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In general, the editors express hope that the journal "Physical Education of Students" contributes to information exchange to combine efforts of the researchers from the East-European region to solve common problems in health promotion of students, development of physical culture and sports in higher educational institutions.

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ORIGINAL ARTICLE

The effect of 8-weeks wrestling training on unilateral muscle imbalances

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: This study aimed to investigate the effect of 8-weeks of wrestling training on unilateral muscle imbalances.

Material: Eight male elite Greco-Roman wrestlers (wrestling group) (age 21.25±2.7 years, height 176.6±6.8 cm, body weight 81.00±9.3 kg) and seven recreationally active male (control group) (age 21.3±3.2 years, height 173.6±4.7 cm, body weight 67.3±5.3 kg) voluntarily participated in the study. Both group participants were students in the Selcuk university in the period of study. Wrestlers were in the off-season before the training period of 10 weeks. Before and after the 8-weeks training period, wrestling and control groups were tested for isokinetic torque measurement. In the training period, the wrestling group carried out only wrestling training without specific strength training. In this period the control group did not involve in any exercise.

Results: In the wrestling group, all quadriceps torque parameters significantly increased for both legs but the torque parameters of the hamstring did not change, except the average torque of the left leg. The peak and average torque of the H/Q (Hamstring/quadriceps) significantly decreased after training periods for right leg in the wrestling group. No parameters significantly changed in the control group.

Conclusions: Specific hamstring strength exercises can be put in training programs to avoid from a possible knee injury.

Keywords: wrestling, strength imbalances, knee isokinetic strength

Introduction

Wrestling is one of the sports branches where muscle strength is most needed. Implementation of different proportions of action, such as pull, push and lift, during wrestling activities causes different physiological requirements for the athletes in this sport branch. Wrestling-specific movements show differences in the production of strength and in the produced strength, depending on which muscle group is used [1]. For example, in standing wrestling, the load on the support leg may be higher than the other leg during the pushing movement, or in the crotch lift movement, the duration of tension under an arm may be higher than for the other arm. These differences depending on the technique applied and can produce differences in body composition and strength values of wrestlers, and the basis of these differences are the muscle imbalances that play a crucial role in injuries.

The hamstring and quadriceps muscles groups from the lower extremity especially can have strength differences between each other, which are derived from athletic activities [2]. It has been reported many times that the strength imbalance is a factor that can seriously affect both athletic performance and injuries [3]. Additionally, it is known that each sports branch can have a specific effect on strength and strength imbalances. Although studies are reporting different effects of different strength training on strength imbalance [4], the effects of the sport branches and branch-specific training on the strength imbalance have had limited examination. Despite the fact that a 15% bilateral strength difference was accepted as a "strength imbalance" in the literature [5], according to the branches, the differences in this ratio make it possible to discuss the effects of strength imbalance on injuries or performance. In the football branch, hitting the ball with one leg and having the same leg on the ball at each repetition can give rise to strength difference to occur between the two legs [6, 7]. At this point, it can not be said that high bilateral leg strength differences for the football branch are unexpected. In the same way, considering that the weightlifting branch is the maximum weight lifting sport with a balance, low bilateral leg strength differences may still occur [8]. Therefore, there is a need for studies examining the effects of training specific to branches on these strength imbalances. In parallel, it is also thought that wrestling training may have different effects on the unilateral strength balance in terms of content. This study aims to evaluate the lower extremity unilateral isokinetic strength of the elite wrestlers after 8 weeks of wrestling.

Materials and Methods

Participants

Eight male elite Greco-Roman wrestlers and seven healthy recreationally active male (control group) voluntarily participated in the study. All the participants were students of Selçuk University in the study period. Wrestlers attended national or international tournaments (at least once in the last 6 months). Elite wrestlers (age 21.25±2.7 years, height 176.6±6.8 cm, body 81.00±9.3

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kg, all wrestlers dominant leg was right) were in the off-season for ten weeks. Active male participants (age 21.3±3.2 years, height 173.6±4.7 cm, body weight 67.3±5.3 kg) did not involve in weight exercise 6 months prior to the second trial. Participants were informed about the aim and the risks of the study. All participants were provided with written informed consent. The study protocol was approved by the Ethics Committee of Selcuk University, Sport Sciences Faculty.

Research Design

Both groups were taken to the sports science faculty laboratory at 10:00 am. Participants were warned to not participate in any exercise in the past 48 hours until the end of the test section. Subjects were applied to a standard warm-up including stretching movements. Following that, participants were taken to isokinetic strength measurement by Cybex (Cybex NORM®, Humac, CA, USA). After the first measurement, wrestlers started their wrestling training for eight weeks three times a week. The control group did not participate in any training or strong physical activity for the 8-weeks period. 48 hours after the last wrestling training section, wrestlers and control groups were subjected to the second measurement of leg strength.

Wrestling Training Program

Wrestling-specific training and training matches were carried out for elite wrestlers for eight weeks. Each training session lasted 60-75 minutes. The wrestling training program did not contain any specific strength training with machines or gym training and this was managed by the trainer during 8-weeks.

Isokinetic Knee Strength Measurement

The isokinetic knee strength measurements were performed with an isokinetic dynamometer (Cybex, Humac Norm 2004) in the kinapometry laboratory of Selcuk University. Participants are seated in the correct position in the test seat. The participants' holders and the middle sections of the thighs were stabilized to the seat by the tapes. In addition, they were allowed to brace for support by holding the handles on the right and left sides of the seat during the test. The subjects were instructed to complete a ROM from 90° to 10°. The point of the beginning was 90° of flexion, then moving into extension.

Each subject was given a warm-up at 60° sec-1 for 5 repetitions [9]. When the isokinetic warm-up was done, each subject had a 2-minute rest. After the rest period, each subject was asked to perform 5 repetitions as hard and as fast as he could at a speed of 60° sec-1. Then, the test for the right leg was performed, then each subject was given a 5-minute rest, and then the procedure was repeated for the other leg [10]. Peak torque and average torque of both legs were recorded in Newton (Nm). Participants were supported by verbally encouraging expressions in order to achieve higher performance during the test.

Statistical Analysis

SPSS program (SPSS for Windows, version 24.0, SPSS Inc., Chicago, Illinois, USA) was used for statistical analyses. The data were presented as mean and standard deviation. Shapiro-Wilk test was used for normality; Levene's test was used for the homogeneity. Skewness and kurtosis values were checked for data sets that were not normally distributed, and those within ±2 were accepted to be normally distributed. Paired sample t-test was used to compare pre and post test parameters of groups. Effect size (Cohen d) and 95% confidence intervals (CI) are included, together with P values, where appropriate. According to this formula, a d value of <0.2 was defined as weak effect size, a d value of 0.5 was defined as moderate, and a d value of >0.8 was defined as strong effect size. Statistical results were assessed within 95% confidence interval and at a significance level of $p<0.05$.

Results

Table 1 shows that the peak torque extension of the wrestling group significantly increased after the training period. Also, the average extension torque of the wrestling group increased significantly. There was no statistical difference between the pre and post-test of the wrestling group for other parameters. The control group did not show any statistical differences after the 8-weeks period for isokinetic output. When the H/Q ratio is evaluated, peak torque and average torque of wrestlers reduced significantly.

In table 2, it is seen that the peak torque extension, the average extension torque and the average flexion torque of the wrestling group significantly increased after the training period. There was no statistical difference in peak torque flexion between the pre and post-test of the wrestling group. The control group did not show any statistical differences after the 8-weeks period for

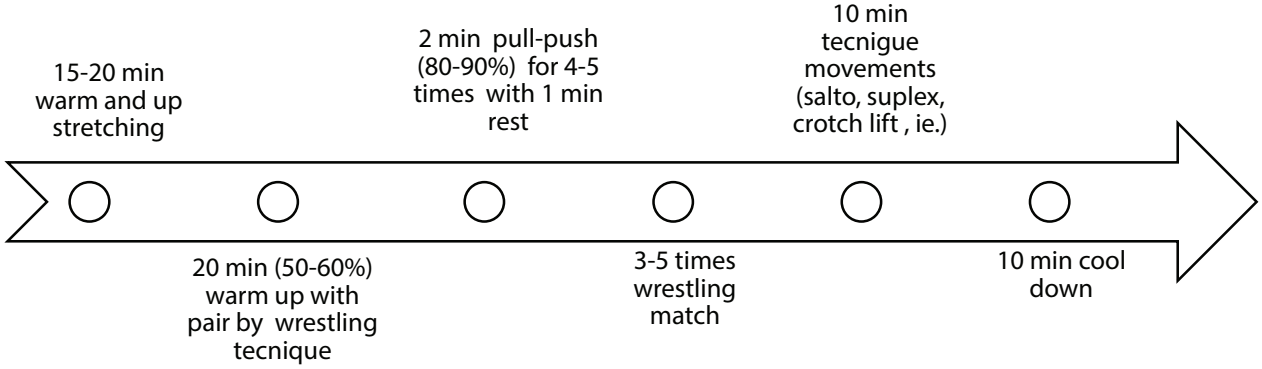

Figure 1. Wrestling Training Pattern

Table 1. Right leg pre and post-test isokinetic torque outputs of wrestling and control groups

Variables (Nm)	Pre and Post test	N	Mean	S.D	t	95% CI	P	E.S
PP Ext	**Wrestling** Pre-Test	8	242.00	21.69	-3.88	-32.97--8.02	*0.006	1.37
	Wrestling post-Test	8	262.50	27.83				
PP Flex	**Wrestling** Pre-Test	8	141.88	19.75	1.15	-6.19-17.95	0.288	0.41
	Wrestling post-Test	8	136.000	24.23				
Avg Ext	**Wrestling** Pre-Test	8	163.88	19.12	-3.71	-27.83--6.16	*0.008	1.31
	Wrestling post-Test	8	180.88	23.85				
Avg Flex	**Wrestling** Pre-Test	8	105.63	10.25	-0.75	-7.25-3.75	0.477	0.27
	Wrestling post-Test	8	107.38	14.30				
H_{pp}/Q_{pp}	**Wrestling** Pre-Test	8	0.58	0.06	3.33	0.01-0.11	*0.013	1.18
	Wrestling post-Test	8	0.52	0.10				
$H_{Avg/}Q_{Avg}$	**Wrestling** Pre-Test	8	0.65	0.09	2.60	0.00-0.09	*0.035	0.92
	Wrestling post-Test	8	0.60	0.08				
PP Ext	Control Pre-Test	7	207.71	40.98	-0.584	-7.41-4.56	0.581	1.37
	Control post-Test	7	209.14	36.13				
PP Flex	Control Pre-Test	7	114.86	22.35	-0.885	-6.99-3.27	0.410	0.41
	Control post-Test	7	116.71	22.32				
Avg Ext	Control Pre-Test	7	140.00	28.23	-0.782	-6.49-3.34	0.464	1.31
	Control post-Test	7	141.57	30.97				
Avg Flex	Control Pre-Test	7	90.43	17.03	-0.962	-6.07-2.64	0.373	0.27
	Control post-Test	7	92.14	16.99				
H_{pp}/Q_{pp}	Control Pre-Test	7	.55	0.09	-0.280	-.026-0.021	0.789	1.18
	Control post-Test	7	.56	0.08				
$H_{Avg/}Q_{Avg}$	Control Pre-Test	7	.65	0.13	-0.458	-0.03-0.02	0.663	0.92
	Control post-Test	7	.66	0.12				

PP Ext= Peak torque extension; **PP Flex**= Peak torque flexion; **Avg Ext**= Average torque extension; **Avg Flex**=Average torque flexion; **H_{pp}/Q_{pp}**=Hamstring/quadriceps peak torque ratio; **H_{pp}/Q_{pp}**=Hamstring/quadriceps average torque ratio. *95% CI: Confidence interval. E.S: Cohen's d effect size.* *Significant difference. P<0.05.

