachmajorseries.com/en/3028/the-five-best-male-blockers-of-the-major-series

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Study regarding the development process of motor qualities endurance and strength in physical education lessons during the pandemic period

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Abstract: In 2020, everybody's life was affected by the general crisis generated by the SARS-CoV-2 Pandemic. The educational system suffered from the transition from face-to-face learning to online learning, and every activity transformed their curricula from living to online. For Physical Education activity, the process was complicated; being a principal practical activity, the online system was not such a generous field for this domain. Our study focused on the effects of the pandemic crisis on the activity of Physical Education students from Sibiu city and how teachers managed to overcome the online difficulties of teaching. As a research method, the questionnaire of opinions was used with ten items and a scale of five levels (starting from 1 that was total disagreement to 5 that was a total agreement with the affirmation). The research subjects were 35 teachers from Sibiu city (age between 22 and 45 years old, 13 females and 22 males), with different experience in the Physical Education domain. The questionnaire results showed that teachers had difficulties in the teaching-learning process during the Pandemic; students' physical condition and health were also affected. Other conclusions highlighted the idea that the endurance and strength of children were reduced due to physical inactivity. Also, the assessing process in physical education classes was complicated. The last conclusion was that most teachers consider that physical education lessons can contribute decisively to the post-pandemic health of students and can be decisive in the harmonious physical development of students and their optimal level of health.

Keywords: improving resistance, developing force, physical Education and sport

Introduction

During the past year, 2020, the worldwide suffered a big crisis generated by the SARS-CoV-2 infection, and a general pandemic was declared all over the planet.

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The pandemic infection generated many malfunctions in everyday life of the human being in all domains starting from the sanitary domain, economic, transportation, and not the last, the educational system. The classical learning process was affected by the restriction of meeting face-to-face and introducing the quarantine and the obligatorily to stay home. The whole education system had to be restructured, and teachers had to find new online solutions for continuing the learning process. Physical Education was one of the most affected from the curriculum discipline, being a predominantly practical activity in which teachers were not accustomed to using interactive electronic means.

Some scientific papers highlighted the importance of daily practicing physical Education and sports activities (Cheng et al., 2018; Engeseth et al., 2018; Tiberi and Piepoli, 2019; Tulbure et al., 2020), and also a decrease in physical activity can also affect a person's mental health, which may be experienced as unpleasant emotions such as sadness, anger, and frustration (Brooks et al., 2020). Physical activity can be positively correlated with a pandemic state. Simple physical activity can reduce the harmful effects of strict quarantine (Apriyanto et al., 2021).

Other scientific papers highlight the importance of coping with stress during the Pandemic and how physical education or sports activities could help reduce stress and anxiety (Samelko et al., 2020; Popa et al., 2020). Positive coping is associated with better mental health outcomes, while negative coping is associated with psychological problems (Mark and Smith, 2012a; Mark and Smith, 2012b). The COVID-19 outbreak poses a significant threat to public health worldwide. This mental distress has been mainly described as sleep disturbance, symptoms of anxiety and depression, post-traumatic stress disorder, decision incapacity, and even somatic symptoms (Master et al., 2020).

World Health Organization sustained the idea that School settings provide youth with critical opportunities for physical activity (PA), a key driver of positive physical, social-emotional and mental health among youth (WHO, 2020).

Following the implementation of the emergency measures, online learning has become a necessary strategy for adequate teaching in this pandemic period (Chen et al., 2020a). Physical Education in school systems should have also been adjusted to the new technologies and the classes in higher institutions that provide Education for the staff, which has raised numerous questions and problems (Batez, 2021).

Online learning is, by its nature, inequitable for school-aged youth due in part to unequal access to technology, consistent high-speed internet, adult supervision, and support, sports equipment, and physical space to participate in online physical Education (Daum, 2020; D'Augustino et al., 2021). Other inequities are presented for youth with disabilities who are mainly dependent on school physical education for PA engagement and face barriers to being physically active in home environments (Esentürk, 2020; D'Augustino et al., 2021).

If designed appropriately, online physical Education may have the potential to reduce health disparities related to inequitable opportunities for PA engagement (Draper et al., 2021; D'Augustino et al., 2021).

We would also like to emphasize the need for interdisciplinary studies, which emphasize the importance of developing proprioception (Szabo et al., 2021);, agility

(Szabo et al., 2020; Sopa et al., 2015), balance and recovery (Szabo et al., 2018) in the process of developing motor skill strength, as well as the practice of prophylactic sports (Szabo and Magdas, 2014). Also, psychomotor assessment and biomechanical and kinematic analysis (Szabo et al., 2021) interpreted by *smart* (Szabo et al., 2019) means, are critical in the development of all motor qualities, not just strength and endurance.

Lately, the students' movement activities have decreased. One of the reasons is the implementation of online learning (Safruddin et al., 2020). The change from offline to online learning made various new problems, one of which is learning behavior. Moreover, the large number of lecture assignments makes students spend more time in front of the laptop (Widodo et al., 2020). This problem caused fewer students movement activities. The reduced movement activities also negatively affect the student's health (Safruddin et al., 2020).

Methods of research

The method used in our experiment was the questionnaire of opinions. The questionnaire had ten items (questions) and a gradation scale of five levels starting from 1 to 5 (with one meaning total disagreement with the affirmation and five meaning total agreement with the affirmation). The questionnaire had objectives to discover teachers' opinions from the Physical Education domain regarding the difficulties that pandemic Covid-19 produced in the learning process.

Study Design and Subjects

The questionnaire objectives were to discover the difficulties that teachers from the Physical Education domain encountered and solutions discovered. The design of the questionnaire was the following:

Table 1. The questionnaire applied to a sample of specialists in the Physical Education domain

Questionnaire items	1	2	3	4	5
1. The physical education and sports lesson represents a corresponding framework for the development of the general resistance of the students					
2. Increasing the level of strength of students is a primary goal in the lesson of Physical Education and sports					
3. The level of general resistance of students was greatly affected during the Covid-19 pandemic lockdown					
4. The development of strength during the Pandemic was a complex process					
5. Assessing motor quality, strength and endurance has been very difficult in the online system due to the Pandemic					
6. The level of functioning of the cardiovascular, respiratory, and exercise capacity of the students was affected by the inactivity due to the pandemic period and lockdown					
7. The teaching-learning process in the physical Education and sports lesson was challenging during the pandemic lockdown					
8. Physical inactivity in students during the pandemic period affected students' level of strength and endurance					
9. The lesson of Physical Education and sports can make a decisive contribution to the post-pandemic health of students					
10. The development of strength and endurance through the lesson of Physical Education and sports contributes to the harmonious physical development of students and their optimal level of health.					

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Subjects of the research

The study focused on researching the opinions of Physical Education teachers (n=35) from different schools in Sibiu city, with ages between 22 and 45 years old, 13 female and 22 males, with different professional levels and experience.

The research protocol and the purpose of the experiment were explained to all participants. The protocol was approved by the Review Board of Physical Education and Sports Department, University "Lucian Blaga" Sibiu (resolution no. 32/30/06/2021), and all the procedures have been carried out in compliance with the Helsinki Declaration's requirements.

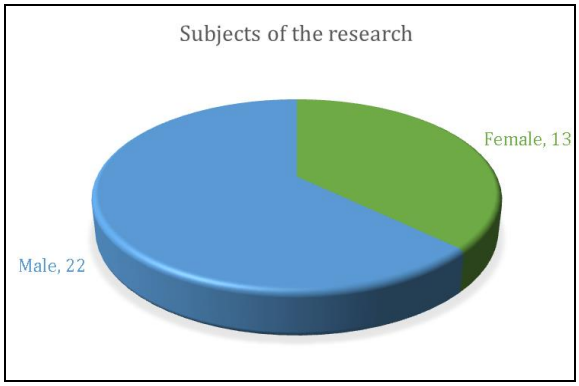
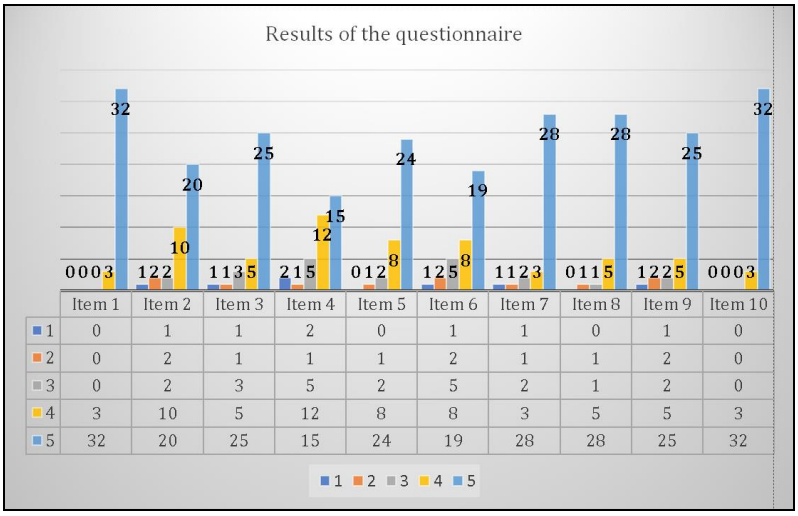


Figure 1. Subjects of the research

Results

The answers to the questionnaire were processed, and the results were presented in the following graphics. The questionnaire had ten items enquiring the effects of Pandemic over the health of children, the process of learning and teaching in Physical Education lessons.



	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10
1	0	1	1	2	0	1	1	0	1	0
2	0	2	1	1	1	2	1	1	2	0
3	0	2	3	5	2	5	2	1	2	0
4	3	10	5	12	8	8	3	5	5	3
5	32	20	25	15	24	19	28	28	25	32

Figure 2. Results of the questionnaire

Discussion

The situation with COVID-19 and the changes in the teaching process showed a possible window of opportunity through modern methods of communication. Moreover, this emphasizes the importance of ICT skills for Sports and Physical Education educators to significantly improve and sustain Education and solve the mentioned problems (Batez, 2021).

Conclusions of some studies (D'Augustino et al., 2021) highlighted that COVID-19 also has indirect effects on minority and low-income youth, including exacerbated poverty, learning losses, poorer social-emotional and mental health, and higher school dropout rates attributable to school closures (Christakis et al., 2020; Dorn et al., 2020; Schulz et al., 2020; Benfer et al., 2021).

It is expected that immunity will increase (Chen et al., 2020b; Hall et al., 2020). Maintaining psycho-physical health in locked situations is of utmost importance, and special attention should be paid to the elderly and children (Apriyanto et al., 2021).

Although online resources are already available for educators, they are insufficient to meet current physical education teacher needs. For example, recent literature determined that "student access to online learning" and "availability of teacher resources" were substantial challenges related to online physical education instruction during the COVID-19 Pandemic (Pavlovic et al., 2021). Similarly, Mercier et al. reported that 20% of physical education teachers felt less effective teaching their students online during the Pandemic. The authors inferred that teacher response might not reflect actual learning, given that half of the sample did not use assignments or video instruction (Mercier et al., 2021).

The results of our investigation showed that Physical Education teachers encountered many difficulties in their process of teaching and learning in the sports field during the pandemic years of 2020.

As the results of the questionnaire show the majority of teachers are in total agreement with the affirmation that physical education and sports lesson represents a corresponding framework for the development of general resistance of students, with 32 teachers, representing 91% from the total of 35 respondents, in total agreement; and three teachers, representing 9% from the total, having a good agreement with the affirmation.

From the questionnaire results, it can be observed that the majority of teachers questioned, 20 representing 57% from the total, are in total agreement with the affirmation that increasing the level of strength of students is a primary goal in the lesson of Physical Education and sports, ten respondents, representing 29% from the total, are in agreement with the affirmation, two persons, representing 6% from the total, did not agree or disagree, one person disagree and one teacher is in total disagreement.

Regarding the 3rd item of the questionnaire, which affirmed that "the level of general resistance of students was greatly affected during the Covid-19 pandemic lockdown", we found that 25 teachers questioned, representing 71% of the total, have a firm agreement with the affirmation, five teachers agree, two did not agree or disagree, one person disagree and one person is in total disagreement with the affirmation.