Table 2. Left leg pre and post-test isokinetic torque outputs of wrestling and control groups

Variables (Nm)	Pre and post test	N	Mean	S.D	t	95% CI	P	E.S
PP Ext	**Wrestling** Pre-Test	8	242.88	32.75	-3.09	-26.68--3.56	*0.017	1.09
	Wrestling post-Test	8	258.00	32.92				
PP Flex	**Wrestling** Pre-Test	8	123.75	8.90	-1.14	-24.87-8.62	0.289	0.41
	Wrestling post-Test	8	131.88	25.38				
Avg Ext	**Wrestling** Pre-Test	8	165.00	20.42	-3.83	-20.40--4.84	*0.006	1.36
	Wrestling post-Test	8	177.63	24.64				
Avg Flex	**Wrestling** Pre-Test	8	95.63	11.32	-2.42	-12.58--0.16	*0.046	0.86
	Wrestling post-Test	8	102.00	17.58				
H_{pp}/Q_{pp}	**Wrestling** Pre-Test	8	0.51	0.07	0.17	-.06-0.06	0.865	0.06
	Wrestling post-Test	8	0.51	0.07				
H_{Avg}/Q_{Avg}	**Wrestling** Pre-Test	8	0.58	.09	0.33	-0.03-0.04	0.751	0.12
	Wrestling post-Test	8	0.58	0.11				
PP Ext	Control Pre-Test	7	201.86	29.22	0.30	-4.04-5.19	0.772	0.11
	Control post-Test	7	201.29	25.49				
PP Flex	Control Pre-Test	7	114.29	19.31	-0.69	-7.09-3.94	0.512	0.25
	Control post-Test	7	115.86	19.50				
Avg Ext	Control Pre-Test	7	137.29	18.01	-0.26	-7.29-5.86	0.799	0.09
	Control post-Test	7	138.00	20.65				
Avg Flex	Control Pre-Test	7	80.43	15.78	-0.89	-5.87-2.72	0.406	0.32
	Control post-Test	7	82.00	14.31				
H_{pp}/Q_{pp}	Control Pre-Test	7	0.57	0.10	-0.36	-0.04-0.03	0.732	0.13
	Control post-Test	7	0.57	0.08				
H_{Avg}/Q_{Avg}	Control Pre-Test	7	0.59	0.13	-0.61	-0.04-0.02	0.559	0.22
	Control post-Test	7	0.60	0.12				

PP Ext= Peak torque extension; **PP Flex**= Peak torque flexion; **Avg Ext**= Average torque extension; **Avg Flex**=Average torque flexion; **H_{pp}/Q_{pp}**=Hamstring/quadriceps peak torque ratio; **H_{pp}/Q_{pp}**=Hamstring/quadriceps average torque ratio. *95 % CI: Confidence interval. E.S: Cohen's d effect size.* *****Significant difference. P<0.05.

isokinetic output. The H/Q ratio did not significantly change for both groups for the left leg.

Discussion

To our knowledge, this study is the first study in the literature to evaluate the effect of long-term wrestling-specific training on the strength of the thigh muscles. In this study, while long-term wrestling-specific training did not cause a significant difference in hamstring muscle strength, it made a significant difference in quadriceps muscle strength and resulted in reduced H/Q ratio.

Several studies reported the incidences and characteristics of injuries in male wrestling athletes [11, 12, 13]. While Jarret et al. [12] reported that the incidence of injury was 9.6 injuries / 1, 000 hours in collegiate wrestling, Yard et al. [11] reported 7.25 injuries / 1, 000 hours in collegiate wrestling and 2.33 injuries / 1, 000 hours in high school wrestling. When the injury locations are examined, the two most frequently injured locations are the knee (17-24.8%) and shoulder (17.8-24%) joints and the injury types were often sprains (22.6-28%) and strains (30.6%) [11, 12, 13]. The knee injuries were not only often but also severe. Surgical treatment may be required and it takes a long time for athletes to return to pre-injury levels [14]. Therefore, the injury mechanism and predisposing factors should be examined and necessary protective measures should be taken [15].

Predisposing factors are divided into two groups - intrinsic and extrinsic. While age, gender, muscle strength imbalance, flexibility and proprioception problems, and surgery history are intrinsic factors, ground, protective equipment (such as helmet, mask, shin splint) are extrinsic [16]. Muscle strength imbalance is one of the most important predisposing factors. It also affects other factors such as flexibility, proprioception, and ground force, and it becomes more important in sports branches that include repetitive jumps, a sudden change of direction and acceleration-deceleration motion patterns [17]. It is recommended that H/Q conventional ratios should be 0.6 or above in order to prevent the thigh muscle imbalance and lower extremity injuries, especially of the knee joint [18, 19]. In our study, wrestling athletes performed wrestling-specific training for 8 weeks without doing strength training; peak torque and average torque values in both thigh extensor muscles and the average torque in the left knee flexor muscles increased significantly. However, when the H/Q ratio was evaluated, a significant decrease was observed in the right thigh peak torque and average torque ($p=0.013$; $p=0.004$, respectively). The quadriceps muscle strength may increase more because of wrestling-specific training which includes repetitively pushing the opponent. Wrestling-specific training reduces the H/Q concentric muscle strength rate and may increase the incidence of knee injuries. Considering the characteristics of wrestling sports injury, thigh muscle strength imbalance caused by performing specific training should be eliminated.

When the subgroups of injuries in wrestling athletes are evaluated, they are reported in the knee joint as a proportion of 17-24.8% [11, 13]. Considering the severity of various injuries, knee injuries are the most important injuries. This is also because 44% of season-ending injuries were in the knee joint [13]. Most of the severe knee injuries are anterior cruciate ligament (ACL) based. In addition, the possibility of not being able to return to sports at the pre-injury level after the ACL injury, and the risk of re-rupture and injury of the other structures in the knee (other ligaments, meniscus, cartilage) makes the subject even more important. Predisposing factors should therefore be identified and eliminated before the injury occurs.

It was reported many times that approximately 70% of ACL injuries occur during non-contact and the most common mechanism of injury is external valgus and femoral rotation [14, 16, 17, 20, 21]. Also known as "knee in-toe out", this mechanism is followed by an anterior tibial translation [22]. Excessive quadriceps activity and varus torque are also other injury mechanisms [23, 24]. However, when we examine the knee injuries in wrestling, it is reported that the most common injury positions were takedown and sparring (68% and 18.4% respectively) [11, 13]. An ACL injury occurs when the total vector of intrinsic and extrinsic risk factors and severity of the injury is greater than the tolerance of dynamic stabilizers on the knee and anterior cruciate ligament tension [25]. Withrow et. al reported that the increase in hamstring muscle strength reduces ligament injuries by decreasing the load on the ACL, and also that increased muscle strength in quadriceps increases the risk of ACL injury [26]. Lloyd and Buchanan [27] reported that the increase in H/Q ratio in the biomechanical model knee does not only decrease tibial anterior translation, but it also reduces external valgus and femoral rotation. According to the results obtained in our study, it can be said that the muscle imbalance caused by wrestling-specific training facilitates all the injury mechanisms of ACL (especially excessive quadriceps activity).

On the other hand, Hewett et al. [24] performed long-term plyometric training in female athletes and observed that the hamstring muscle strength increased and the reaction force of the ground also decreased significantly. The increase in hamstring muscle strength not only regulates the intrinsic factors but can also reduce the likelihood of knee injury by providing relative improvement in the extrinsic predisposing factor such as the ground force. In this context, the decrease in H/Q ratio may increase the possibility of injury by increasing ground reaction force, especially in sports branches in which repetitive jumps are frequent.

The imbalance in H/Q muscle strength ratio does not only increase the possibility of ACL injury. At the same time, other structures in and around the knee joint also can be injured easier. For example, external meniscus tears, collateral ligaments, and femoral lateral condyle cartilage damage may accompany ACL injuries frequently [28]. In addition, the decrease in functional H/Q ratio increases the likelihood of hamstring muscle injuries, especially in sports branches with repetitive sprints; hamstring

strengthening exercise may reduce the incidence and severity of hamstring muscle injuries [29]. On the other hand, in accordance with the results obtained in our study, wrestling-specific training also increases the load on the anterior knee and increases the likelihood of overuse injuries, such as patellofemoral joint problems, quadriceps and patellar tendinopathy, and infrapatellar bursitis.

One of the most important things to provide the function of joint stability is co-activation between agonist and antagonist muscle groups. Hamstring and quadriceps co-activation is the functional component that limits all excessive knee movements, prevents overload the structure of the knee and helps maintain dynamic stability [30]. Lloyd and Buchanan reported that co-activation was 11-14% protective against external varus and the valgus moment [27]. The decrease in H/Q muscle strength ratio also reduces the effectiveness of these protective mechanisms and may increase the incidence and severity of injuries.

There are some limitations to this study. Firstly, the participants were few. The results of the study with more participants may be different. Secondly, injuries and symptoms in athletes were not followed up. Lastly, we measured the conventional H/Q ratio at 60 degrees angular velocity. It may be more useful to measure the functional H/Q ratio at higher angular velocities.

Conclusions

Wrestling specific training may increase the likelihood of knee injuries, especially ACL, by reducing H/Q muscle strength ratio. The imbalance caused by specific training should be eliminated especially by hamstring eccentric strength and proprioception training.

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Conflicts of Interest

The authors declare no conflict of interest.