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Another presumption regarding the difficulties that teachers from the Physical Education domain encountered was the development of strength during the Pandemic, 15 teachers (representing 43% from the total) are in total agreement with the complicated process of learning and developing strength; 10 teachers (representing 29% from the total) agree with the affirmation; 5 were not decided, two did not agree, and 1 had a total disagreement with the affirmation.

The assessment process of motor quality, strength, and endurance have been complicated in the online system due to the Pandemic that is what we discovered analyzing the results of the questionnaire, 24 teachers (representing 69% from the total) are in total agreement, 8 teachers (representing 23% from the total) agree, only one person did not agree with the statement.

The level of functioning of the cardiovascular, respiratory, and exercise capacity of the students was affected by the inactivity due to the pandemic period, and lockdown that's what the majority of the teachers 19 (54% from the total) questioned total agree with the affirmation; 8 teachers (23% from the total) agree with the affirmation; 5 are not decided, and only two teachers did not agree, and one person is in total disagreement with the affirmation.

The teaching-learning process in the physical Education and sports lesson was challenging during the pandemic lockdown that is the presumption accepted by the majority of the teachers questioned 28 (80% from the total), three agree, two are not decided, one does not agree, and one is in total disagreement with the affirmation.

Physical inactivity in students during the pandemic period affected students' level of strength and endurance was the conclusion of the majority of teachers questioned in our experiment, 28 people (representing 80% from the total) had a total agreement with this affirmation, five teachers had agreed with the affirmation, and only one was not decided, and one did not agree with the affirmation.

Also, another conclusion of the study was that the lesson on Physical Education and sports could make a decisive contribution to the post-pandemic health of students, 25 teachers (representing 71% of the total) had a solid agreement with this statement, five teachers agreed with the affirmation, two were not decided, two did not agree, and 1 had a strong disagreement.

In the last item of the questionnaire, the conclusions were that development of strength and endurance through the lesson of Physical Education and Sports contributes to the harmonious physical development of students and their optimal level of health, the majority of teachers 32 (representing 91% from the total) had a firm agreement and three teachers (representing 9% from the total) agreed with this statement, none disagreed the statement.

Conclusions

The Pandemic Covid 19 certainly changed the teaching-learning habits for both sides teachers and students; the standard curricula had to be adapted to the online activity conditions, changing and affecting all learning systems. Physical Education, a principal practical activity, was undoubtedly affected by the impossibility of practicing it on good gyms or fields, with particular objects, making

it sometimes an impossible mission. Teachers managed to find a way to adapt the curricula of Physical Education to online activity, and the process of teaching and learning somewhat survived.

The conclusions of our investigation highlight the low efficiency of online teaching and learning in the Physical Education activity during the pandemic Covid 19 period. The majority of teachers enquired had a strong agreement that the physical education classes represent the perfect framework for developing general resistance and has as main goal developing children's strength. Also, most teachers agreed that the Pandemic Covid-19 greatly affected children's general health and physical condition because they were unable to do physical activity propriety, physical strength and resistance levels were also affected by poor options for physical activity at home.

Other conclusions of the questionnaire were that assessing the motor development was difficult to impossible in the online system with many difficulties and finding adequate teaching methods.

The level of functional development, cardiovascular and respiratory system was affected due to the Pandemic; children's physical activity was reduced close to none, affecting their strength and endurance.

Positive conclusions were also found in questioning the teachers; the majority of the respondents agreed that physical education lessons could contribute decisively to the post-pandemic health of students and can be decisive in the harmonious physical development of students and their optimal level of health.

References

Apriyanto, R. & Adi, S. (2021). Effectivness of online learning and physical activities study in physical Education during Pandemic Covid 19. *Kinestetik: Jurnal Ilmiah Pendidikan Jasmani*, 5(1), 64-70. https://doi.org/10.33369/jk.v5i1.14264

Batez, M. (2021). ICT skills of university students from the Faculty of Sport and Physical Education during the COVID-19 Pandemic. *Sustainability*, 13, 1711. https://doi.org/10.3390/su13041711

Benfer, E.A., Vlahov, D., Long, M.Y., Walker-Wells, E., Pottenger, J.L.Jr., & Gonsalves, G. (2021). Eviction, health inequity, and the spread of COVID-19: housing policy as a primary pandemic mitigation strategy. *J. Urban Health,* 98, 1–12. https://doi.org/10.1007/s11524-020-00502-1

Brooks, S., Webster, R., Smith, L., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *The Lancet*, 395. https://doi.org/10.1016/S0140-6736(20)30460-8

Chen, P., Mao, L., Nassis, G.P., Harmer, P., Ainsworth, B.E., & Li, F. (2020a). Wuhan coronavirus (2019): The need to maintain regular physical activity while taking precautions. Journal of Sport and Health Science, 9(2), 103–104. https://doi.org/10.1016/j.jshs.2020.02.001

Chen, T., Peng, L., Jing, B., Wu, C., Yang, J., Cong, G. (2020b). The impact of the COVID-19 Pandemic on user experience with online education platforms in China. Sustainability, 12, 7329. https://doi.org/10.3390/su12187329

Cheng, W., Zhang, Z., Cheng, W., Yang, C., Diao, L., & Liu, W. (2018). Associations of leisure-time physical activity with cardiovascular mortality: A systematic review and meta-analysis of 44 prospective cohort studies. *European Journal of Preventive Cardiology*, 25(17), 1864–1872. https://doi.org/10.1177/2047487318795194

Christakis, D.A., Van Cleve, W., & Zimmerman, F.J. (2020). Estimation of US children's educational attainment and years of life lost associated with primary school closures during the coronavirus disease 2019 pandemic. *JAMA network open*, 3(11), e2028786-e2028786.

D'Augustino, E.M., Urtel, M., Webster, C.A., McMullen, J., & Culp, B. (2021). Virtual Physical Education During Covid-19: Exploring future directions for equitable online leargning tools. *Frontiers in Sports and Active Living,* 3, 1-6. https://doi.org/10.3389/fspor.2021.716566

Daum, D.N. (2020). Thinking about hybrid or online learning in physical Education? Start here! *JOPERD,* 91, 42–44. https://doi.org/10.1080/07303084.2020.1683387

Dorn, F., Khailaie, S., Stoeckli, M., Sebastian C., Binder, S.C., Lange, B., Lautenbacher, S., Peichl, A., Vanella, P., Wollmershäuser, T., Fuest, C., & Meyer-Hermann, M. (2020). The Common Interests of Health Protection and the Economy: Evidence from Scenario Calculations of COVID-19 Containment Policies. *BMJ Yale.* https://doi.org/10.1101/2020.08.14.20175224

Draper, C.E., Milton, K., & Schipperijn, J. (2021). COVID-19 and physical activity: how can we build back better? *J Phys Act Health*, 18, 149–150. https://doi.org/10.1123/jpah.2021-0037

Engeseth, K., Prestgaard, E.E., Mariampillai, J.E., Grundvold, I., Liestol, K., Kjeldsen, S.E., ... & Skretteberg, P.T. (2018). Physical fitness is a modifiable predictor of early cardiovascular death: A 35-year follow-up study of 2014 healthy middle-aged men. *European journal of preventive cardiology*, 25(15), 1655-1663. https://doi.org/10.1177/2047487318793459

Esentürk, O.K. (2020). Parents' perceptions on physical activity for their children with autism spectrum disorders during the novel Coronavirus outbreak. *Int. J. Dev. Disabil,* 1–12.

Hall, G., Laddu, D., Phillips, S., Lavie, C., & Arena, R. (2020). A tale of two pandemics: How will COVID-19 and global trends in physical inactivity and sedentary behavior affect one another? *Progress in Cardiovascular Diseases,* 64, 108. https://doi.org/10.1016/j.pcad.2020.04.005

Mark, G., & Smith, A.P. (2012a) Effects of occupational stress, job characteristics, coping, and attributional style on the mental health and job satisfaction of university employees. *Anxiety, Stress, and Coping,* 25(1), 63–78. https://doi.org/10.1080/10615806.2010.548088

Mark, G., & Smith, A.P. (2012b). Occupational stress, job characteristics, coping, and the mental health of nurses. *British Journal of Health Psychology,* 17(3), 505–521. https://doi.org/10.1111/j.2044-8287.2011.02051.x

Master, A.N., Su, X., Zhang, S., Guan, W., & Li, J. (2020). Psychological impact of COVID-19 outbreaks on frontline nurses: A cross-sectional survey study. *Journal of Clinical Nursing*, 29(21/22), 4217-4226.

Mercier, K., Centeio, E., Garn, A., Erwin, H., Marttinen, R., & Foley, J. (2021). Physical education teachers' experiences with remote instruction during the initial phase of the COVID-19 Pandemic. *J. Teach. Phys. Educ.* 40, 337–342. https://doi.org/10.1123/jtpe.2020-0272

Pavlovic, A., DeFina, L. F., Natale, B. L., Thiele, S. E., Walker, T. J., Craig, D. W., ... & Kohl, H. W. (2021). Keeping children healthy during and after COVID-19 pandemic: meeting youth physical activity needs. *BMC public health*, 21(1), 1-8. https://doi.org/10.1186/s12889-021-10545-x

Popa, C. O., Schenk, A., Rus, A., Szasz, S., Suciu, N., Szabo, D. A., & Cojocaru, C. (2020). The Role of Acceptance and Planning in Stress Management for Medical Students. *Acta Marisiensis-Seria Medica*, 66(3), 101-105.

Safruddin, S., Nasaruddin, N., Widodo, A., Sobri, M., & Radiusman, R. (2020). Students' basic movement skills in Physical Education during the online learning. *Advances in Social Science, Education and Humanities Research,* 556, 314-317.

Samelko, A., Szczypinska, M., & Guszkowska, M. (2020). Styles of coping with stress presented by female and male students of Physical Education during the Pandemic. *International Journal of Physical Education, Fitness and Sports*, 9(4), 85-90. https://doi.org/10.34256/ijpefs2049

Schulz, A.J., Mehdipanah, R., Chatters, L.M., Reyes, A.G., Neblett, E.W. Jr., & Israel, B.A. (2020). Moving health education and behavior upstream: lessons from COVID-19 for addressing structural drivers of health inequities. *Health Educ. Behav.* 47, 519–524.

Sopa, I.S., & Szabo, D.A. (2015). Testing agility and balance in volleyball game. *Discobolul Phys Educ Sport Kinetother J*, *11*(41), 167-174.

Szabo, D.A., Magdaş, L. (2014). Increasing the defensive efficiency in volleyball using the statistical program "Click&Scout". *Conference proceedings of eLearning and Software for Education (eLSE),* Issue 1, p. 223-228.

Szabo, D.A., Neagu, N., Popoviciu, H.V., Szasz, S., Şopterean, T.A., & Munteanu, R.M. (2020). The benefits of the TECAR therapy in flexion recovery after revision of the anterior cruciate ligament (ACL). *Timisoara Physical Education and Rehabilitation Journal*, 13(25), 27-35. http://dx.doi.org/10.2478/tperj-2020-0013

Szabo, D.A., Sopa, I.S., Stoica, R.S., & Ivănescu, A. (2018). The effectiveness of physiotherapeutic treatment in the recovery of the collateral ligament lesion. *Discobolul – Physical Education, Sport and Kinetotherapy Journal*, 14(52), 16-24.