References

1. Horswill CA. Applied Physiology of Amateur Wrestling. *Sports Medicine*, 1992;14:114–43. https://doi.org/10.2165/00007256-199214020-00004
2. Daneshjoo A, Rahnama N, Mokhtar AH, Yusof A. Bilateral and Unilateral Asymmetries of Isokinetic Strength and Flexibility in Male Young Professional Soccer Players. *Journal of Human Kinetics*, 2013;36:45–53. https://doi.org/10.2478/hukin-2013-0005
3. Impellizzeri FM, Bizzini M, Rampinini E, Cereda F, Maffiuletti NA. Reliability of isokinetic strength imbalance ratios measured using the Cybex NORM dynamometer. *Clin Physiol Funct Imaging*, 2008;28:113–9. https://doi.org/10.1111/j.1475-097X.2007.00786.x
4. Gioftsidou A, Ispirlidis I, Pafis G, Malliou P, Bikos C, Godolias G. Isokinetic strength training program for muscular imbalances in professional soccer players. *Sport Sci Health*, 2008;2:101–5. https://doi.org/10.1007/s11332-008-0047-5
5. Cheung R, Smith A, Wong D. H:Q Ratios and Bilateral Leg Strength in College Field and Court Sports Players. *Journal of Human Kinetics*, 2012;33:63–71. https://doi.org/10.2478/v10078-012-0045-1
6. Fousekis K, Tsepis E, Vagenas G. Lower limb strength in professional soccer players: profile, asymmetry, and training age. *Journal of Sports Science & Medicine,* 2010;9(3):364.
7. Kellis S, Gerodimos V, Kellis E, Manou V. Bilateral isokinetic concentric and eccentric strength profiles of the knee extensors and flexors in young soccer players. *Isokinetics and Exercise Science,* 2001;9:31–9. https://doi.org/10.3233/IES-2001-0061
8. Kang SH, Kim CW, Kim YI, Kim KB, Lee SS, Shin K ok. Alterations of Muscular Strength and Left and Right Limb Balance in Weightlifters after an 8-week Balance Training Program. *J Phys Ther Sci,* 2013;25:895–900. https://doi.org/10.1589/jpts.25.895
9. Brown LE. Isokinetics in human performance. *Human Kinetics*; 2000.
10. Rossi MD, Brown LE, Whitehurst M, Charni C, Hankins J, Taylor CL. Comparison of knee extensor strength between limbs in individuals with bilateral total knee replacement. *Archives of Physical Medicine and Rehabilitation*, 2002;83:523–6. https://doi.org/10.1053/apmr.2002.30935
11. Yard EE, Collins CL, Dick RW, Comstock RD. An Epidemiologic Comparison of High School and College Wrestling Injuries. *Am J Sports Med*, 2008;36:57–64. https://doi.org/10.1177/0363546507307507
12. Jarrett GJ, Orwin JF, Dick RW. Injuries in Collegiate Wrestling. *Am J Sports Med*, 1998;26:674–80. https://doi.org/10.1177/03635465980260051301
13. Pasque CB, Hewett TE. A Prospective Study of High School Wrestling Injuries <sup/>. Am J Sports Med 2000;28:509–15. https://doi.org/10.1177/03635465000280041101
14. Myklebust G. Return to play guidelines after anterior cruciate ligament surgery. *British Journal of Sports Medicine*, 2005;39:127–31. https://doi.org/10.1136/bjsm.2004.010900
15. van Mechelen W, Hlobil H, Kemper HCG. Incidence, Severity, Aetiology and Prevention of Sports Injuries: A Review of Concepts. *Sports Medicine*, 1992;14:82–99. https://doi.org/10.2165/00007256-199214020-00002
16. Bahr R. Understanding injury mechanisms: a key component of preventing injuries in sport. *British Journal of Sports Medicine,* 2005;39:324–9. https://doi.org/10.1136/bjsm.2005.018341
17. Kirkendall DT, Garrett WE. The Anterior Cruciate Ligament Enigma: Injury Mechanisms and Prevention. *Clinical Orthopaedics and Related Research*, 2000;372:64–8. https://doi.org/10.1097/00003086-200003000-00008
18. Coombs R, Garbutt G. Developments in the use of the hamstring/quadriceps ratio for the assessment of muscle balance. *Journal of Sports Science & Medicine*, 2002;1(3):56.
19. Holcomb WR, Rubley MD, Lee HJ, Guadagnoli MA. Effect of Hamstring-Emphasized Resistance Training on Hamstring:Quadriceps Strength Ratios. *J Strength Cond Res*, 2007;21:41. https://doi.org/10.1519/R-18795.1
20. McLean SG, Huang X, Su A, van den Bogert AJ. Sagittal plane biomechanics cannot injure the ACL during sidestep cutting. *Clinical Biomechanics*, 2004;19:828–38.

https://doi.org/10.1016/j.clinbiomech.2004.06.006
21. Yu B, Garrett WE. Mechanisms of non-contact ACL injuries. *British Journal of Sports Medicine*, 2007;41:i47–51. https://doi.org/10.1136/bjsm.2007.037192
22. Kobayashi H, Kanamura T, Koshida S, Miyashita K, Okado T, Shimizu T, et al. Mechanisms of the anterior cruciate ligament injury in sports activities: a twenty-year clinical research of 1,700 athletes. *J Sports Sci Med,* 2010;9:669–75.
23. Demorat G, Weinhold P, Blackburn T, Chudik S, Garrett W. Aggressive Quadriceps Loading Can Induce Noncontact Anterior Cruciate Ligament Injury. *Am J Sports Med*, 2004;32:477–83. https://doi.org/10.1177/0363546503258928
24. Hewett TE, Stroupe AL, Nance TA, Noyes FR. Plyometric Training in Female Athletes: Decreased Impact Forces and Increased Hamstring Torques. *Am J Sports Med*, 1996;24:765–73. https://doi.org/10.1177/036354659602400611
25. Meeuwisse WH. Assessing Causation in Sport Injury: A Multifactorial Model. *Clinical Journal of Sport Medicine*, 1994;4:166–70. https://doi.org/10.1097/00042752-199407000-00004
26. Withrow TJ, Huston LJ, Wojtys EM, Ashton-Miller JA. Effect of Varying Hamstring Tension on Anterior Cruciate Ligament Strain During in Vitro Impulsive Knee Flexion and Compression Loading: *The Journal of Bone and Joint Surgery-American Volume*, 2008;90:815–23. https://doi.org/10.2106/JBJS.F.01352
27. Lloyd DG, Buchanan TS. Strategies of muscular support of varus and valgus isometric loads at the human knee. *Journal of Biomechanics*, 2001;34:1257–67. https://doi.org/10.1016/S0021-9290(01)00095-1
28. Cerabona F, Sherman MF, Bonamo JR, Sklar J. Patterns of meniscal injury with acute anterior cruciate ligament tears. *Am J Sports Med,* 1988;16:603–9. https://doi.org/10.1177/036354658801600609
29. Brooks JHM, Fuller CW, Kemp SPT, Reddin DB. Incidence, Risk, and Prevention of Hamstring Muscle Injuries in Professional Rugby Union. *Am J Sports Med*, 2006;34:1297–306. https://doi.org/10.1177/0363546505286022
30. Ford KR, van den Bogert J, Myer GD, Shapiro R, Hewett TE. The effects of age and skill level on knee musculature co-contraction during functional activities: a systematic review. *British Journal of Sports Medicine*, 2008;42:561–6. https://doi.org/10.1136/bjsm.2007.044883

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PHYSICAL EDUCATION OF STUDENTS

ORIGINAL ARTICLE

Examination of sports science faculty students' attitudes towards online learning by different variables

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Abstract

Background and Study Aim: In distance education, students' attitudes towards this method gain importance in the process. The aim of this research is to examine the impact of coronavirus anxiety, academic self-sufficiency and life satisfaction levels of students in the faculty of sports sciences over their attitudes towards online learning.

Material and Methods: A total of 379 sports science faculty students voluntarily participated for the cross-sectional data collection. A simple random sampling method was used in the selection of students from four universities in the Eastern Anatolian region, which make up the universe of the study. Data were collected electronically and analysed by IBM SPSS and AMOS statistical package program.

Results: The structural equity model results revealed that academic self-sufficiency and life satisfaction are positive predictors of online learning attitudes and negative predictors of coronavirus anxiety. Online learning attitude was found to be positively correlated with other variables other than coronavirus anxiety. In addition, it has been determined that the scale total scores are slightly above average, except for coronavirus anxiety.

Conclusions: The results have been discussed in terms of their meaning for the environment of physical education. In this research, which created a model for understanding online learning attitudes in students of the faculty of sports sciences, it was understood that coronavirus anxiety has a statistically significant effect on online learning attitudes while academic self-sufficiency and life satisfaction do not have a statistically significant effect. Students' positive attitude towards online learning and understanding the predictors of this attitude will be a development to be appreciated by all stakeholders of the subject.

Keywords: sports sciences, online learning, coronavirus anxiety, academic self-sufficiency, life satisfaction.

Introduction

The continuous self-renewal of technology and adaptation to the conditions of the times have manifested itself in the field of education as well as in many other fields. Subject of education also try to keep up with the conditions of the current trends and move into new learning environments following the technological developments. One of these new learning environments is undoubtedly the online learning environment [1].

From both a pedagogical and technical point of view, it is safe to say that online learning is rapidly changing and being developed. As technological advances enable the development of new software and hardware, they constantly lead researchers to analyse the success of theories and concepts between media, technology, and teaching strategies. However, researchers are struggling to expand on what kind of knowledge, skills and attitudes are necessary for the success of online learning [2].

At the beginning of 2020, human race faced the threat of a virus that was claimed to have appeared in Wuhan, China. Different measures and practices have been raised because of the fast spread of the virus threatening the lives of many affecting countries and the global economy. After the healthcare sector, education sector took the next big hit as a result of the pandemic [3]. According to the latest data obtained from the United Nations, almost 770 million learners (students, etc.) have been affected by the closure of schools and universities [4].

In this globalized and digitized century, governments, educational institutions and companies around the world increasingly encouraged online learning, and so the transition from traditional face-to-face classrooms to remote and online learning has spread around the world [5]. As of March 13, 2020, education was suspended in schools and 18 million primary and secondary education students who had previously received face-to-face education started to receive their education from their homes. At the same time, approximately 8 million students enrolled in associate, undergraduate and graduate programs have started to receive distance education after a brief break from their traditional education [6].

As one of the most important elements of online learning environments, students' positive or negative attitude towards these programs has a great impact on learning [7]. Studies conducted to study the effects of the attitude over student actions have concluded that conflicting emotions, interests, and thoughts on a topic, affect behaviour that is displayed or to be displayed [8]. A positive attitude towards learning allows students to strive to learn the knowledge and skills that will be useful to them in life and ultimately set them ready for the behavioural, emotional and psychomotor aspects required in the courses [9–12]. It is believed that the number of

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students who do not want distance education is more than usual especially in sports science academies, due to the fact that the courses of this particular department usually require physical participation [13].

During the course of this pandemic, anxiety, fear and uncertainty interact in a multifaceted way. The predisposition of emotionally, cognitively, and behaviourally negative reactions to uncertain events and situations manifests itself as intolerance [14]. In addition, Aktaş et al. has found out that students wanted to follow up with their courses remotely but at the same time, the exams conducted through the distance education system do not increase their competency rates and thus, do not really improve their conditions [13]. From this point of view, it is assumed that there is an inverse correlation between coronavirus anxiety and online learning motivation. One of the factors affecting the student's success in their courses is their self-sufficiency levels [15]. Some research shows that the perception of self-sufficiency influences success [16–19]. Life satisfaction shows the cognitive side of the value that a person attributes to him/herself, while academic motivation is related to motivators towards learning. Therefore, it is as expected that the academic motivations of individuals with high satisfaction of life will also be high. One important predictor of satisfaction of life is loneliness. Given the negative effects of loneliness, which is a natural outcome of the pandemic and lockdowns, it is possible that there is a negative correlation between loneliness and life satisfaction [20].

After the coronavirus outbreak, online learning has become a common education tool for students of the faculty of sports sciences. However, it is thought that it is important to question the attitudes of students towards online learning in terms of various variables. Therefore, at a time when the effects of the pandemic still continue to dominate our country, it is a question of whether these effects have a role to play in explaining the attitudes of online learning by evaluating the coronavirus anxiety, academic self-sufficiency and life satisfaction levels of the students of the faculty of sports sciences. Thus, it would be possible to know what types of variables should be laid out in any possible intervention programs in the future, in an evidence-based manner. In this study, the effects of coronavirus anxiety, academic self-sufficiency, and life satisfaction levels over online learning attitudes of sports sciences faculty students in the adaptation to changing living conditions during the distance learning phase due to coronavirus were examined. For this purpose, basic three hypotheses were examined in the structural model: H_1: Coronavirus anxiety positively affects the attitude towards online learning, H_2: The sense of academic self-sufficiency positively affects the attitude towards online learning and H_3: Life satisfaction positively affects the attitude towards online learning.

Material and Methods

Study design. This research was designed in relational screening model. In this context, structural equation modeling (SEM), a data analysis method often used in correlational research, was used to explain predictor correlations between variables as it allows to simultaneously study predictive correlations between variables [21].

Participants. The universe of the research consists of about 2785 students who study in the Faculty of Sports Sciences of 4 different universities in the Eastern Anatolia region. The sample consists of a total of 383 students, 245 (63.96%) male and 138 (36.04%) female students, selected by simple random method from probabilistic sampling techniques. The characteristics of the units that make up the universe are not very important in terms of sampling, and simple random sampling may be preferred if the characteristics of the units are homogeneous [22]. A sample of about 10 times the number of variables observed in structural equality modeling studies is considered sufficient in cases where the data is distributed normally [23]. Again, the minimum number of samples for structural equality models, provided that they demonstrate a normal distribution, is 100, and the sample size, which is usually considered sufficient, is 200 [24]. In another analysis, critical number of people was found to be 378 and the strength of the study was determined as .948 [25]. These results show that the power of hypothesis testing is at a high level.

Data Collection.

The OLAS (Online Learning Attitude Scale) used in the study to measure university students' attitudes towards online learning was developed by Usta et al. [26]. OLAS has a likert type of 5 and consists of a total of 20 items. The scale measures the educational burnout as a structure consisting of four different dimensions: "general acceptance", "individual awareness", "usefulness", and "practical effectiveness". This four-factor structure accounts for a total of 63.82% of the variance related to educational burnout. Factor load values of items vary between -.43 and .81. Any high score taken from each of the four factors of the scale and the entire scale means that the level of educational burnout experienced by the individual is high. As a result of the analysis based on the internal consistency criteria, it was concluded that the factors contained in the scale were distinctive in measuring the property to be measured. Internal coefficients of consistency (Cronbach Alpha) were calculated as .77 for the overall acceptance factor, .85 for the individual awareness factor, .79 for the usability factor, and .68 for practical effectiveness. The internal coefficient of consistency for the entire scale was found to be 0.904.

Accordingly, as a result of repeated Discriminant function analysis for the current study, it was observed that compliance indexes indicate sufficient compliance (CMIN/DF= 3.77; GFI = .83; AGFI = .79; NFI = .87; CFI = .90; SRMR = .05). Although it is suggested that the GFI and AGFI values of absolute compliance indices which are between 0.90 and 0.95 indicate a satisfactory level of compliance, Anderson & Gerbing and Marsh et al. states that situations where the GFI value is 0.85 and the AGFI value is above 0.80 are also acceptable for compliance

[27,28]. It can be seen that the above-mentioned values are close to the specified values. The calculated reliability coefficients of OLAS were found to be .82 for general acceptance factor, .92 for the individual awareness factor, .87 for the usability factor and .70 for practical effectiveness. The reliability coefficient calculated for the whole of OLAS is.94. Based on this, both the four subscales and the whole of OLAS are over the lower limit necessary for the measurement tool to be considered reliable which is .70 [21,29–31].

Academic Self-Sufficiency Scale (ASSS): ASSS used in the research was developed by Yılmaz et al. to measure the level of academic self-sufficiency of university students [32]. ASSS has a likert type of 5 and consists of a total of 7 items. It turned out that the scale adapted to Turkish is one-dimensional as in the original scale, and consists of a total of 7 items. Scale explains a total of 45% of the variance on academic self-sufficiency. Factor load values of items vary between .50 and .82. The higher the scores taken from the sum of the scale, the higher the level of academic self-sufficiency of the individual. As a result of the analysis based on the internal consistency criteria, it was concluded that the factors contained in the scale were distinctive in measuring the property to be measured. The Cronbach alpha reliability value of the scale is .79.

Accordingly, as a result of repeated Discriminant function analysis for the current study, it was observed that compliance indexes indicate sufficient compliance (RMSEA = .12; GFI = .93; AGFI = .86; NFI = .91; CFI = .92; SRMR = .052). The reliability coefficient for ASSS was calculated as .83. Based on this, we can say that the whole of ASSS is over the lower limit necessary for the measurement tool to be considered reliable which is .70 [21,29–31].

Coronavirus Anxiety Scale (CAS). The CAS used in the study was developed by Biçer et al. to measure the anxiety levels of university students related to coronavirus pandemic [33]. CAS has a likert type of 5 and consists of a total of 5 items. CAS which has been studied for validity and reliability, shows the same characteristics as the original scale, which is one-dimensional and consists of five questions. As a result of statistical analysis, the Cronbach Alpha reliability coefficient of the scale consisting of 5 questions and one dimension was calculated as 0.832. Factor loads for the items of the scale consisting of a single factor and 5 items vary between 0.625 and 0.784. Scale explains a total of 60.54% of the variance on academic self-sufficiency. The higher the scores taken from the sum of the scale, the higher the level of coronavirus anxiety of the individual.

Accordingly, as a result of repeated Discriminant function analysis for the current study, it was observed that compliance indexes indicate sufficient compliance (RMSEA = .16; GFI = .94; AGFI = .82; NFI = .91; CFI = .95; SRMR = .034). The reliability coefficient for CAS was calculated as .91. Based on this, we can say that the whole of CAS is over the lower limit necessary for the measurement tool to be considered reliable which is .70 [21,29–31].

Life Satisfaction Scale (LSS). The LSS used in the research was developed by Dağlı et al. in order to get the students' views on their satisfaction from life [34]. LSS has a likert type of 5 and consists of a total of 5 items. LSS which has been studied for validity and reliability, shows the same characteristics as the original scale, which is one-dimensional and consists of five questions. To test the consistency between scores from both scales, pearson product-moment correlation coefficient was calculated and it was found to be 0.92. As a result of statistical analysis, the Cronbach Alpha reliability coefficient of the scale consisting of 5 questions and one dimension was calculated as 0.832. Cronbach Alpha internal consistency coefficient of the scale was found to be 0.88 and test-retest reliability was found to be 0.97. The results of the factor analysis revealed that the LSS showed a single-factor structure, as it was on the original scale, and consisted of 5 items, again as in the original scale. Factor load values of the scale vary between .72 and .89. The scale describes a total of 68.38% of the variance for life satisfaction. The higher the scores taken from the sum of the scale, the higher the level of life satisfaction of the individual.

Accordingly, as a result of repeated Discriminant function analysis for the current study, it was observed that compliance indexes indicate sufficient compliance (RMSEA = .06; GFI = .98; AGFI = .96; NFI = .98; CFI = .98; SRMR = .023). The reliability coefficient for LSS was calculated as 84. Based on this, we can say that the whole of LSS is over the lower limit necessary for the measurement tool to be considered reliable which is .70 [21,29–31].

Statistical analysis.

Permissions to use the scale and other data collection tools in the research process and approval of the Ethics Committee have been obtained. The scale questions uploaded to the online system were answered with the participation of a total of 383 students. After the data was uploaded to the digital environment, the data set was tested for parametric statistical analysis. The analysis was conducted with version 22 of IBM SPSS Statistics and version 24 of IBM SPSS AMOS (Chicago, USA). In order to make structural equality modelling in the analysis of the data, some assumptions had to be made. The assumptions in question are that observable and implicit variables have a multivariate normal distribution, there are no multiple linear connections between variables and the extraction of outliers in the data set [35–37]. For this purpose, z test and coefficients of kurtosis and skewness were examined (-1, +1) [38], (-2, +2) [39]. However, it was determined that the coefficients of kurtosis and skewness of the data were in the specified ranges for online learning (.18; -.54), academic self-sufficiency (-.14;-.06), coronavirus anxiety (.74; -.10) and life satisfaction (.05; -.46). In the next step, the end values (outliers) were examined and at this stage, 3 data sets that deviated from the normal distribution were excluded from the analysis. In order to examine the multi-directional end values alongside the single-directional end value analysis, the Mahalonobis distance coefficients were examined and 1 data set was

taken out of the analysis by taking this into account. After analysing the single directional and multi directional end values, Assessment of normality test was carried out and it was understood that the data met the conditions of multiple normality. After the normal distribution counts were tested, the variance inflation factors and Auto-Correlation were examined before the analysis and after it was determined that there was no auto-correlation and the variance inflation factors were within the required limit values, it was decided that the data set was suitable for parametric statistical analysis. Path analysis was carried out within the framework of structural equality modelling to determine the direct and indirect predicting power of the independent variable over the dependent one. X^2/Sd, RMSEA, RMR, CFI, IFI, NFI, GFI and AGFI compliance indexes were used to evaluate the compliance of path analysis model.

Results

Findings regarding the Descriptive Statistics of Variables.

Descriptive statistics, range, kurtosis and skewness features for all scales are presented in Table 1.

The average scores of participants appear to be slightly above the midpoint for all variables except coronavirus anxiety. It has been observed that the values of kurtosis and skewness meet the +1 and -1 range which is the assumption of normality [40,41].

Findings regarding the study of online education attitudes via path analysis.

At the data analysis stage, correlation analysis was conducted to test the correlations between "online education attitude", which is the predicted variable of the research, and "coronavirus anxiety", "academic self-sufficiency and "life satisfaction" which are the predictors. Correlations between variables were studied by using pearson product-moment correlation analysis. Correlations between the variables are presented in Table 2.

There is a positive and statistically significant correlation between the total scores received by the students participating in the study for online learning attitude scale and its lower dimensions. Online learning attitude scale scores appear to have a positive and low-level correlation with academic self-sufficiency and life satisfaction scales. In addition, it is understood that it has a negative and low-level correlation with the coronavirus anxiety scale. The Predictor effect of "coronavirus anxiety", "academic self-sufficiency", "life satisfaction" variables on the "online learning" variable was tested by path analysis in the following figure.

In the model presented in Figure 1, model compliance

Table 1. Descriptive statistical results for variables

Scales	Number of people	Range	Average	Standard Deviation	Skewness	Kurtosis
Online Total	379	1-5	2.79	0.91	0.18	0.54
General Acceptance	379	1-5	2.73	0.89	0.20	0.61
Individual Difference	379	1-5	2.39	1.09	0.62	0.41
Usability	379	1-5	3.00	1.22	0.04	0.93
Practical Effectiveness	379	1-5	3.03	0.92	0.32	0.08
Coronavirus Anxiety	379	1-5	2.15	1.03	0.74	0.10
Academic Self-sufficiency	379	1-5	3.87	0.62	0.14	0.06
Life Satisfaction	379	1-5	2.82	0.92	0.05	0.46

Table 2. Examination of the correlations between variables using pearson product-moment correlation analysis.

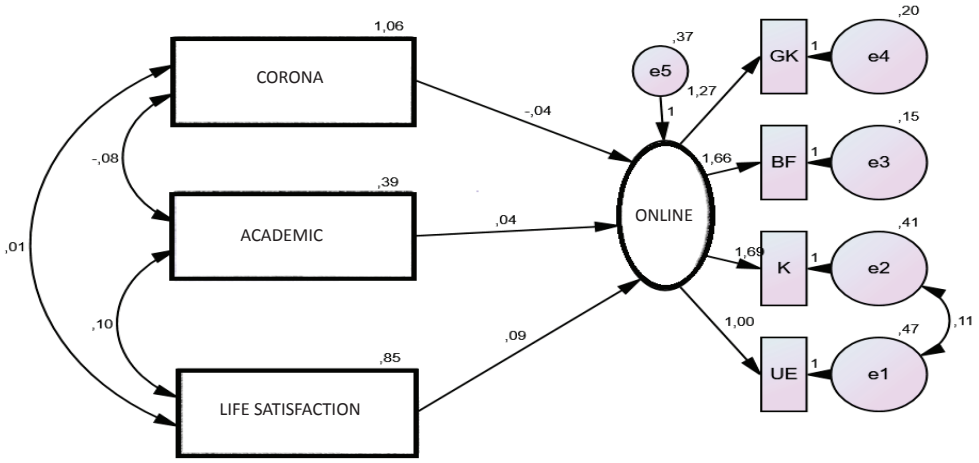
Scales	Online Total	GA	ID	U	PE	U	AS	LS
Online Total								
General Acceptance	.878**							
Individual Difference	.921**	.810**						
Usability	.921**	.741**	.793**					
Practical Effectiveness	.802**	.568**	.629**	.668**				
Coronavirus Anxiety	-.082	-.068	-.056	-.094	-.066			
Academic Self-sufficiency	.074	.072	.058	.054	.083	-.118*		
Life Satisfaction	.130*	.165**	.130*	.058	.125*	.008	.173**	

**. Correlation is significant at the 0.01 level (2-tailed); *. Correlation is significant at the 0.05 level (2-tailed); GA: General Acceptance, ID: Individual Difference U: Usability, PE: Practical Effectiveness, AS: Academic Self-Sufficiency, LS: Life Satisfaction.

indexes were first examined without any modifications, but it was observed that the model did not meet the required compliance criteria as is (x2 = 31,769, sd = 11, x2/sd = 2.88, RMSEA = .071, SRMR = .022 CFI = .98, GFI = .97, NFI = .97, TLI = .96, AGFI= .94). The recommended modifications for the model were then examined and in line with these recommendations, the errors related to the "usability" and "practical effectiveness" items are drawn and associated with the bidirectional covariance and one modification was applied.