Szabo, D.A., Neagu, A., Ilieş, A., & Ardelean, M. (2021). Linear kinematic analysis of cinematic biomechanics in semi-squat knee flexion: a case study. *Geosport for Society*, 14(1), 56-66. https://doi.org/10.30892/gss.1406-073

Szabo, D. A., Neagu, N., Teodorescu, S., Panait, C. M., & Sopa, I. S. (2021). Study on the Influence of Proprioceptive Control versus Visual Control on Reaction Speed, Hand Coordination, and Lower Limb Balance in Young Students 14–15 Years Old. *International Journal of Environmental Research and Public Health*, *18*(19), 10356. https://doi.org/10.3390/ijerph181910356

Tiberi, M., & Piepoli, M. F. (2019). Regular physical activity only associated with low sedentary time increases survival in post myocardial infarction patient. *European Journal of Preventive Cardiology*, 26(1), 94–96. https://doi.org/10.1177/2047487318811180

Tulbure, R. E., Neagu, N., & Szabo, D. A. (2020). Comparative study on the development of the motor skill (strength) through the circuit method versus dynamic games in physical education classes. *Health, Sports & Rehabilitation Medicine*, 21(4), 223-230. https://doi.org/10.26659/pm3.2020.21.4.223

WHO (2020). Prevalence of Insufficient Physical Activity. Available online at: https://www.who.int/gho/ncd/risk factors/physical activity text/en/ (Accessed September 12, 2021)

Widodo, A., Nursaptini, N., Novitasari, S., Sutisna, D. (2020). From face-to-face learning to web base learning: How are student readiness? *Premium Educandum: Journal Pendidikan Dasar dan Pembelajaran,* 10(2), 149-160. https://doi.org/10.25273/pe.v10i2.6801

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Testing the visual-motor coordination and reaction speed in children aged between 10–14 years old

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Abstract: The present study aimed to debate a topic less addressed by most people, which involved research on a group of 20 students from rural areas, aged 10–14 years, which consists of performing two tests, namely the Ruler drop test and the Hand-eye coordination test, which aims at the reaction speed of the dominant and non-dominant hand and also the hand-eye coordination capacity of the subjects. The paper aimed to identify whether somatic factors and age influence the results of the group. In order to perform the two tests, it was necessary, for the beginning, information related to the study group, information on weight, age, height, dominant hand, respectively dominant eye. These represented the point of interest of the research, being reported individually to the test results, thus constituting the study basis of statistics. After obtaining the results, we concluded that a significant significance is encountered when comparing the dominant hand with the non-dominant one, obtaining a positive value for the dominant hand. At the same time, we interpreted after the research that females tend to have a much faster reaction speed, more significant than the males when it comes to using the non-dominant hand. The hypothesis was confirmed, with differences in somatic factors' influence, but the others do not show significant values except those stated above. In addition to the practical part, the research involves an interesting theoretical foundation being reached aspects related to proprioception, coordination, speed, ways of using tests, and the opinion of other researchers who have conducted similar studies.

Keywords: visual-motor coordination, reaction speed, proprioception, physical education and sport

Introduction

Proprioception was first defined by neuropsychologist Charles Sherrington in the early 20th century. The study concluded that in the body, there are specific receptors in the musculoskeletal system in which different stimuli are triggered by

changes in the body that are perceived in space, depending on the position of the physique, limbs, and connection with the layer. He argued that the body triggers stimuli to receptors, so he called this area of sensory perception the proprioceptive field. Sherrington defined proprioception as the perception of the position and movement of joints, and the body in space is, in fact, very close to the current understanding of proprioception (Kim, 2001).

Proprioception can be defined in a variety of ways. Proprioception is now described as an organism's ability to detect the location and movement of joints and the perception of spatial forces (Lephart et al., 1997). It is the whole neural input from mechanoreceptors into the central nervous system (Myers et al., 1999).

Proprioception plays a crucial role in planning accurate and concerted motions, maintaining balance, and managing body position. It also affects sports learning and re-education (Westlake and Culham, 2007).

Understanding the body parts in space is essential for effective communication with the environment (Riemann and Lephart, 2002). The importance of proprioception is evident in all fields. In sports, proprioception plays a vital involvement in trauma preventive and rehabilitation. The role of proprioception increases with the aging of the population, especially in the case of falls. With age, proprioception is also affected, including other functions, resulting in a poor perception of the body's position in space. Decreased proprioception can alter the limb's joint biomechanics and neuromuscular regulation, leading to impaired balance and a greater likelihood of falls (Ribeiro and Oliveira, 2007).

With age, the deterioration of the proprioceptive mechanism involves changes in the peripheral and central nervous systems. Due to changes in proprioception, the biomechanics of the joints and the neuromotor regulation of the limbs change, leading to balance disorders. Proprioceptive function declines in the elderly procedure that is related to balance defects. Poor balance and proprioception boost the probability of collapses (Ribeiro and Oliveira, 2007). Many authors (Erickson, 2007; Ellison, 2015) describe the eye-hand vision-motor reaction time as a series of decisions to complete a specific task and the resulting movement (Szabo et al., 2020). The eye-hand vision-motor reaction time represents integrating visual information, perception-based decision-making, and movement to complete a specific task (Laby et al., 2018). Eye-hand coherence is the capability of the visual process to supervise the knowledge obtained throughout the eyeballs to manage and guide the thinking of the hand to complete a given task (such as writing or capturing a ball) (Singh, 2010). Hand-eye collaboration is one of the skills required by humans and can affect all aspects of daily life, including school, daily life activities, and social interaction (Bakhtiar et al., 2018).

Proprioceptive control has long been essential for improving sports performance, medical disorders, everyday life activities, or further sports performance. Some specialists associated the proprioceptive control with somatosensory or proprioceptive deficiencies with effects on movement regulation that can develop from early ages (Coleman et al., 2001; Goble et al., 2009; Zwicker et al., 2013; Li et al., 2015), is linked with a low level of movement and sports practice (Szabo et al., 2021). These capacities were associated with the sense of relative

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location and movement of the limbs and body (Konczak, 2009) and needed in any human activity. Other proprioceptive control viewpoints emphasize the viewpoint of mechanoreceptors in joints, muscles, tendons, and skin (Holst-Wolf et al., 2016) provide proprioceptive information. Also, other studies highlight the importance of balance in developing proprioception skills (Sopa and Pomohaci, 2021).

Methods of research

The research used two different tests for assessing hand-eye coordination, the alternate-hand wall toss test, and the ruler drop test.

The hand-eye coordination test (Mackenzie, 2009)

A hand-eye coordination test is an assessment tool for hand-eye coordination. Participants throw a ball against the wall with one hand during axillary movements and try to catch it with the other hand.

Purpose: To measure hand-eye coordination

Equipment required Tennis or baseball, smooth and solid wall, marking belt, stopwtch (optional)

Pre-test: Explain the test procedure to the subject. Carry out health risk screening and obtain informed consent. Prepare a form and record basic information such as age, height, weight, gender, and test conditions. Perform proper warm-ups and exercises. View more detailed information about the pre-test procedure. Procedure: Place a mark at a certain distance from the wall (for example, 2 meters, 3 feet). This person is standing behind the line, facing the wall. The ball was thrown towards the wall in an underarm motion from one hand and tried to catch it with the other hand. Then throw the ball back to the wall and catch it with the original hand. The test can continue for a specified number of attempts or a set period (for example, 30 seconds). By increasing the fixed-term constraint, the factor of work stress is also increased.

Scoring: This table lists the general scores of the wall throw test based on the number of successful catches in 30 seconds.

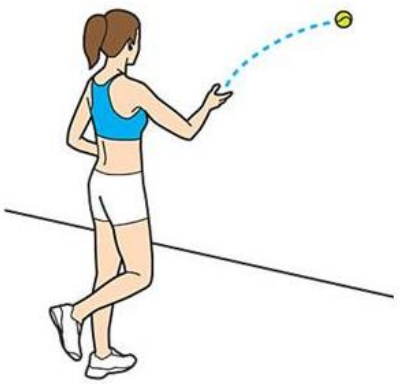

Figure 1. The hand-eye coordination test [1]

[1] *https://nathankanginanpdhpeassignment.weebly.com/hand-wall-toss.html*

Table 1. Scoring scale for the hand-eye coordination test [2]

Rating	Score (in 30 seconds)
Excellent	>35
Good	30–35
Average	20–29
Fair	15–19
Poor	<15

The ruler drop test (Mackenzie, 2004)

The goal of this test is to time athletes' response times.

Resources required

You will need the following items to complete this test:

-Assistant -Meter stick

The assistant places the ruler between the athlete's dominant hand's outstretched index finger and thumb, flushing the top of the athlete's thumb with the ruler's zero centimeter line (Davis et al., 2000). When the ruler is released, the aide instructs the athlete to grab it as soon as possible.

The athlete grips the ruler with his index finger and thumb as soon as the helper loosens it. The assistant detects the measurement between the bottom of the ruler and the top of the athlete's thumb, the position of the ruler is taken. The test is repeated twice, and the mean value is evaluated in evaluation. The following standard data can be used for this test.

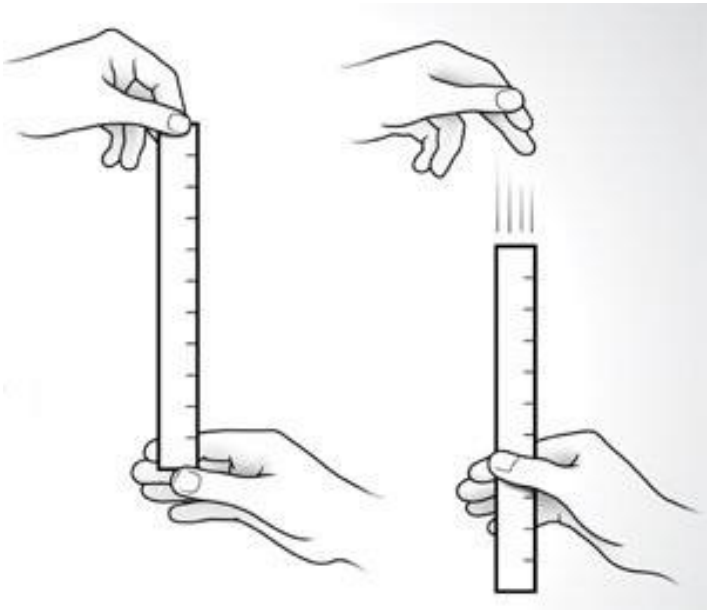

Figure 2. Ruler drop test protocol [3]

[2] *https://www.topendsports.com/testing/tests/wall-catch.htm*
[3] *http://math.oxford.emory.edu/site/home/futurePages/excelProjectReactionTime/*

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Table 2. Scoring scale for ruler drop test [4]

Rating	Score (in 30 seconds)
Excellent	<7.5 cm
Above average	7.5—15.9 cm
Average	15.9 cm—20.4 cm
Below average	20.4 cm—28 cm
Poor	>28

Study Design and Subjects

The research hypothesized that there is a significant difference between reaction speed and hand-eye coordination in children of different ages due to age and morphological characteristics such as height, sex and weight. The objective of the research was to monitor the ability of children to visually transmit the information received in order to control, guide and direct their hands when catching a ball (hand-eye coordination). To achieve this goal, it is necessary to identify the dominant eye and hand. A second objective of the study was to determine the reaction time of the students with the help of the drop test of the rule, to observe the speed differences and to compare the dominant hand with the non-dominant hand. The study site was Lunca Bradului secondary school with boys aged 10-14 (n = 20), 11 girls and 9 boys studying at school. Subjects were asked to perform two hand-eye coordination tests, throwing the ball against the wall and catching it, and the ruler drop test to measure their ability to coordinate

Statistical tests used

For comparison of means and medians, the t-student test was applied for paired and unpaired data; respectively, the Mann-Whitney test and the Pearson test were applied to determine the correlation. The significance threshold chosen for p was 0.05. Statistical analysis was performed using the GraphPad Prism demo utility.

Results

The table below presents the group of students on whom this research was prepared, being presented their general data, respectively data that are of interest in the research.