Table 3 has been created to make the operations before and after the modification more understandable. As seen in Table 3, post-change fit indices were examined in all aspects and it was checked whether they met the required values. The chi-square value of the model is 13,955 and the degree of freedom is 10. The division chi-Square to the degree of freedom (1,396) results in a value less than 3.00. The GFI (.99) value of the measuring model is within the acceptable range [42,43]. RMSEA and SRMR values with acceptable goodness ranges 0.05 and 0.08 are .032 and.01, respectively. Schermelleh-Engel &Moosbrugger interpreted the SRMR and RMSEA values smaller than 0.05 as a good fit indicator [44]. As an absolute compliance goodness index, it can be stated that the AGFI value (.97) is close to 1 which is an acceptable value. The model's NFI value (0.98) and complex-regulated CFI (0.99) were also observed to be within the acceptable compliance range [42,43,45].

Table 4 has been created to better understand the parameter estimates and coefficients on behalf of the structural equation model. As seen in Table 4, it was determined that the paths formed by the sub-dimensions of online learning attitude in the tested structural model showed statistical significance (p <.001). Also, it was determined that the path with life satisfaction (p<.05) was significant, and not significant with academic self-sufficiency and coronavirus anxiety. Total and direct impact values show that academic self-sufficiency (β = .04) and life satisfaction (β = .13) directly and positively affect the online learning attitude variable. Coronavirus anxiety (β =-.076) directly and negatively affects the online learning attitude variable. In the model, the total



CMIN=13,955;DF=10;CMIN/DF=1,396;RMSEA=,032;GFI=,990;CFI=,996; NFI=,987; TLI=,992

Figure 1. Path diagram regarding the prediction of online learning attitude

Table 3. Compliance values of the structural equality model

Compliance Indexes			**Pre-Modification**	**Post-Modification**
Compliance Index	**Acceptable Compliance Index**	**Perfect Compliance Index**		
X^2			31.769	13.955
Degree of Freedom (df)			11	10
X^2/df	1-5	0 ≤ χ2/df ≤ 2	**2.88**	**1.39**
GFI	0.90≤GFI≤0.95	0.95≤ GFI ≤1.00	.97	.99
AGFI	0.85≤AGFI≤0.90	0.90≤AGFI≤1.00	.94	.97
SRMR	0.05≤SRMR≤0.10	0≤ SRMR ≤0.05	.02	.01
RMSEA	0.05≤RMSEA≤0.08	0≤ RMSEA ≤0.05	.07	.03
CFI	0.95≤CFI≤0.97	0.97≤ CFI ≤1.00	.98	.99
TLI	0.95≤NNFI≤0.97	0.97≤NNFI≤1.00	.96	.99
NFI	0.90≤NFI≤0.95	0.95≤ NFI≤1.00	.97	.98

Table 4. Parameter estimates and coefficients for structural model

Hidden and Observable Variables			β	B	S.E.	t	p
Structural Equality Model							
Ç	<---	CA	-.076	-.057	.040	-1.42	.155
Ç	<---	AS	.040	.049	.067	.740	.459
Ç	<---	LS	.131	.110	.045	2.447	<.05
GA	<---	Ç	.865	1			
ID	<---	Ç	.921	1.302	.054	24.321	<.001
U	<---	Ç	.868	1.37	.062	22.257	<.001
PE	<---	Ç	.699	.830	.053	15.725	<.001

* These values are equal to 1 for estimation purposes; Ç: Online Learning Attitude, GA: General Acceptance, ID: Individual Difference U: Usability, PE: Practical Effectiveness, CA: Coronavirus Anxiety, AS: Academic Self-Sufficiency, LS: Life Satisfaction.

effect of the academic self-sufficiency variable on online learning attitude was determined as d = .04, while the total effect of the life satisfaction variable on online learning attitude was calculated as d = .13. The effect of coronavirus anxiety variable on online learning attitude was found to be d = .08. Cohen (1988) says that in cases where the impact magnitude value is lower than .2, we can talk about a weak effect, in cases where the impact value is between .3 and .5, we can talk about a medium effect, and in cases where the impact value is .8 and above, it can be considered as a high level of impact. Based on this, it can be said that academic self-sufficiency, life satisfaction, and coronavirus anxiety have a low impact on online learning attitudes. In addition, academic self-sufficiency, life satisfaction and coronavirus anxiety variables together account for a total of 3% of the change in the online learning attitude variable (R^2 = .026).

Conclusion

The transformation of Covid-19 virus into a pandemic around the world affected education and higher education systems in all countries and led to the use of distance education as a substitute for face-to-face education with the support of governments in order to slow the spread of the disease in educational structures [46]. One past research on distance education demonstrates that students ' attitudes towards distance education were at a near-ambivalent level [47], while some other research [48,49] shows that attitudes towards distance education lead to both positive and negative outcomes. Today, when it is a necessity to keep up with rapidly changing information age, higher education institutions have a very important task of incorporating technology into the educational lives of their students while preparing them for a life of work. With the integration of computer and internet technology into distance education programs, the concept of online learning has emerged. Online learning which provides education to students without space and time constraints effectively manages the process by forming interactions of student-student, student-teacher, student content or student system [50].

While online learning activities were usually carried out on request, coronavirus (COVİD-19) pandemic which started around March 2020 has made it mandatory in universities all over the country [51]. Attitudes are predicted to be an important tool in the performance of students [52]. Because any negative performance can be associated with a negative attitude [53]. If the attitude shown is negative and insignificant, the student may have a reduced chance of entering into the learning process [54]. Dhull & Sakshi points out that failure to carefully schedule online learning activities can seriously disrupt the learning process [55]. Therefore, students' ability to develop time management in the online learning process is an important criterion. As Hung et al. stated, students are required to devote sufficient time to the course, participate in discussions and respond to related messages and establish self-discipline in order to perform the tasks given [56]. In the study conducted by Yaman, it was reported that while the students of the physical education and sports departments thought that distance education was a useful education system, the students of the sports management department had some negative ideas about it [57]. Although online distance education offers flexibility in many respects, it is thought that it is not sufficient in terms of psycho-motor learning, which plays an important role in gaining skills, and that distance education is more suitable for theoretical courses [58].

In the study conducted by Aktaş et al., it was reported that the majority of university students thought their social life was temporarily over during the pandemic [13]. In the study of Yalçın et al. with students, it was determined that the fear of Covid-19 positively predicted depression, anxiety and stress [59]. Çetin & Anuk states that students' future concerns and dissatisfactions and death in their families or close circles have been widespread during the pandemic [60]. Duman has revealed that students had moderate levels of fear during the COVID-19 pandemic [61]. Cao et al. found high levels of stress and anxiety among the university students in China [62]. Dikmen stated that although students were found to be moderately depressed, some students were found to have

very severe symptoms of depression [63]. In a study conducted by Çölgeçen & Çölgeçen where the majority of participants were university students, it is stated that the average anxiety of individuals was above the average constant anxiety, and this was associated with the stressful situations due to the pandemic [64]. Şen & Kızılcalıoğlu concluded that students were dissatisfied with the distance learning process for reasons such as the boring courses in the distance learning method, the hindrance social life, and the lack of connection established with academicians [65]. Acar et al., examined the anxiety levels of sports science students during the Covid-19 pandemic and found that the students' anxiety levels were high [66].

Saltürk & Güngör state that emotional and physical deprivation affects the academic motivation of students [67]. In addition, they state that not being able to socialize and do physical activities have a predicting role on academic motivation. The current study showed that Covid-19 pandemic lockdowns affect the academic performance of most participants to varying degrees. For the veterinary medical sciences, the main challenges faced by online education are related to the lack of practical courses. Dai, D. & Xia, in their study, stated that the e-learning platform implemented in China with the motto "School is Out, but Class is On" significantly improved the academic performance of students [68]. In addition, Eroğlu et al. has identified a positive and highly significant relationship between students' academic self-sufficiency scores and academic motivation levels, which are important indicators of the teaching process [69].

Satıcı et al. examined the correlations between Covid-19 fear and life satisfaction, depression, anxiety and stress variables [70]. As a result of that research, it was determined that the fear of Covid-19 negatively affects life satisfaction. Kaçik & Acar reported that the average life satisfaction scores of students were slightly above average [71]. Ekizler states that optimistic (life satisfaction) students who are satisfied, happy and feel useful also have lower overall concerns about COVID-19 [72]. Addressing the need to consciously expand awareness in order to reduce anxiety and increase life satisfaction during the COVID-19 outbreak is important [73,74].

In this research, which created a model for understanding online learning attitudes in students of the faculty of sports sciences, it was understood that coronavirus anxiety has a statistically significant effect on online learning attitudes while academic self-sufficiency and life satisfaction do not have a statistically significant effect. As students' coronavirus anxiety levels decrease and their academic self-sufficiency and life satisfaction levels increase, their attitudes towards online learning also increase. As in many other institutions of education, university education continues remotely (online). It can be foreseen that the current and future teaching processes will be carried out in the same way. Students' positive attitude towards online learning and understanding the predictors of this attitude will be a development to be appreciated by all stakeholders of the subject. In this research, it was seen that the attitude towards online learning is significantly predicted by the life satisfaction variable. So, there is a need to increase the life satisfaction levels of the students and to investigate the factors that are thought to have an effect on it. It can also be said that the attitude towards online learning should also be predicted by the variables that are mostly left out in the literature.

Suggestions:

To establish a national understanding by conducting this research nationwide,

Using qualitative techniques such as observation and interviewing in a study to be carried out in the same subject,

In a study on online learning attitudes, it may be recommended to consult to family members, instructors and administrative staff who are considered to be influential in the attitudes of students.

Conflicts of Interest

The authors declare no conflict of interest.