Table 3. Subjects of the investigation

Subjects of the research	Age	Gender	Height	Weight	Non-dominant hand	Dominant eye
Subject 1	13	F	1.50	40	Right	Left
Subject 2	12	F	1.47	44	Left	Left
Subject 3	12	F	1.45	35	Right	Right
Subject 4	13	M	1.65	60	Right	Right
Subject 5	12	F	1.66	52	Right	Right
Subject 6	12	F	1.61	54	Right	Left
Subject 7	12	F	1.54	41	Left	Left
Subject 8	12	F	1.65	87	Right	Right

[4] *https://www.brianmac.co.uk/rulerdrop.htm*

Subject 9	14	F	1.64	52	Right	Right
Subject 10	13	M	1.55	57	Right	Right
Subject 11	13	M	1.60	42	Right	Right
Subject 12	13	M	1.83	80	Right	Left
Subject 13	13	F	1.55	45	Right	Right
Subject 14	13	F	1.61	85	Right	Right
Subject 15	13	M	1.58	45	Right	Left
Subject 16	14	M	1.69	42	Right	Left
Subject 17	13	M	1.68	60	Right	Right
Subject 18	14	M	1.85	95	Right	Right
Subject 19	14	F	1.62	57	Right	Right
Subject 20	15	M	1.75	50	Right	Right
Arithmetic Mean	13	-	1.54	61.35	-	-

The table below presents the results obtained after performing the two coordination and speed tests, presenting an average of the group, which is detailed below.

Table 4. The results at the two tests (hand-eye coordination test and ruler drop test)

Subjects of the research	**Age**	**Gender**	**Ruler drop test**		**Hand-eye coordination test**
			Non-dominant hand	**Dominant hand**	
Subject 1	13	F	14	12	11
Subject 2	12	F	22	25	11
Subject 3	12	F	10	11	16
Subject 4	13	M	18	17	13
Subject 5	12	F	10	9	13
Subject 6	12	F	14	12	16
Subject 7	12	F	15	11	10
Subject 8	12	F	13	14	18
Subject 9	14	F	10	9	10
Subject 10	13	M	18	17	12
Subject 11	13	M	16	12	20
Subject 12	13	M	12	9	23
Subject 13	13	F	14	10	19
Subject 14	13	F	15	15	18
Subject 15	13	M	14	10	15
Subject 16	14	M	17	17	17
Subject 17	13	M	15	10	12
Subject 18	14	M	15	13	14
Subject 19	14	F	9	5	20
Subject 20	15	M	16	15	17
Aritmetic Mean	13	-	14.35	12.65	12.25

Statistical analysis of the results

The statistical analysis included elements of descriptive statistics (frequency, percentage, mean, median, standard deviation, correlation coefficient, and 95% confidence interval) and elements of inferential statistics. The Shapiro-Wilk test was applied to determine the distribution of the analyzed data series.

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Table 5. Statistical interpretation of the two tests

Statistical parameters	Average±Standard Deviation	Median
Age	13.00±0.8584	13.00
Height	1.627±0.1026	1.615
Weight	56.15±17.33	52.00
Ruler drop test—non-dominant hand	14.35±3.183	14.50
Ruler drop test—dominant hand	12.65±4.283	12.00
Hand-eye coordination test	15.25±3.740	15.50

Table 6. The frequency of the results

		Frequency	Percent
Class	V	3	15%
	VI	5	25%
	VII	10	50%
	VIII	2	10%
Gender	Female	11	55%
	Male	9	45%
Dominant hand	Right	18	90%
	Left	2	10%
Dominant eye	Right	13	65%
	Left	7	35%

Table 7. Statistical comparison between dominant hand and non-dominant hand in the ruler drop test

Non-dominant/dominant hand.	Non-dominant hand	Dominant hand	Value of p
Ruler drop test	14.35±3.183	12.65±4.283	**0.0019**
Dominant right eye/dominant left eye	**Dominant right eye**	**Dominant left eye**	**Value of p**
Ruler drop test-non-dominant hand	13.77±3.113	15.43±3.259	0.2778
Ruler drop test-dominant hand	12.08±3.523	13.71±5.589	0.7801
Hand-eye coordination test	15.54±3.382	14.71±4.572	0.6509
Gender comparison	**Female gender**	**Male gender**	**Value of p**
Ruler drop test-non-dominant hand	13.27±3.663	15.67±1.936	**0.0289**
Ruler drop test-dominant hand	12.09±5.049	13.33±3.279	0.3025
Hand-eye coordination test	14.73±3.823	15.89±3.756	0.5044
Age comparison	**r Coefficient**	**Interval of confidence**	**Value of p**
Ruler drop test-non-dominant hand	-0.01926	-0.4580 to 0.4270	0.9358
Ruler drop test-dominant hand	-0.1145	-0.5303 to 0.3456	0.6307
Hand-eye coordination test	0.1803	-0.2850 to 0.5769	0.4467
Height comparison	**r Coefficient**	**Interval of confidence**	**Value of p**
Ruler drop test-non-dominant hand	-0.1266	-0.5390 to 0.3348	0.5949
Ruler drop test-dominant hand	-0.2029	-0.5923 to 0.2633	0.3909
Hand-eye coordination test	0.3274	-0.1347 to 0.6726	0.1588
Weight comparison	**r Coefficient**	**Interval of confidence**	**Value of p**
Ruler drop test-non-dominant hand	-0.06684	-0.4948 to 0.3872	0.7795
Ruler drop test-dominant hand	-0.01131	-0.4517 to 0.4335	0.9623
Hand-eye coordination test	0.2861	-0.1792 to 0.6468	0.2214

The next phase of the research was to statistically compare the medians of the sample, considering non-dominant hand/dominant hand, dominant eye right/dominant eye left, gender comparison, age comparison, height comparison, and weight comparison.

Using the t-student test for paired data, for the ruler drop test dominant vs. non-dominant hand, $p < 0.05$, it was observed that there was a statistically significant difference ($p=0.0019$) between the mean values in the ruler drop test in the two groups.

Another statistically significant difference was found using the t-student test for paired data, for the ruler drop test non-dominant hand comparing males to females ($p=0.0289$) between the mean values in the ruler drop test 2 groups.

No other statistical difference was found in the non-dominant hand/dominant hand, dominant eye right/dominant eye left, gender comparison, age comparison, height comparison, and weight comparison for the ruler drop test non-dominant hand, Ruler drop-dominant hand in hand-eye coordination test.

Discussion

In these experiments, the subjects were asked to catch a tennis ball moving towards them. These conditions are more natural than some experimental protocols because the subjects intercepted an unpredictable moving target and started their free-will movement. Our analysis focuses on the coordination model of eye and hand movement in this task, predicting the degree of target movement and the factors that determine the initiation of interception (Mrotek and Soechting, 2007).

Improved hand-eye coordination (EHC) is associated with greater participation in physical activity. No longitudinal study examined the change in discarded-captured EHC from childhood to adolescence. We investigated the development of EHC with a control test of objects from childhood to mid-adolescence in boys and girls. Rated at 8, 10, 12, and 16 years of age, EHC is measured as the overall success rate of the wall capture test. The test includes 40 trials of increasing difficulty, determined by the increase in distance from the wall and the transition from catching the ball with both hands to catching the ball with one hand. The results are processed and modeled by generalized linear mixed logistic regression analysis. EHC improves with age, from childhood to mid-adolescence, although boys are better at every age group ($p < 0.001$). Models of change in EHC with increasing age varied depending on the degree of pregnancy difficulty ($p < 0.001$); the skill of throwing and catching with both hands develops earlier than throwing and catching with one hand in both sexes. EHC for boys was better than for girls from 8, and male competence was maintained until mid-adolescence. The competence of two-handed throwing and catch rates has developed faster than one-handed throwing rates for both sexes (Lenon et al., 2015).

Our experiments show that people make the same kinds of compromises made in the visual routines model. When pouring the coffee, the subjects stop at a fixed distance from the top of the cup and have minimal deviations between the level in successive fillings, suggesting the use of standard procedures. Also, as our model shows, most of this variance can be explained as noise in an image matching process. In making sandwiches, subjects present very similar ordering tasks so that

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their performance can be easily captured by a decision-making process based on behavioral routines that contain alternative ordering tasks (Yi and Ballard, 2009).

Often used in high schools and colleges as a portion of a pack of sports performance assessment tests, the ruler drop test needs the sportsman to grab the falling ruler; then the clinician calculates the dimension or range of the ruler traveled when caught to provide a simple measure of clinical response time. The clinical utility of the ruler drop test has been previously studied. The researchers confirmed that this clinical reaction time test could be part of a multifaceted contusion assessment battery and a possible way to track recovery from a head injury. The ruler drop test has an acceptable test-retest reliability, which compares favorably with computerized reaction time measures.

The simple reaction time decreased (i.e., improved) after repeated evaluations, and the foremost pronounced improvement happened between the primary two test sessions. Between the first and second tests, the reaction time was reduced by almost seven milliseconds; the overall enhancement among the first and tenth meetings was nearly 13 milliseconds. To some extent, these data are parallel to the data reported in the previous study: between the initial and subsequently modified ruler drop tests, the simple reaction time improved by approximately 11 milliseconds. Unfortunately, based on the data of the 2 test phases alone, researchers cannot determine whether the reaction time will continue to improve with additional exposure (Eckner et al., 2011).

All experiment investigations possess restrictions that affect the generality of the results due to the methods used. The various methodological limitations of our investigation include the fact that participants were not questioned at all during the study about their motivation levels. According to reports, the ruler drop test is an essentially motivational task, and we assume that the motivation level remains constant throughout the research process. In addition, we did not control or monitor participants' diets, fatigue levels, or amount of sleep, all of which are known to affect reaction time (Cote et al., 2009; Hernandez et al., 2007; Jauch-Chara et al., 2010; Van den Berg and Neely, 2006).

In summary, the ruler drop test is easily affected by practice; therefore, practitioners who use this test for diagnostic purposes or pursuit recovery after concussions should consider taking at least one practice session before determining the patient's baseline (Del Rosi et al., 2014).

Our hands are essential tools for our daily lives, and we can use them with grace and skill. To do this, we need to bring them to the right place at the right time. The example of catching a ball can illustrate this. The hand must be positioned at the meeting point at exactly the right time to catch the ball successfully. Moreover, she must be ready for the catch, with her fingers closing around the ball before the moment of contact, or she will not be able to catch it. Too, the level of physical and useful improvement of children (Szabo and Sopa, 2020a; Szabo and Sopa, 2020b; Szabo and Sopa, 2020c) is an important aspect in improving eye-hand coordination, reaction speed, agility, balance and motor abilities in general (Pomohaci and Sopa, 2017a; Pomohaci and Sopa, 2017b; Sopa and Pomohaci, 2017; Sopa and Pomohaci, 2018a; Sopa and Pomohaci, 2018b).

If the speed of the hand during a touching motion is plotted as a function of time, it can be seen that the tangential velocity curve is bell-shaped. The touch of the movement is continuous with a single top speed. In the last part of the touch movement, the speed is lower when the hand is close to the target. This indicates that the touch movement is programmed before the onset of the high-level movement (Brigit, 2006).

Conclusions

The differences observed in the research, based on statistics, indicate that significant results were obtained when comparing the dominant hand with the non-dominant one, confirming the hypothesis regarding the agility of the dominant hand. Another aspect of significant significance is given by the differences between the genders, the female having a higher reaction speed when using the non-dominant hand than the males.

Finally, although we found that the reaction time data started to apply after the first test session, it remains unclear how long the effects of the practice persist. Therefore, future researchers should try to determine whether there is a limit to how long the effects of the practice are maintained.

References

Bakhtiar, S., Famelia, R. (2018). *Institute Role of Teachers' Education in Improving the Standard of Development Achievement Rate and Standard of Teacher and Education Personnels of Early Childhood Education*, 33-45.

Brigit, R. (2006). *Chapter 5-Reaching and Eye-Hand Coordination*, Hand Function in the Child (Second Edition) Foundations for Remediation, 89–99.

Coleman, R., Piek, J.P., & Livesey, D.J. (2001). A longitudinal study of motor ability and kinaesthetic acuity in young children at risk of developmental coordination disorder. *Human movement science*, *20*(1-2), 95-110. https://doi.org/10.1016/s0167-9457(01)00030-6

Cote, K.A., Milner, C.E., Smith, B.A., Aubin, A.J., Greason, T.A., Cuthbert, B.P., ... & Duffus, S.E. (2009). CNS arousal and neurobehavioral performance in a short-term sleep restriction paradigm. *Journal of sleep research*, *18*(3), 291-303. https://doi.org/10.1111/j.1365-2869.2008.00733.x

Davis, B. et al. (2000). *Physical Education and the study of sport*. 4th ed. London: Harcourt Publishers. p. 130.