References

1. Hergüner G, Yaman Ç, Sarı SÇ, Yaman MS, Dönmez A. The effect of online learning attitudes of sports sciences students on their learning readiness to learn online in the era of the new coronavirus pandemic (Covid-19). T*urkish Online J Educ Technol*. 2021; 20:68–77.
2. Watkins R, Leigh D, Triner D. Assessing readiness for e-learning. *Perform Improv Q.* 2004; 17:66–79. https://doi.org/10.1111/j.1937-8327.2004.tb00321.x
3. Yamamoto G, Altun D. The coronavirus and the unstoppable rise of online education. *Journal of University Studies.* 2020;3:25–34. https://doi.org/10.32329/uad.711110
4. Zhong R. The coronavirus exposes education's digital divide. *New York Times.* 2020;18.
5. Aldhafeeri FM, Khan BH. Teachers' and students' views on e-learning readiness in Kuwait's secondary public schools. *J Educ Technol Syst.* 2016; 45:202–35. https://doi.org/10.1177/0047239516646747.
6. *Higher Education Information Management System* [Internet]. 2021 [cited 2021 Feb 26]. Available from: https://istatistik.yok.gov.tr/
7. Alomyan H, Au W. Exploration of ınstructional strategies and ındividual difference within the context of web-based learning. *Int Educ J.* 2004; 4:86–91.
8. Pierce R, Stacey K, Barkatsas A. A scale for monitoring students' attitudes to learning mathematics with technology. *Comput Educ.* 2007; 48:285–300. https://doi.org/10.1016/j.compedu.2005.01.006
9. Scheiter K, Gerjets P. Learner control in hypermedia environments. *Educ Psychol Rev.* 2007; 19:285–307. https://doi.org/10.1007/s10648-007-9046-3
10. Yang A, Lau L. Student attitudes to the learning of English at secondary and tertiary levels. *System*. 2003; 31:107–23. https://doi.org/10.1016/S0346-251X(02)00076-3
11. Merisuo-Storm T. Pupils' attitudes towards foreign-language learning and the development of literacy skills in bilingual education. *Teach Teach Educ.* 2007; 23:226–35.

https://doi.org/10.1016/j.tate.2006.04.024
12. Yudko E, Hirakawa R, Chi R. Attitudes, beliefs, and attendance in a hybrid course. *Comput Educ.* 2007; 50:1217–27. https://doi.org/10.1016/j.compedu.2006.11.005
13. Aktaş Ö, Büyüktaş B, Gülle M, Yıldız M. Attitudes of sports science students towards distance education during the days of isolation caused by the covid-19 virus. *Sivas Cumhuriyet University Sports Science Journal*. 2020; 1:1–9.
14. Buhr K, Dugas MJ. The intolerance of uncertainty scale: Psychometric properties of the English version. *Behav Res Ther.* 2002; 40:931–45. https://doi.org/10.1016/S0005-7967(01)00092-4
15. Öncü H. Adaptation of the academic self-efficacy scale into Turkish. *J Kirsehir Educ Fac.* 2012;13.
16. Zimmerman BJ. Self-efficacy and educational development. *Self-Efficacy Chang Soc.* 1995; 1:202–31. https://doi.org/10.1017/CBO9780511527692.009
17. Suk Hwang Y, Vrangistinos K. Elementary ın-service teachers' self-regulated learning strategies related to their academic achievements. *J Instr Psychol.* 2002; 29:147–54.
18. Hampton NZ, Mason E. Learning disabilities, gender, sources of efficacy, self-efficacy beliefs, and academic achievement in high school students. *J Sch Psychol.* 2003; 41:101–12. https://doi.org/10.1016/S0022-4405(03)00028-1
19. Alcı B, Erden M, Baykal A. The pattern of explanatory and predictive relationships between university students' mathematics achievement and their perceived problem-solving skills, self-efficacy perceptions, metacognitive self-regulation strategies and OSS numerical scores. *Boğaziçi University Education Journal*.2008;25:53–68.
20. Huebner ES, Antaramian SP, Hills KJ, Lewis AD, Saha R. Stability and predictive validity of the brief multidimensional students' life satisfaction scale. *Child Indic Res.* 2011; 4:161–8. https://doi.org/10.1007/s12187-010-9082-2
21. Fraenkel JR, Wallen NE, Hyun HH. *How to design and evaluate research in education*. New York: McGraw Hill; 2012.
22. Gürbüz S, Şahin F. *Research methods in social sciences*. Ankara: Seçkin Publishing; 2016.
23. Ullman JB. Structural equation modeling. In: Tabachnick BG, Fidell LS, editors. *Using Multivar Stat.* 4th ed. Boston, MA: Allyn & Bacon; 2001. p. 653–771.
24. Tanaka JS, Panter AT, Winborne WC, Huba GJ. Theory in personality and social psychology with structural equation models: A primer in 20 questions. In: Hendrik C, Clark M, editors. *Rev Pers Soc Psychol.* New bury Park: Sage; 1990. p. 217–41.
25. Preacher KJ, Coffman DL. *Computing power and minimum sample size for RMSEA* [Computer software]. 2006.
26. Usta İ, Uysal Ö, Okur MR. Online learning attitude scale: development, validity and reliability. *J Int Soc Res.* 2016; 9:2215–22. https://doi.org/10.17719/jisr.20164317786
27. Anderson JC, Gerbing DW. The effect of sampling error on convergence, improper solutions, and goodness-of-fit indices for maximum likelihood confirmatory factor analysis. *Psychometrika*. 1984; 49:391–411. https://doi.org/10.1007/BF02294170
28. Marsh HW, Balla JR, McDonald RP. Goodness-of-fit indices in confirmatory factor analysis: Effects of sample size. *Psychol Bull.* 1988; 103:391–411. https://doi.org/10.1037/0033-2909.103.3.39
29. Creswell JW. *Educational research: planning, conducting, and evaluating quantitative and qualitative research.* 4th ed. Pearson Education Inc.; 2012.
30. DeVellis RF. *Scale development: Theory and applications.* Newbury Park: Sage Publications; 2003.
31. Domino G, Domino ML. *Psychological testing: An introduction*. Cambridge: Cambridge University Press; 2006. https://doi.org/10.1017/CBO9780511813757
32. Yılmaz M, Gürçay D, Ekici G. Adaptation of the academic self-efficacy scale into Turkish. *Hacettepe University Faculty of Education Journal.* 2007; 33:253–9.
33. Biçer İ, Çakmak C, Demir H, Kurt ME. Coronavirus anxiety scale short form: Turkish validity and reliability study. *Anadolu Klin Medical Science Journal.* 2020; 25:216–25. https://doi.org/10.21673/anadoluklin.731092
34. Dağlı A, Baysal N. Adaptation of life satisfaction scale into Turkish: validity and reliability study. *Electron Sos Science Journal.* 2016;15. https://doi.org/10.14689/ejer.2015.58.1
35. Çokluk Ö, Şekercioğlu, G. Büyüköztürk Ş. *Multivariate statistics for social sciences: SPSS and LISREL applications.* Ankara: Pegem Academy; 2016.
36. Şimşek ÖF. *Introduction to structural equation modeling: Fundamentals and applications of LISREL*. Ankara: Ekinoks; 2007.
37. Sümer N. Structural equation models: Basic concepts and sample applications. *Turkish Psychological Writings.* 2000; 3:49–74.
38. Tabachnick B, Fidell L. *Using multivariate statistics*. 5th ed. Boston, MA: Allyn & Bacon; 2007.
39. George D, Mallery P. *SPSS for Windows step by step: A simple guide and reference*. 11.0 update. 4th ed. Boston, MA: Allyn & Bacon; 2003.
40. Can A. *Quantitative data analysis in scientific research process with SPSS*. Ankara: Pegem Academy Publications; 2016.
41. Morgan GA, Leech NL, Gloeckner GW, Barrett KC. *SPSS for introductory statistics: Use and interpretation.* Psychology Press; 2004. https://doi.org/10.4324/9781410610539
42. Arbuckle JL. *Amos 5.0 update to the AMOS user's guide içinde*. Chicago: Small Waters Corp.; 2003.
43. Byrne BM. *Structural equation modeling with AMOS, basics concepts, applications, and programming*. Hillsdale, NJ: Lawrence Erlbaum Associates; 2001.
44. Schermelleh-Engel K, Moosbrugger H. Evaluating the fit of structural equation models: tests of significance and descriptive goodness-of-fit measures. *Methods Psychol Res Online.* 2003; 8:23–74.
45. Hair JF, Black WC, Babin BJ, Anderson RE. *Multivariate data analysis*. 7th ed. Upper Saddle River, NJ: Prentice Hall; 2009.
46. Telli SG, Altun D. The coronavirus and the unstoppable rise of online education. *Journal of University Studies*. 2020; 3:25–34. https://doi.org/10.32329/uad.711110
47. Brinkerhoff J, Koroghlanian CM. Student computer skills and attitudes toward ınternet-delivered ınstruction: an assessment of stability over time and place. *J Educ Comput Res.* 2005; 32:27–56. https://doi.org/10.2190/AR4T-V3P8-UMMX-AB4L
48. Belcheir MJ, Cucek M. *Faculty perceptions of teaching distance education courses*. Idaho; 2002.
49. Drennan J, Kennedy J, Pisarski A. Factors affecting student attitudes toward flexible online learning in management education. *J Educ Res.* 2005; 98:331–8. https://doi.org/10.3200/JOER.98.6.331-338
50. Moore RE. *Effects of the use of two different teaching styles on motor skill acquisition of fifth-grade students* [Doctoral

Dissertation]. [Texas]: East Texas State University; 1996.
51. Sarıtaş E, Barutçu S. Digital transformation in teaching and students' readiness for online learning: A study on Pamukkale University students during the pandemic period. *Journal of Internet Applications and Management.* 2020; 11:5–22.
52. Love EG, Love DW, Northcraft GB. Is the end in sight? Student regulation of in-class and extra-credit effort in response to performance feedback. *Acad Manag Learn Educ.* 2010; 9:81–97. https://doi.org/10.5465/amle.9.1.zqr81
53. Sadik A, Reisman S. Design and implementation of a web-based learning environment: Lessons learned. *Q Rev Distance Educ.* 2004; 5:157–71.
54. Prior DD, Mazanov J, Meacheam D, Heaslip G, Hanson J. Attitude, digital literacy and self-efficacy: Flow-on effects for online learning behavior. *Internet High Educ.* 2016; 29:91–7. https://doi.org/10.1016/j.iheduc.2016.01.001
55. Dhull I, Sakshi M. Online learning. *Int Educ Res J.* 2017;3.
56. Hung ML, Chou C, Chen CH, Own ZY. Learner readiness for online learning: Scale development and student perceptions. *Comput Educ.* 2010; 55:1080–90. https://doi.org/10.1016/j.compedu.2010.05.004
57. Yaman M. Perceptions of students on the application of distance education in physical education lessons. *Online Submiss.* 2009;8.
58. Dutile C, Wright N, Beauchesne M. Virtual clinical education: going the full distance in nursing education. *Newborn Infant Nurs Rev.* 2011; 11:43–8. https://doi.org/10.1053/j.nainr.2010.12.008
59. Yalçın İ, Mançe Çalışır Ö, Can N, Yalçın S, Çolak B. *Protective and moderator effect of risk factors on the relationship between fear of COVID-19 and mental health variables*. Ankara; 2020.
60. Çetin C, Anuk Ö. Loneliness and resilience during the COVID-19 pandemic: A sample of public university students. *Journal of Eurasia Sauce and Econ Research*. 2020; 7:170–89.
61. Duman N. Fear of COVID-19 and intolerance of uncertainty in college students. *J Soc Sci.* 2020; 4:426–37.
62. Cao W, Fang Z, Hou G, Han M, Xu X, Dong J, et al. The psychological impact of the covid-19 epidemic on college students in China. *Psychiatry Resesarch*. 2020; 287:1–5. https://doi.org/10.1016/j.psychres.2020.112934
63. Dikmen M. The relationship between university students' depression levels and social media addictions in the COVID-19 pandemic: A structural equation model. *Journal of Addiction - J Depend.* 2021; 22:20–30.
64. Çölgeçen Y, Çölgeçen H. Evaluation of anxiety levels due to the Covid-19 pandemic: The case of Turkey. *Electron Turkish Stud.* 2020;15. https://doi.org/10.7827/TurkishStudies.44399
65. Şen Ö, Kızılcalıoğlu G. Determining the views of university students and academicians on distance education during the Covid-19 pandemic process. *Int J 3D Print Technol Digit Ind.* 2020; 4:239–52.
66. Acar K, Mor A, Baynaz K, Arslanoğlu E. An investigation on anxiety states of students in faculty of sport sciences during COVID-19. *Int J Disabil Sport Heal Sci.* 2020; 3:66–73. https://doi.org/10.33438/ijdshs.736875
67. Saltürk A, Güngör C. The experience of transition to distance education during the covid-19 pandemic period from the eyes of university students. *J Soc Sci.* 2020; 36:137–74.
68. Dai, D. & Xia X. Whether the school self-developed e-learning platform is more conducive to learning during the Covıd-19 pandemic? *Best Evid Chin Edu.* 2020; 5:569–80. https://doi.org/10.15354/bece.20.ar030
69. Eroğlu O, Yıldırım Y, Şahan H. Examining the relationship between academic self-efficacy and academic motivation levels of students in the faculty of sports sciences: The case of Akdeniz University. *Turkish Journal of Sports Science.* 2017; 1:38–47.
70. Satıcı B, Gocet-Tekin E, Deniz ME, Satıcı SA. Adaptation of the Fear of COVID-19 Scale: Its association with psychological distress and life satisfaction in Turkey. *Int J Ment Health Addict.* 2020. https://doi.org/10.1007/s11469-020-00294-0
71. Kaçik S, Acar F. Examination of university students' fear of missing out and their level of life satisfaction in terms of demographic variables. *Kayseri University Sos Science Journal.* 2020; 2:74–90.
72. Ekizler H. The effect of mental well-being on covid-19 related anxieties. *J Curr Res Bus Econ*. 2020; 10:173–86. https://doi.org/10.26579/jocrebe.81
73. Behan C. The benefits of meditation and mindfulness practices during times of crisis such as COVID-19. *Ir J Psychol Med.* 2020;1. https://doi.org/10.1017/ipm.2020.38
74. Di Giuseppe M, Gemignani A, Conversano C. Psychological resources against the traumatic experience of COVID-19. *Clin Neuropsychiatry.* 2020;17.