Del Rossi, G., Malaguti, A., & Del Rossi, S. (2014). Practice effects associated with repeated assessment of a clinical test of reaction time. *Journal of athletic training*, 49(3), 356–359. https://doi.org/10.4085/1062-6059-49.2.04

Eckner, J.T., Kutcher, J.S., & Richardson, J.K. (2011). Between-seasons test-retest reliability of clinically measured reaction time in National Collegiate Athletic Association Division I athletes. *Journal of athletic training*, *46*(4), 409-414. https://doi.org/10.4085/1062-6050-46.4.409

Ellison, P.H. (2015). *Eye-hand Coordination: An Exploration of Measurement and Different Training Methods Using the SVTTM [doctoral dissertation].* Ormskirk, UK: Edge Hill University.

Erickson, G.B. (2007). *Sports Vision: Vision Care for the Enhancement of Sports Performance*. St. Louis, MO: Butterworth-Heinemann Elsevier.

Goble, D. J., Hurvitz, E.A., & Brown, S.H. (2009). Deficits in the ability to use proprioceptive feedback in children with hemiplegic cerebral palsy. *International Journal of Rehabilitation Research*, *32*(3), 267-269. https://doi.org/10.1097/MRR.0b013e32832a62d5

Hernández, O.H., Vogel-Sprott, M., & Ke-Aznar, V.I. (2007). Alcohol impairs the cognitive component of reaction time to an omitted stimulus: a replication and an extension. *Journal of studies on alcohol and drugs*, *68*(2), 276-281. https://doi.org/10.15288/jsad.2007.68.276

DOI 10.30892/gss.1505-077

Holst-Wolf, J.M., Yeh, I., & Konczak, J. (2016). Development of proprioceptive acuity in typically developing children: normative data on forearm position sense. *Frontiers in human neuroscience*, *10*, 436. https://doi.org/10.3389/fnhum.2016.00436

Jauch-Chara, K., Hallschmid, M., Schmid, S.M., Bandorf, N., Born, J., Schultes, B. (2010). Sleep loss does not aggravate the deteriorating effect of hypoglycemia on neurocognitive function in healthy men. *Psychoneuroendocrinology,* 35(4), 624–628. https://doi.org/10.1016/j.psyneuen.2009.09.018

Kim, O.J. (2001). Development of neurophysiology in the early twentieth century: Charles Scott Sherrington and The Integrative action of the nervous system. *Uisahak,* 10(1), 1–21.

Konczak, J., Corcos, D.M., Horak, F., Poizner, H., Shapiro, M., Tuite, P., ... & Maschke, M. (2009). Proprioception and motor control in Parkinson's disease. *Journal of motor behavior*, *41*(6), 543-552. https://doi.org/10.3200/35-09-002

Laby, D.M., Kirschen, D.G., Govindarajulu, U., DeLand, P. (2018). The hand-eye coordination of professional baseball players: the relationship to batting. *Optom Vis Sci*, 95(7), 557–567.

Lennon, J.W., Rohan, M.T., Ross, B.C. (2015). Longitudinal patterns of change in eye—hand coordination in children aged 8–16 years. Human Movement Science, 43, 61-66. https://doi.org/10.1016/j.humov.2015.07.002

Lephart, S.M., Pincivero, D.M., Giraldo, J.L., Fu, F.H. (1997). The role of proprioception in the management and rehabilitation of athletic injuries. *Am J Sports Med.,* 25(1), 130–137. https://doi.org/10.1177/036354659702500126

Li, K.Y., Su, W.J., Fu, H.W., & Pickett, K.A. (2015). Kinesthetic deficit in children with developmental coordination disorder. *Research in developmental disabilities*, *38*, 125-133. https://doi.org/10.1111/j.1365-2214.2012.01379.x

Mackenzie, B. (2009). *Hand Eye Coordination Test* [WWW] Available from: https://www.brianmac.co.uk/handeye.htm [Accessed 1/10/2021]

Mackenzie, B. (2004) *Ruler Drop Test* [WWW] Available from: https://www.brianmac.co.uk/rulerdrop.htm [Accessed 1/10/2021]

Mrotek, L.A., Soechting, J.F. (2007). Target interception: hand-eye coordination and strategies. The *Journal of neuroscience: the official journal of the Society for Neuroscience*, 27(27), 7297–7309. https://doi.org/10.1523/JNEUROSCI.2046-07.2007

Myers, J. B., Guskiewicz, K.M., Schneider, R.A., Prentice, W.E. (1999). Proprioception and Neuromuscular Control of the Shoulder after Muscle Fatigue. *J Athl Train,* 34(4), 362–367.

Pomohaci, M., Sopa, I.S. (2017a). The utility of motor activities in developing coordonation and mobility at students. *Academia Navala "Mircea cel Batran" Scientific Bulletin,* 20(2), 57–66.

Pomohaci, M., Sopa, I.S. (2017b). The utility of motor evaluation in the analysis of effects of motor activities on students. *Academia Fortelor Terestre" Nicolae Balcescu" din Sibiu, Revistă Stiintifică*, 22(3), 163–172.

Ribeiro, F., Oliveira, J. (2007). Aging effects on joint proprioception: the role of physical activity in proprioception preservation. *Eur Rev Aging Phys Act.,* 4(2), 71-76. https://doi.org/10.1007/s11556-007-0026-x

Riemann, B.L., Lephart, S.M. (2002). The Sensorimotor System, Part I: The Physiologic Basis of Functional Joint Stability. *J Athl Train*., 37(1), 71–79.

Singh, J.P. (2010). *United Nations Educational, Scientific, and Cultural Organization (UNESCO): creating norms for a complex world*. Routledge, 10-23.

Sopa, I.S., Pomohaci, M. (2017). Study regarding the development of agility skills of students aged between 10 and 12 years old, Timişoara Physical Education and Rehabilitation Journal. *The Journal of West University of Timişoara*, 9(17), 7. https://doi.org/10.1515/tperj -2016-0009

Sopa, I.S., Pomohaci, M. (2018a). Leisure sport activities and their importance in living a healthy physical and psycho-social lifestyle. *Buletinul Academiei Fortelor Terestre "Nicolae Balcescu" Sibiu*, 22(1), 36–42.

Sopa, I.S., Pomohaci, M. (2018b). Evaluation of motor development and skills in mini-volleyball game (10–12 years old), *Bulletin of the Transilvania University of Brasov Series IX: Science of Human Kinetics*, 11(1), 95–104.

Sopa, I.S., Pomohaci, M. (2021). Using coaching techniques in assessing and developing the static and dynamic balance level of young volleyball players. *Bulletin of the Transilvania University Brasov*, 14(63), 89–100. https://doi.org/10.31926/but.shk.2021.14.63.1.12

Szabo, D.A., Sopa, I.S. (2020a). Study regarding the level of physical and functional development of children from primary school level. *Journal of Physical Education and Sport (JPES) Pitești*, 20(3), 1479–1504.

Szabo, D.A., Sopa, I.S. (2020b). Study regarding the level of bio-motor and health of children from gymnasium level. Sport si Societate, Interdisciplinary Journal of Physical Education and Sports Iași, 20.1(1), 1–9.

Szabo, D. A., Sopa, I. S. (2020c). Research regarding development and evaluation of agility (balance, coordination and speed) in children aged 9–10 years. *Health, Sports & Rehabilitation Medicine Cluj,* 21(1), 33–40.

Szabo, D.A., Neagu, N., Teodorescu, S., Sopa, I.S. (2020). Eye-hand relationship of proprioceptive motor control and coordination in children 10–12 years old. Health, Sports & Rehabilitation Medicine Cluj, 21(3), 185–191.

Szabo, D.A., Neagu, N., Teodorescu, S., Panait, C.M., & Sopa, I.S. (2021). Study on the Influence of Proprioceptive Control versus Visual Control on Reaction Speed, Hand Coordination, and Lower Limb Balance in Young Students 14–15 Years Old. *International Journal of Environmental Research and Public Health*, *18*(19), 10356. https://doi.org/10.3390/ijerph181910356

Van den Berg, J., Neely, G. (2006). Performance on a simple reaction time task while sleep deprived. *Percept Mot Skills*, 102(2), 589–599. https://doi.org/10.2466/pms.102.2.589-599

Westlake, K.P., Culham, E.G. (2007). Sensory-specific balance training in older adults: effect on proprioceptive reintegration and cognitive demands. *Phys Ther.,* 87(10), 1274–1283. https://doi.org/10.2522/ptj.20060263

Yi, W., & Ballard, D. (2009). Recognizing behavior in hand-eye coordination patterns. *International journal of HR: humanoid robotics,* 6(3), 337–359. https://doi.org/10.1142/S0219843609001863

Zwicker, J.G.; Harris, S.R.; Klassen, A.F. (2013). Quality of life domains affected in children with developmental coordination disorder: a systematic review. *Child Care Health Dev*., 39, 562–580. https://doi.org/10.1111/j.1365-2214.2012.01379.x

https://www.brianmac.co.uk/rulerdrop.htm

https://www.topendsports.com/testing/tests/wall-catch.htm

https://nathankanginanpdhpeassignment.weebly.com/hand-wall-toss.html

http://math.oxford.emory.edu/site/home/futurePages/excelProjectReactionTime/

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Amateur football map (4th league) from Romania generated by the coronavirus (COVID-19) in the pre-pandemic season (2019/2020)

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Abstract. After the 2nd World War, for the first time after 7 decades, sports in general, and amateur football in particular, are facing a new global challenge generated by the coronavirus (COVID-19) pandemic. *Pre-pandemic football season 2019/2020* held on the field only for the first part (690 teams; 781 games), was suspended at the beginning of March, 2020. This situation generated an uncertain 5-month break until the first official games in play-offs (1-9 August, 2020) in wich only 46 teams (6.6%) in total actually participated. In a state of global uncertainty, to the suggestion of RFF, the 42 county football associations were "invited" to identify new solutions in order to "finalize the season", by declaring, or not, a champion team, another team for the national phase of Romania's Cup and a county representative for the 3rd league play-off. With the help of statistical information provided by county structures, with the spatial analysis of statistical data reported and analyzed on local and regional level, were analyzed the created situations and, especially, the consequences generated by the pandemic situation upon amateur football in Romania illustrated by maps.

Keywords: Romaina, amateur football maps, coronavirus COVID-19, pre-pandemic season 2020/2021

Introduction

"Freezing" the amateur football competitions at the beginning of March, 2020, had consequences upon the small football by entering in a sequential improvisation stage, with attempts to resume the competitions, be them singular or regional, with strategies applied on the County Football Association (CFA)[1] level in cooperation with the Romanian Football Federation (RFF)[2], in order to provide relationships between competition systems. The topic of this study refers to the finality of the 2019/2020 pre-pandemic season, interrupted on the beginning of March, 2020, after the tournament (781 games) which took place 690 football teams in the august-september of 2019. Having as support the maps of administrative territorial units (ATU-s) and localities with engaged teams, there are analyzed the applied strategies, the territorial systemic relationship and the typology of regional competition systems, the regional and local consequences and particularities of participating clubs from Romania.

Methodology

Elaborating a data base with statistical information referring to the competitions which took place in the 2019/2020 pre-pandemic season, taken from the archives of clubs, county football associations (CFA)[1], Romanian Footbal Federation (RFF)[2], etc, represented the first step of our endeavor. In order to manage such a complex data base which includes information referring to the number of clubs, teams, competition type, human resource (senior players), we used as cartographic reporting basis the administrative-territorial units (ATU) of county type, of ATU type (cities, towns and communes) and urban and rural localities. The complexity of spatial analysis (Bale, 2003; Sam and Hughson, 2010; Ilieş et al., 2014; Murphy, 2019) was dwelt with by the use of certain tools such as geographic information systems (GIS), ArcGis program. With the help of this program and the help of geographical and interdisciplinary analysis and synthesis methods used in similar studies (Reilly and Gilbourne, 2003, Ilieş et al., 2015; Kozma, 2015; Gartner and Huang, 2016; Ilieş et al., 2016a; Herman et al., 2016; Kijewski and Wendt, 2019, we have managed to represent graphically and cartographically (Dehoorne et al, 2019; Ilieş and Caciora, 2020), under the form of spatial and temporal analyses (Conner, 2014; Ilieş et al. 2016b; 2016c; Robinson et al., 2017; Raisch, 2018; the results of the combinations between the used items illustrated by the maps.

Analitical component

There are analyzed series of data referring to: the finality of the 2019/2020 "pre-pandemic" season, which took place only partially, with scarce attempts of competition organization and "survival" and the territorial impact upon the amateur football from Romania.

2019-2020 competition season. Usually with a different start from one county to another (depending on the geographical position (fig.1; tab.1), the number of enrolled teams, the CFA's strategy to promote football, the geomorphological (fig.1) and climatic conditions, as well as the vacation season for amateurs, it takes

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place from August to September and the tournament ends, the latest, at the beginning of December. Unfortunately, the threat of coronavirus pandemic, more and more obvious in the European space at the turn of the year, proved to be a reality with negative effects upon the human community and without the perspective of "eradication" on short term. Facing an "unknown opponent", the sports have been affected on all levels (Margvelashvili, M., 2021), and that includes football as well (Rico-Gonzales, 2021). The spring season (2019/2020 return matches) was resumed in 28 counties for one or two stages (suspended on the beginning of March), situation which continued until the summer of 2021 when, after almost two years of waiting, amateur football "partially came back to life".

Organized on 2-3 hierarchical levels (league 4-6), amateur football distinguishes itself from one county to another, depending on the number of inhabitants, football tradition, economic potential, sports infrastructure, etc. The 2019/2020 pre-pandemic season, on the level of elitist league of organizing amateur football (league 4), included, from the 42 territorial administrative units, a number of 690 senior teams, encompassing around 13,800 amateur football players (an average of 20 players per team). It is important to mention that for amateur football, the title of county champion (League 4) and winner of Romania's Cup, county level, represent the two major trophies on this level.

The pandemic situation which "covered" the world (Mc Curry, 2020) and Europe[3] (Colluci et al., 2020) led to blocking the amateur football competitions in the spring of 2020 (starting with the beginning of March). In a situation with very many unknown variables, the chances of resuming amateur competitions decreased as the virus made more and more victims. Still, in order to ensure the cohesion between amateur, semi-professional and professional football (resumed with considerable sacrifices) at the proposal of the RFF, certain county structures (CFA-s), with modified rules and adapted to the situation, tried to finalize the edition begun before the pandemic.

On the level of the 42 county structures (NUTS 3) which manage amateur football in Romania, the 2019/2020 football season practically ended in 14 counties after finishing the tournament at the end of the year 2019. In 28 counties (67%; fig.1), the football activity was resumed in February (22)-March (7), 2020, but for at most one (15 counties), two (10 counties) or three stages (4 counties) because, starting with beginning of March, it was imposed the ceasing of all amateur sports competitions. Other counties also tried to provide a competition form to the unusual championship finality, but they gave up out of objective reasons, out of which the most important was the impossibility to respect the sanitary[4;5] and financial conditions generated by the sanitary protocol imposed by the RFF and Ministry of Sport and Youth (MSY). To this it is added the lack of documents which should prove the official status of football club certified by *Sport identify certificate* (SIC) and MSY.

The effects of this situation, with consequences on the map of amateur football during the pandemic, show the lack of coherent strategies on national level. Each county structure identified "emergency solutions" with the declared purpose to send one team in the 3rd league's play-offs.

Under these uncertain circumstances, after a break of almost 5 months (March-July), in an extremely critical sanitary situation on national and global level, to the suggestion of the RFF, the county structures tried to finalize, somehow forced, the competition and to send a team to the play-offs for the 3rd league. It was an optional request from the RFF, without being mandatory that the respective team should be also declared the county champion, but which, in Romania, generated a territorial option mosaic. The spatial analysis shows a variety of decisions depending also on the competition complexity established at its beginning: simple championship, championship with play-off and play-out, organization on one (33 counties), two (7 counties: Bacău, Bistrița-Năsăud, Caraș-Severin, Dolj, Giurgiu, Harghita, Maramureș, Neamț) or three series/groups (2 counties: Satu Mare and Vrancea) with participation of 46 teams. In some counties, such as Maramureș, the two series of league 4 are determined by the relief conditions, the Oaș-Gutâi-Țibleș mountain range separating the two depression spaces from North to South, the access being made through passes situated at 1,000m altitude (fig.1).

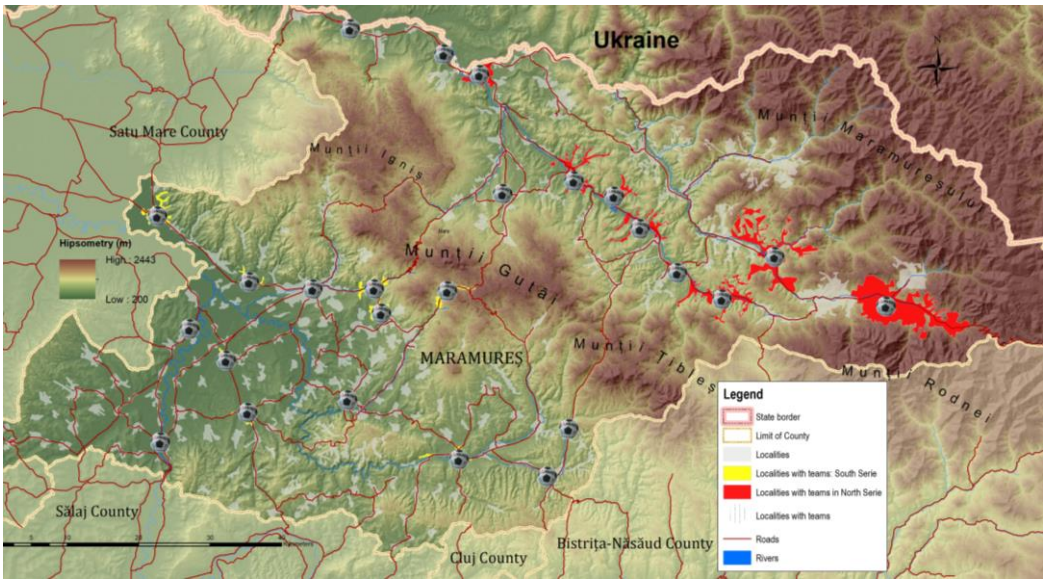

Figure 1. Maramureș County with central mountain barrier (Igniș-Gutâi-Țibleș) between North and South series of 4th fotball league (*data source: [1]; CFA Maramureș, 2020*)

The forced break, the main enemy of the competition. For 42 counties, the date of March 7 suspended all amateur competitions, the break until the play-offs being of 5-9 months. Medically and sportively, on this level, it is extremely difficult to manage and protect the situation, if we refer to the "sports performance" of the implied human resource, especially players. The situation becomes even more complicated for 8 counties which finalized the tournament in November, the forced break being of 9 months. Under these circumstances, the absence of athletes' regular medical checkup, together with the effects of the virus, those who identified solutions to finalize the competition took an important risk regarding the athletes' health condition (Buhaș et all, 2018; Dragoș et all, 2019; Primorac et al., 2020).

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Table 1. Romania. The situation at the level of the 4th league championships from the 42 CFAs *(data sources:[1; 2])*

No	County	Footbal team ranked 1st, 2nd or 3rd	No of		Place in ran-king	Stages played	Decision to declare the champion by		Aban-don	Champion	To the promo-tion play-off
			serie	teams			Place	By play-off			
1	Alba	**CS Ocna Mureș**	1	15	1	16	x			C	B
2	Arad	**Victoria Zăbrani**	1	16	1	15	x			C	B
3	Argeș	**Voința Budeasa**	1	20	1	22	x			C	B
4	Bacău	**ACS Viitorul Curița**	2	12	1	15		X		C	B
		Dinamo Bacău		12	1	15		X			
5	Bihor	**CAO 1910 Oradea**	1	16	1	15	x			C	B
6	Bistrița Năsăud	Silvicultorul Maieru	2	8	1	12			X	**NO**	**NO**
		Progresul Năsăud		7	1	11			X		
7	Botșani	**Dante Botoșani**	1	1	1	14	X	X		C	B
8	Brăila	ACS Victoria Traian	1	11	**1**	17			X		
		ACS Sportul Chiscani			**2**			X		C	B
9	Brașov	FC Precizia Săcele	1	16	1	16		X	X		
		Corona Brașov			**2**			X		C	B
		ACS Colțea 1920 Brașov			3			X			
10	București	**CSA Steaua București**	1	16	1	18	x			C	B
11	Buzău	**CSM Râmnicu Sărat**	1	18	1	20	x	X		C	B
12	Călărași	**Venus Independența**	1	18	1	20	x			C	
		AFC Unirea Mănăstirea			**1**				X		
		ACSM Oltenița			**3**		x				B
13	Caraș Severin	**ACS Progresul Ezeriș**	2	9	1	14		X		C	B
		ACS Rapid Buchin		9	1	13			X		
14	Cluj	**ACS FC Someșul Dej**	1	14	1	15		X		C	B
		ACS Florești			2				X		
		ACS Suporter Cluj N			3			X			
15	Constanța	Viitorul Fântânele	1	18	1	20			X		
		CS Năvodari			2				X		
		Gloria Albești			**3**		x			C	B
16	Covasna	**ACS Sepsi OSK 2**	1	14	1	16	x	X		C	B
17	Dâmbovița	**ACS Roberto Ziduri**	1	18	1	18	x	X		C	B
18	Dolj	**Unirea Tricolor Dăbuleni**	1	16	1	17	x			**NO**	B
19	Galați	**Avântul Valea Mărului**	1	14	1	14	x			C	B
20	Giurgiu	AFC Victoria Adunați Copăceni	2	16	1	18			X		
		CS Argeșul 2009 Mihăilești		16	1	18	x			C	B
21	Gorj	**ACS Știința Turceni**	1	14	1	14	x			C	B
22	Harghita	**CS Gheorgheni**	2	10	1	13	x			C	B
		AS Sporting Odorhei		14	1	13			X		
23	Hunedoara	**CSM Jiul Petroșani**	1	11	1	19	x			C	B
24	Ialomița	**AS Bărăganul Ciulnița**	1	15	1	17		X		C	B
		Victoria Țăndărei			2			X			
25	Iași	**Unirea Mircești**	1	16	1	17	x			C	B
26	Ilfov	**AS Viitorul Domnești**	1	12	1	11	x			C	B
27	Maramureș	CSM Sighetu Marmației	2	11	1	13		X			
		CS Progresul Șomcuta Mare		13	1	14		X		C	B

28	Mehedinți	*CS Recolta Dănceu*	1	12	1	11				**NO**	
		CS Strehaia			**2**		x				B
29	Mureș	**CS Unirea Ungheni 2018**	1	12	1	13	x			C	B
30	Neamț	**AS Bradu Borca**	2	12	1	13	x			C	B
		Victoria Horia		12	1	13			X		
31	Olt	**CSO Petrolul Potcoava**	1	15	1	17	x			C	B
32	Prahova	**CSO Plopeni**	1	16	1	16	x			C	B
33	Sălaj	**Sportul Șimleul Silvaniei**	1	11	1	14	x			C	B
34	Satu Mare	**CSM Satu Mare**	3	14	1	12	x			C	B
		Talna Orașu Nou		11	1	11			X		
		Recolta Dorolț		12	1	16			X		
35	Sibiu	**CS Măgura Cisnădie**	1	17	**1**	19		X		C	B
		ACS FC Avrig			2				X		
		Păltiniș Rășinari			3			X			
36	Suceava	**CSO Siretul Dolhasca**	1	14	1	15	x			C	B
37	Teleorman	**CS Unirea Țigănești**	1	16	1	18	x			C	B
38	Timiș	**CS Avântul Periam**	1	18	1	18	x			C	B
39	Tulcea	**Pescărușul Sarichioi J**	1	9	1	10	x			C	B
40	Vâlcea	**ACS Minerul Costești**	1	12	1	19	x			C	B
41	Vaslui	**Sporting Juniorul Vaslui**	1	13	1	14	x			C	B
42	Vrancea	*Sportul Ciorăști*	3	6	1	10		X			
		Victoria Gugești		5	1	8		X		**NO**	B
		CS Panciu		5	1	8			X		
	TOTAL			**690**		**781**				**39**	