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04

REVIEW ARTICLE

A scientific overview of the impact of COVID-19 pandemic on sports affairs: A systematic review

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Authors' contributions: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Background and Study Aim: COVID-19 pandemic has impacted all spheres of human life. This study presents the impact of the COVID-19 pandemic on sports activities and the life of sportsmen. It is analysed the inter-connected themes for identifying research trends and motifs from the published studies between March 2020 to March 2021.

Material and Methods: With the assistance of the UTM library for accessing online databases and electronic resources of Scopus, Web of Science, and ScienceDirect a rigorous search for published collecting data on the impact of COVID-19 on the sports participation and sportsmen was carried out. 650 studies retrieved from the reputable online database of Web of Science, ScienceDirect, and Scopus. 32 studies of which are matched with the criteria for analyzing through NVIVO-12 and Vos Viewer software. For selecting the articles most relevant to the objectives of this study, the principles of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were followed.

Results: The results show that the COVID-19 pandemic mostly influences making constraints on physical activities. The mental and physical life were concurrently impacted by it. Bibliometrics analysis for key-word and term co-occurrence indicates that the research trend of COVID-19 and its impact was mainly focused on COVID-19 and Mental health or physical health or economic life of the stakeholders of sports affairs.

Conclusions: This study has some implications for the players for maintaining a healthy life and for the authority of managing impacts, and researchers researching with new dimensions.

Keywords: impact of COVID-19, sports participation, sports activities, PRISMA

Introduction

The pandemic of COVID-19 has impacted all spheres of life since its inception. The novel coronavirus disease 2019 (COVID-19) was discovered in late December 2019 in the Chinese city of Wuhan and has since spread throughout the world. Later, COVID-19 was declared a global emergency on January 30th, 2020 and a global pandemic on March 11th, 2020 by the World Health Organization (WHO). Now, COVID-19 is currently affecting more than 225 countries and territories (WHO, 2021). Due to the disease's high infectiousness, it can easily be transmitted from person to person through respiratory droplets and various contact points such as the hands, nose, and mouth (2020) [1]. Thus, social distancing has become a buzzing word in the globe right now. Many countries have put a state of lockdown avoiding person-to-person contact and any kinds of the congregation [2]. Thus, the field of sports affairs has been also suffering from this humanitarian crisis.

The COVID-19 pandemic compelled governments to take unprecedented steps to contain the disease's rapid spread, including strict lockdowns, the prohibition of all organized and social gatherings (including sporting events), and the restriction of all non-essential travel, all of which had a direct impact on the sports industry and athletes [3]. Many countries have postponed the local professional football leagues for considering health issues after much deliberation on the transmission risk for the spectators and on-field players [2]. The consequences of COVID-19 have resulted in a decrease in income, and elite football clubs are struggling to control the pandemic's economic impact [4]. Even international sports competition such as the Union of European Football Associations (UEFA) formally decided to postpone the top tier UEFA Champions League Final and other games on March 23, 2020, until further notice; the International Olympic Committee (IOC), along with the Japanese government rescheduled the 2020 Tokyo Olympics to July 2021 keeping the name of 2020 Tokyo Olympics [2].

However, the COVID-19 pandemic has left sports stakeholders with serious uncertainty about regulatory, economic, social, and technological consequences [5]. Many scientific studies (peer-reviewed and non-peer-reviewed) have been published dealing with epidemiology, pathogenesis, complications, and treatment in the field of sports affairs [6]. Nonetheless, this study will project the impact of the COVID-19 pandemic on sports activities and the life of sportsmen by illustrating inter-connected themes for identifying research trends and motifs from the

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published studies between March 2020 to March 2021.

Objectives

For the projection of the current status of the sports participation and activities in the published studies during the COVID-19 pandemic the following research questions were set for

1. How was the impact of the COVID-19 Pandemic on sports activities?
2. How was the impact of the COVID-19 pandemic on the life and health of sportsmen?
3. What are the inter-connected themes on the impact of the COVID-19 pandemic on the sports participation of these studies?

Material and Methods

A rigorous electronic search of articles was carried out into the reputable online database of Scopus, Web of Science, and ScienceDirect through February 2021 to confirm the reliability of this study. The principles of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were followed to select the articles most relevant to the objectives of this study. The PRISMA model is an evidence-based set of items envisioned to prepare authors to report a wide range of systematic reviews and meta-analyses [7]. PRISMA has been successfully taken place in many earlier educational studies [8–10]. Peer-Reviewed Instructional Materials Online Database (PRIMO) was employed for searching articles published during the COVID-19 pandemic on the impact of COVID-19 on sports participation and sportsmen from March 2020 to February 2021 in the database of Scopus, Web of Science and ScienceDirect (Figure 1).

Search methods

With the assistance of the UTM library for accessing online databases and electronic resources of Scopus, Web of Science, and ScienceDirect a rigorous search for published collecting data on the impact of COVID-19 on the sports participation and sportsmen was carried out. The authors used the Boolean method on keywords for searching articles. The keywords were "impact of COVID-19", "Sports Participations", "Sports activities" and "Sportsmen" from March 2020 to March 2021. All non-English papers, studies other than sports activities, and studies are written earlier the COVID were excluded. We included all the studies that dealt with the impact of COVID-19 on sportsmen and sports participation in the world.

Study selection

Fig. 1 shows the PRISMA flow diagram for the search and inclusion process of this study. Researchers independently checked a list of 650 titles and/or abstracts created by automatic search and excluded 591 papers as they did fit for answering the research questions. The other 59 abstracts were assigned for a full examination to identify the answers to the research questions. Of 59, 32 studies (n=32) were considered for this study. The consistency of the data and relevance to the questions were then checked. Some studies have been reviewed for multiple research questions. Each article was evaluated for identifying the impact of COVID-19 on Sports participation or activities or sportsmen.

Results

Demography of the articles

All the selected articles were published in 25 different journals presented in the table 1. The highest number of articles came into this study from "International Journal of Environmental Research and Public Health" (n=4) followed by "Apunts Sports Medicine" (n=3). These articles dealt with different sports namely football, cycling, handball, soccer, etc. presented in the figure 2. These articles presented the perceptions of players, trainers, and referees. Most of the articles dealt with overall sports (n=11).

Table 1. List of journals of the studies

Journal's Name	Number of matching items
Apunts Sports Medicine	3
Arthroscopy, Sports Medicine, and Rehabilitation,	1
Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology	1
Early Human Development	1
European Journal of Preventive Cardiology	1
EUROPEAN SOCIETIES	1
Frontiers in Psychiatry	1
Health Prob Civil.	1
International Journal of Environmental Research and Public Health	4
International Journal of Sport and Exercise Psychology	1
JACC: Cardiovascular Imaging	1
Journal of Interprofessional Care	1
Journal of Pediatric Nursing	1
Journal of Physical Education and Sport	1
Journal of Science and Medicine in Sport	2
Managing Sport and Leisure	1
Mayo Clinic Proceedings: Innovations, Quality & Outcomes	1
Public Health	1
Retos	1
Sensors	1
Sports	1
Soccer & Society	1
Solitons and Fractals	1
Technological Forecasting & Social Change	2
The Physician and Sports medicine	1
Total	32