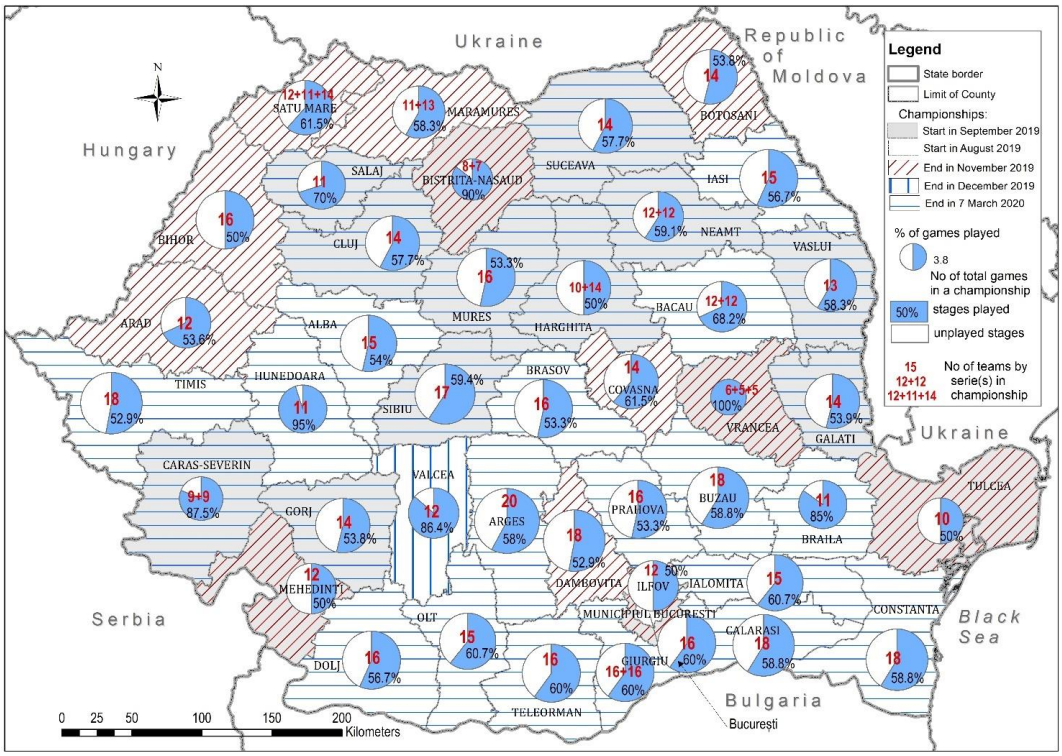

Figure 2. Romania. Sezon(s), no of teams, no of series and no of stages played in league 4 sezon 2019-2020 (data sources: [1])

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The figure 2 generated by the territorial relationship between the competition break and specific activity, shows this risk which, in the absence of proper training conditions, could lead to severe situations regarding the athletes' health. The longest competition breaks ocuured in the following counties: Ilfov (10), Maramureş (10), Tulcea (10), Arad (9), Botoşani (9), Vrancea (9), Covasna (8), Dâmboviţa (8), Mehedinţi (9), Vâlcea (7), and the longest seasons were in Argeş (22 stages, 5 months break), Buzău (20; 5), Hunedoara (19; 5), Teleorman (18; 5), Timiş (18; 5); Constanţa (20; 5), Călăraşi (20; 5). In Bistriţa Năsăud County, after playing 12 stages in each of the two series, on the 24th of November, 2019, the championship ended for good, being the county, which did not send any team to the play-off and neither did it declare any champion team[6].

Designating the champion or the team participating in the play-off. While waiting for a more favorable sanitary situation for resuming the competition, the organizing bodies of the counties (CFA/AMB) had to "improvise" in this respect. Thus, several situations occurred (Tab.2; Fig.3):

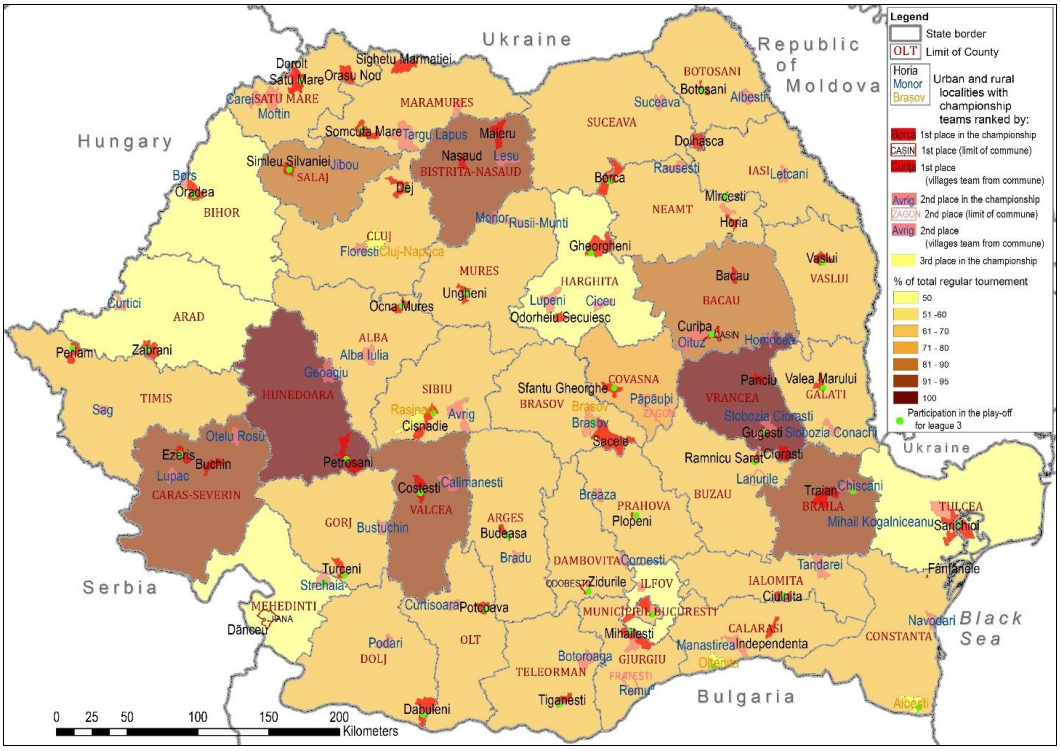

Figure 3. Romania. The situation at the level of the 4th league championships from the 42 CFAs *(data sources:[1; 2])*

-Most counties decided "the champion" based upon its sports merits, that is the ranking at the moment the competition stopped (the beginning of March, 2020). The decision was easier in the case of championships with a single series and where

there were points or score differences between the highest-ranking teams. There were 35 counties in this situation (83.3%).

-A qualifying tournament with first ranked teams took place in 5 counties (11.9%): Brăila, Braşov, Cluj, Ialomiţa and Sibiu. In all cases there were teams which declined their participation or withdrew during the tournament because of sanitary or financial protocols, or because of the lack of perspective to reach the play-off[7]. There were teams which did not meet the RFF's requirements (Certificate of Sport Identify; financial sustainability), condition which could have been solved in a regular championship.

-Some play-off matches were played by the first ranked teams on level series in 6 counties (14.2%): Bacău, Caraş-Severin, Giurgiu, Harghita, Maramureş and Neamţ.

-In Bistriţa-Năsăud, the only one on national level, the CFA did not designate any champion team, out of the winners of the two League 4 series, to participate to the play-off for League 3, practically ending the competition on the 24th of November, 2019.

-After the teams ranked on the first two places, the teams situated on the 2nd place in Mehedinţi and 3rd place in Călăraşi were designated to participate, without being designated county champions;

-In Constanţa County, the teams ranked on the first two places abandoned and the team from the 3rd place, Gloria Albeşti, was declared champion and participant in the play-off;

-After the play-offs between the teams ranked on the first two places, the team on the 2nd placed became champion and participant to the play-off in Brăila and Braşov Counties;

-In 4 counties: Bistriţa Năsăud, Dolj, Mehedinţi and Vrancea, the title of county champion for the 2019/2020 season was not awarded;

-The longest seasons with the most matches were in the following counties: Argeş 22 (20 teams) and 20 in Buzău (18), Călăraşi (18) and Constanţa (18), and the least matches were played, 11 in each county, in Bistriţa Năsăud (8), Ilfov (12), Satu Mare (13), Tulcea 10 (9) and Vrancea 8 (5) etc;

-In 12 counties the championship was not resumed in spring, the break being a much longer under these circumstances, up to 9 months;

-For the play-off organized at the beginning of August, the CFA-ssent 41 teams, except Bistriţa Năsăud, which fought for the 14 places with promotion possibility. In the end, in order to complete the L3 series, 2020/2021 season, other teams from the 2nd and 3rd places from the qualification groups were also invited, the number of teams which got in the 3rd league in the following season being of 25 (61%) out of 41 participating (tab.2).

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Regional architecture of the 3rd league promotion play-off

Table 2. Romania. Participating teams, dam groups and their performance (*data source:* [8])

	Region	County	Team 1	Team 2	Team 3
1	**A North-West**	Bihor, Cluj, Satu Mare	**CSM Satu Mare**	**ACS CAO 1910 Oradea**	**ACS FC Someșul Dej**
2	**B North-West**	Bistrița-Năsăud[a;b], Maramureș, Sălaj	**CS Progresul Șomcuta Mare**	**CS Sportul 2007 Șimleu Silvaniei**	No team
3	**A North-East**	Iași, Neamț, Suceava	**ACS Bradu Borca**	CSO Siretul Dolhasca	CS Unirea Mircești
4	**B North-East**	Bacău, Botoșani, Vaslui	**CS Dante Botoșani**	**Sporting Juniorul Vaslui**	AFCS Viitorul Curița
5	**A South-East**	Brăila, Galați, Vrancea	**ACS Sportul Chiscani**	**CS Avântul Valea Mărului**	CSL Victoria Gușești
6	**B South East**	Buzău, Constanța, Tulcea	**CSM Râmnicu Sărat**	**CS Gloria Albești**	Pescărușul Sarichioi[b]
7	**A South**	Călărași, Ilfov, Prahova	**ACSM Oltenița**	**CSO Plopeni**	ACS Viitorul Domnești
8	**B South**	București, Ialomița, Giurgiu	**CSA Steaua București**	AS FC Bărăganul Ciulnița	CS Argeșul Mihăilești 2009
9	**A South-West**	Argeș, Dâmbovița, Dolj	ACS Voința Budeasa	ACS Roberto Zidurile	Unirea Tricolor Dăbuleni
10	**B South-West**	Olt, Teleorman, Vâlcea	**CSO Petrolul Potcoava**	**ACS Minerul Costești**	CS Unirea Țigănești[b]
11	**A West**	Arad, Gorj, Caraș-Severin	**ACS Progresul Ezeriș**	ACS Știința Turceni	CS Victoria Zăbrani
12	**B West**	Hunedoara, Timiș, Mehedinți	**CS Avântu Periam**	**CSM Jiul Petroșani**	CS Strehaia[b]
13	**A Center**	Covasna, Mureș, Sibiu	**CS Unirea Ungheni 2018**	**CS Măgura Cisnădie**	**ACS Sepsi OSK Sfântu Gheorghe 2**
14	**B Center**	Alba, Brașov, Harghita	**CSM Corona Brașov**	**CS Ocna Mureș**	CS Gheorgheni

Note: XX Xxxxx– teams that promoted to the 3rd league;
XX Xxxxxx – teams participating in the promotion play-off but not able to be promoted to league 3;
XX Xxxxxx – teams which did not participate in the league promotion 3 play-off due to the medical expenses needed to comply with the medical protocol.

Figure 4. Romania. Promotion play-off groups, participating teams and their performances *(data source:* [6]*)*

[a] Bistrita-Năsăud County did not designate the champion for the 2019/2020 season and no representative to the promotion play-off to the 3rd league[6];
[b] Counties with teams designated champions but which did not participate in the league promotion 3 play-off due to the medical expenses needed to comply with the medical protocol.

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The situation identified on the RFF level in the first stage was the configuration of some regional groups within the development regions, grouping 3 county representatives/champions on geographic criterion. 14 groups resulted with 3 teams each (table 2; fig.4), with 2 games each and a group with teams (North West B[7;8]) during the period 1-9 August.

The first 14 teams ranked qualified directly in 13, while other 7 teams from the 2nd place, with best ranking line were to complete the list of 21 promoted teams. Finally, there were 25 teams promoted to complete the 3rd league series. The spatial analysis emphasizes certain aspects with local and regional impact upon the amateur football map (L4) and semi-amateur (L3) from Romania:

-Since the RFF established that in the pre-pandemic season no team from league 3 would be demoted, the 25 CFA-s/counties "lost" a team each, usually the best one and with financial resources, for the 3rd league semi-professional competition;

-On ATU-s level, the county representative teams had the headquarters in 7 cities, county residence, 18 towns, 15 villages, commune residence and two more villages: Zidurile (841 inhabitants) from Odobeşti commune (Dâmboviţa) and Curiţa (725 inhabitants) from Caşin commune (Neamţ);

-According to the table and results, 14 teams prevailed from 9 towns and 5 communes, taking the first place in groups;

-If Bistriţa Năsăud County did not designate any team representative for the county, the teams designated by the counties Tulcea, Teleorman and Mehedinţi did not participate to the play-off in groups because of the medical protocol[5];

-Out of the 41 represented localities, only Bucharest (L1), Botoşani (L1), Braşov (L3) and Dej (L3) also had other teams in the upper leagues;

-Out of the 41 participating teams, 25 were promoted to the 3rd league. In A North-West and A-Center groups, all 3 teams participating to the play-off were promoted. Out of other 8 groups, 2 teams were promoted from each, from 3 groups, one team and from A South-West group, no team was promoted because of financial and sanitary protocol reasons.

Conclusions

The 2019/2020 pre-pandemic amateur football season was the first, after 52 uninterrupted editions, in a situation very difficult to manage for the 690 clubs and organizing bodies from the "small football". On the level of the 42 county associations, after a complete tournament and maximum 3 stages in retour, the football competitions stopped in 30 counties, on the beginning of March, 2020, played 781 stages. After a forced break of 5 months (34 counties) and of 9 months (8 counties), to the RFF's suggestion, the county structures "identified" original solutions in July, in order to have a team in the play-off for the 3rd league. In most cases, in 35 counties, the teams situated on the first place were declared county champions on the 7th of March and were designated to represent the county in play-offs. There were play-offs in other 5 counties between 2 or 3 series winner teams or ranked on the first places. During the play-offs, some teams gave up out of financial reasons or because of not respecting the sanitary protocol. In 4 counties, the

champion title was not awarded and in 5 counties, the teams ranked 2nd or 3rd were declared champions and/or participants in play-offs. At the same time, the economic strength of urban areas is reflected, on this level as well, in the fact that out of the 41 participants in play-offs, 17 (41.4%) came from the rural area. Still, the biggest problem, with impact on emphasizing the disappearance phenomenon of teams, remains the forced break, also with medical and sportive effects. In reality, only 46 teams "come-back" on the pitch to play in July. With all the sportive and financial effort to respect the sanitary protocol, out of the 41 county representatives, regional play-off participants "in 3" (2 games each), 25 teams succeeded to play in the first "full-pandemic 2020-2021 league 3 season". For the following period, the highest challenge remains the health issue generated by the virus, but the prolonged sports break and the "thresholds" of the medical protocol are difficult to overcome on amateur sports level.

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References

Bale J.R.. (2003). *Sports Geography*. Routledge, London.

Buhaș, S., Ștef, M., Negruț, E., & Herman, G.V. (2018). *Aspects regarding the physical training level of "CSL Sporting Lugaș" female football team during the competitive year 2017-2018*. *Geosport for Society*, 9(2), 63-70.

Colucci, M., Coni, A., Cottrel, S., & Sethna, R. (eds) (2020). *Coronavirus and its impact on football*, ISSN 978-88-943373-1-0.

Conner, N. (2014). *Geography of Sports*, in: Geography *(http://dx.doi.org/10.1093/obo/9780199874002-0067);*

Covid-19 and amateur sports: The situation in Europe, 2020 (https://www.disinfobservatory.org/covid-19-and-amateur-sports-the-situation-in-europe/)

Dehoorne, O., Wendt, J.A., Mikhaylov, A., Berdenov, Z., & Ilieș, A. (2019). Cartographic representation of a sports (football) competition – UEFA Youth League (2013-2019). *Geosport for Society*, 11(2), 86–100. https://doi.org/10.30892/gss.1104-051

Dragoș, F.P., Herman, G.V., Szabo-Alexi, M., Szabo-Alexi, P., Olău, V.M., & Buhaș, S. (2019). Motivating employees in sports organizations, an important factor in managerial policy. *Geosport for Society,* 10(1), 39–47. https://doi.org/10.30892/gss.1004-047

Gartner, G., & Huang, H., (2016). Recent research developments in modern cartography in Europe. *International Journal of Cartography*, 2(1), 1-5. https://doi.org/10.1080/23729333.2016.1187908

Herman, G.V., Buhaș, S.D., Stance, L., & Pop, A.C., (2016b). Considerations regarding the evolution, distribution and dynamics of the romanian football (League I) between 1989 – 2016. *GeoSport for Society*, 5(2), 69-78.

Ilieș, A., & Caciora, T. (2020). Mapping the Scottish university football competitions. A dual performance model: organized sports and professional training. *Geosport for Society*, 12(1), 72–90. *https://doi.org/10.30892/gss.1208-061*

Ilieș, A., Deac, A.L., Wendt. A.J., & Bulz G.C. (2015). Romanian universities sports – cultural landscape defined by the sportive space determined by national competitions (in 2015) in team sports. *GeoSport for Society*, 3(2), 61-87.

Ilieș, A., Dehoorne, O., Wendt, A.J., & Kozma, G. (2014). For Geography and Sport, Sport Geography or Geography of Sport. *GeoSport for Society*, 1(1-2), 7-18.

Ilieș, A., Ilieș, M., & Morariu C. (2016b). Socialist heritage and symbols in football teams (1981-1989) in Maramureș County (Romania). *GeoJournal of Tourism and Geosites*, 18(2), 259-269.

Ilieș, A., Ilieș, M., Morariu, C., & Bulz G.C. (2016c). History and Tradition on the Maramureș County football map (period 1980-2016). *GeoSport for Society***,** 5(2), 107-132.

Ilieș, A., Stance, L., & Bulz G.C. (2016a). Geographical landmarks for delimitation of sport-cultural space defined by amateur football in Crisana and Maramures (2011-2016). *Analele Universitatii din Oradea, seria Geografie*, 26(2), 223-234.

Kijewski, T., & Wendt, J. A. (2019). *Polish Football Teams in the Champions League - Does the Budget Decide Everything?* Geosport for Society, 11(2), 101–112. https://doi.org/10.30892/gss.1105-053

Kozma, G., Bacs, Z., Zilinyi, Z. (2015). The possibilities and results for the scientific research into the relationship between settlements and sport. *Geosport for Society*, 3(2), 41-52.

Margvelashvili, M. (2021). Sport and tourism facing the covid-19 pandemic. *Geosport for Society*, 14(1), 21-27. https://doi.org/10.30892/gss.1403-067

McCurry, J. (2020). Tokyo 2020 organisers fight false rumours Olympics cancelled over coronavirus crisis. In *The Guardian*, January 31. Available at *https://www.theguardian.com/world/2020/feb/01/tokyo-2020-organisers-fight-false-rumours-olympics-cancelled-over-coronaviruscrisis* (Accesed on August 25, 2021).

Murphy, C., (2019). Designing the imagery on image maps – how far can we take it?, International Journal of Cartography, 5(2-3), 316-331. https://doi.org/10.1080/23729333.2019.1613074

Primorac, D., Matiši,´C.V., Molnar, V., Bahtijarevi,´C.Z., Polašek, O. (2020). Pre-Season Football Preparation in the Era of COVID-19: Croatian Football Association Model. *J. Glob. Health*, 10, 010352. https://doi.org/10.3390/ijerph18020568

Raisch, M. (2018), *The Football Atlas: the illustrations putting the World Cup on the map* (theguardian.com/football/these-football-times/2018/jun/25/football-atlas-illustrated-world-cup (accessed on 25 juin, 2021).

Reilly, T., & Gilbourne, D., (2003). Science and football: a review of applied research in the football codes. *Journal of Sports Sciences*, 21, 693-705.

Rico-González, M., Pino-Ortega, J., & Ardigò, L.P. (2021), Playing Non-Professional Football in COVID-19 Time: A Narrative Review of Recommendations, Considerations, and Best Practices. *International Journal of Environmental Research and Public Health,* 18, 568. https://doi.org/10.3390/ijerph18020568

Robinson, A.C., Demšar, U., Moore, A.B., Buckley, A., Jiang, B., Field, K., Kraak, M.-J., Camboim, S., & Sluter, C.R. (2017), Geospatial big data and cartography: research challenges and opportunities for making maps that matter. *International Journal of Cartography,* 3(sup1), 32-60. https://doi.org/10.1080/23729333.2016.1278151

Sam, M.P., & Hughson, J. (2010). Sport in the city: cultural and political connections. *Sport in Society*, 13, 10, 1417-1422. http://dx.doi.org/10.1080/17430437.2010.520933

Web-sites sources:

[1] *www.frf-ajf.ro; https://www.ajfarad.ro/; http://ajfvrancea.ro/; http://ajf-suceava.ro/; http://www.ajfalba.ro/ (accessed at: 11.07.2021)*

[2] *https://www.frfotbal.ro/index.php?competition_id=2&season=521&serie_id=2149 (accessed at: 11.07.2021)*

[3] *Covid-19 and amateur sports: The situation in Europe, 2020 (https://www.disinfobservatory.org/covid-19-and-amateur-sports-the-situation-in-europe/) (accessed at: 14.06.2021)*

[4] *https://www.frf.ro/wp-content/uploads/2018/07/Protocol-Reluare-Competitii-13-iunie-2020.pdf (accessed at: 11.08.2020)*

[5] *https://www.frf.ro/wp-content/uploads/2020/07/Protocol-reluare-competitii-fotbal-amator-14-iulie.pdf (accessed at: 20 september, 2020)*

[6] *https://liga2.prosport.ro/liga-4/ajf-bistrita-nasaud-fara-reprezentanta-la-barajul-pentru-liga-3-sezonul-nu-a-fost-inghetat-dar-conducatorii-au-anuntat-ca-nu-pot-desemna-campioana-deocamdata-19140436 (accessed at: 15.08.2020)*

[7] *https://liga2.prosport.ro/liga-3/stiri/frf-a-stabilit-meciurile-de-baraj-pentru-promovare-in-liga-3-editia-2020-2021-cand-se-vor-desfasura-partidele-tur-retur-18862356 (accessed at: 16.08.2020)*

[8] *https://www.frfotbal.ro/index.php?competition_id=2&season=521&serie_id=2151) (accessed at: 11.06.2021)*

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