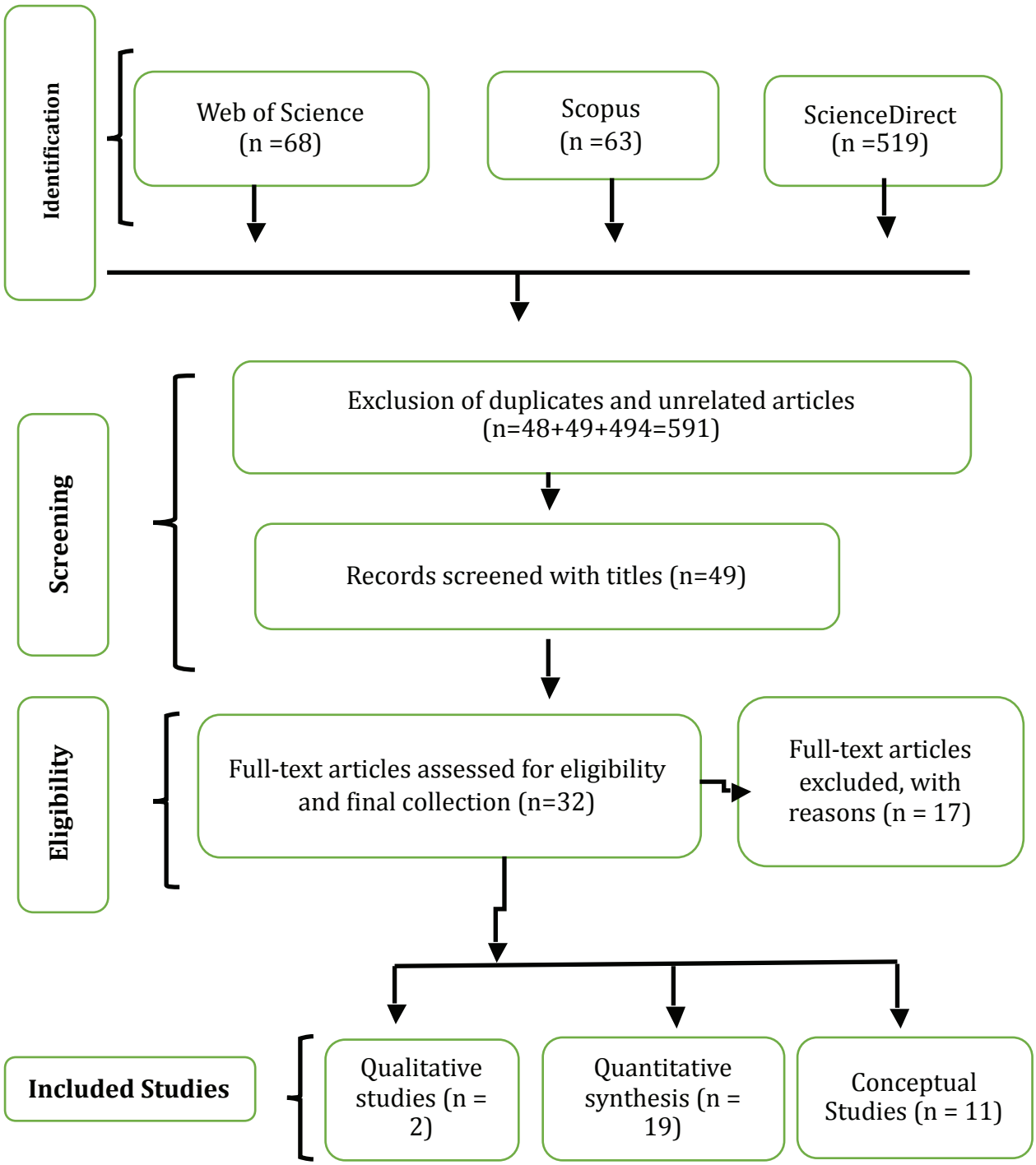

Figure 1. PRISMA model for selecting articles for this study

RQ-1: The impact of COVID-19 Pandemic on sports activities

In response to research question no.1, the themes related to the impact of the COVID-19 pandemic on sports activities were constraints on physical activities, cancellation events, and traditional practice presented in the figure 3. The findings show that the highest number of the studies dealt with the impact of COVID-19 on the constraints of physical activities in sports affairs.

The impact of the COVID-19 pandemic had severely on the physical activities, training, and practice of all the staff related to the sports sector. For the youth sports field, COVID-19 poses an unparalleled challenge. The public health initiatives aimed at slowing the spread of this highly contagious disease and mitigating its main consequences on abrupt interruptions on sports programs worldwide. [11,12]. These types of constraints influenced individuals' personal and social lifestyles. For millions of citizens, involuntary inactivity became a reality during the Covid-19 pandemic, as prevention and containment measures included the closure of sports and entertainment facilities. Individuals who discontinued or significantly decreased their sport and traditional practices during the pandemic record a significant reduction in well-being

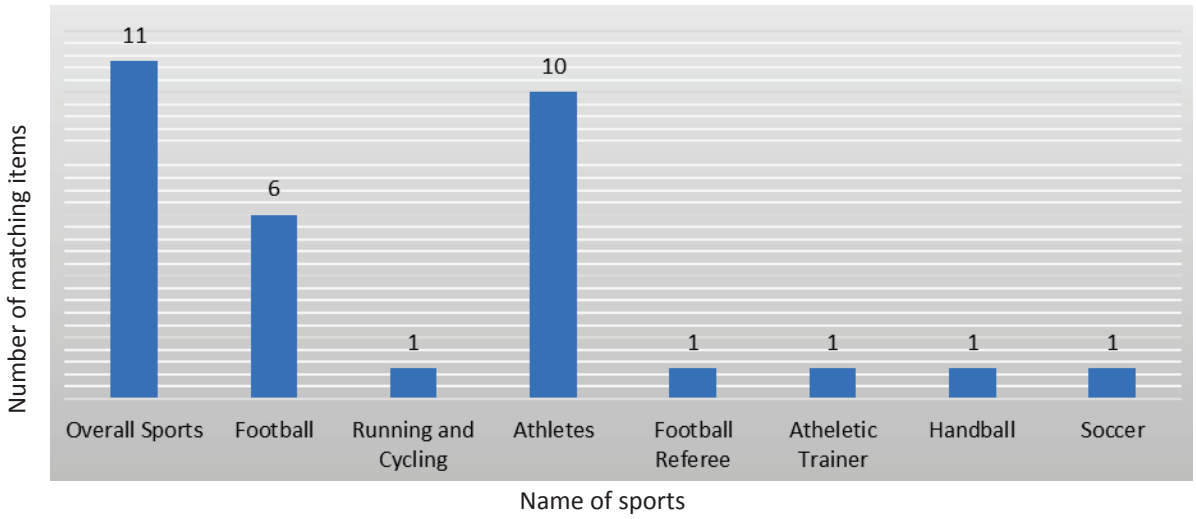

Figure 2. Name of sports in these studies

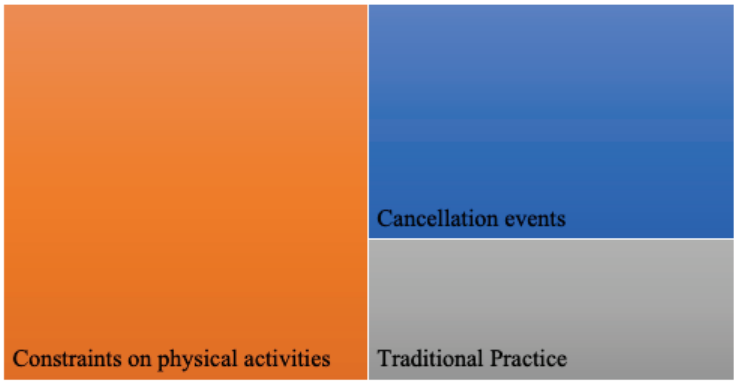

Figure 3. Impacts on sports activities in these studies

relative to pre-pandemic levels. Individuals who decreased their physical activity due to social pressures showed the greatest decrease in well-being [13,14]. The other study held in Spain and Portugal found that the effect of the COVID-19 pandemic had on physical activity on people involved in cycling who participate in sporting events in the natural environment [15]. Due to home confinement, as well as training and sport competitions cancellations, the prolonged inactivity impact, and lack of in-person interactions among teammates-coaches, had negatively affected athletes [16].

However, for these constraints, athletes in different sports were suffering a lot such as they were fully leveraging their knowledge, skills, and abilities [17] that negatively impacted competitive sport [18]. Moreover, using a mandatory mask and staying at home apart from home had the physiological impact of the hypercapnia hypoxia generated by the masks during aerobic sports practice [19] and brought a change into sports and exercise behavior [14]. Again, the COVID-19 isolation period caused reductions in training volume and intensity and decreased sleep quality of the sports staff [20]. Besides, because of constraints on sports participation like European football competition, millions of employees and people who are emotionally attached to the sport suffered a lot in terms of economic, social, and technological implications [5]. Thus, constraints on sports activities impacted physically, psychologically, and emotionally on the people in Australian society [21].

RQ-2 the impact of COVID-19 pandemic on the life and health of sportsmen

For answering research question no-2 the themes related to the life of sportsmen were physical health, mental health, and economics presented in the figure 4. The findings show that COVID-19 impacted the physical and mental life of sportsmen equally. The findings are discussed in the following:

Physical Health

The COVID-19 pandemic foremostly impacted the physical health of the people who were involved in the sports as the virus transmitted through human contacts. The study showed that the sportsmen who tested positive had suffered different types of physical health issues like ST depression, T-wave inversion, ST-T changes, and presence of QRS. Loss of smell, loss of taste, headache, and sore throat [22]. Apart from that, the complications of coronavirus disease–2019 (COVID–19) associated with subclinical cardiac pathologies such as myocarditis, pericarditis, and right ventricular dysfunction in the absence of substantial clinical symptoms are concerning

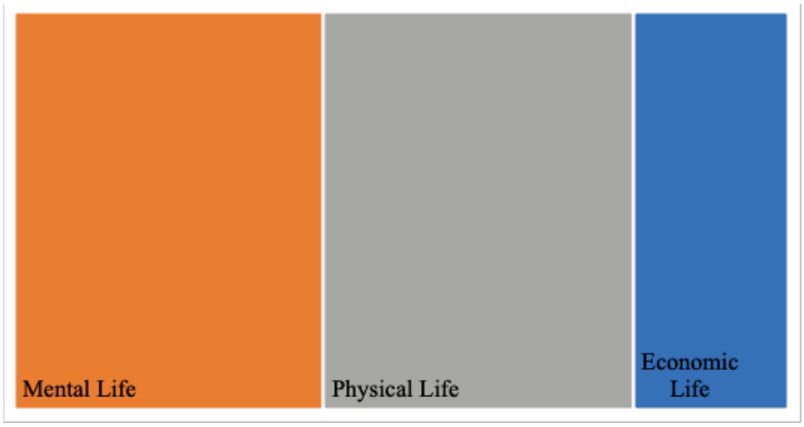

Figure 4. Impacts on the life of sportsmen

[23]. As a result of public health policies aimed at slowing the spread of this highly infectious disease and mitigating primary effects, the use of masks results in athletes experiencing hypoxic and hypercapnic breathing, as demonstrated by increased effort during exercise [19]. Moreover, wearing a facemask had significantly elevated heart rate and perceived exertion that increased the physiological burden of the body [2]. Thus, COVID-19 had physical consequences that impacted the safe RTS and general health of athletes [6]. Despite this, there is still no answer about the players who are affected by COVID-19 will endure any long-term effects on their health or game performance [24].

Economic Life

COVID-19 pandemic creates a world of lost opportunities and uncertain financial and sporting futures that impacted athletes and the sports industry (Pillay et al., 2020). In the sports, we observed the suspension, postponement, or cancellation of the most important international level competitions [25]. Concerning the cancellation and postponement of such events created a communicable pandemic that negatively influenced the economic life of sportsmen [26]. Consequently, the global spectator market fell from US$144.2 billion in 2019 to US$139.5 billion in 2020. According to KPMG, the total value of sponsorship across 'big five leagues (Bundesliga in Germany, La Liga in Spain, Premier League in England, Ligue 1 in France and Serie A in Italy) in 2020 is more than €3.3 billion (US$3.8 billion). It is worth noting that front-of-shirt sponsorship represents nearly a third of this figure. [27]. The actions initiated by governments to minimize person-to-person contact have also severely affected professional football clubs (PFCs) in the season 2019/20. During the pandemic, the fragility of PFCs due to their financial structure and underdeveloped managerial and entrepreneurial strategies to cope with the crisis [4]. Thus, the Covid-19 pandemic brought a change in the economic life of stakeholders of the different games.

Mental Health

During the COVID-19 pandemic, isolation and quarantine restricted the population's physical and social behaviors, which led to an increased incidence of mental illness. Depression and anxiety are the most common mental illnesses [28] that resulted in fragile and decreased sleep quality [20]. This mental health distortion did not deviate in terms of athlete's gender [16,29] Studies showed that the impact of pandemic brought insane into the mental health of an individual [30]. The prolonged inactivity and lack of interactions among teammates-coaches impacted negatively on the mental health of players [16].

For research question-3

For the answering research question, no-3 researchers analyzed the selected studies with VOS VIEWERS software for finding out the inter-connected themes of these studies in terms of keyword co-occurrence and term co-occurrence. The results are discussed in the following:

Key-words co-occurrence

The result from the keyword occurrence is presented in the figure 5 and table 2. For the result of keyword co-occurrence researchers used the full counting method. For presenting inter-connected themes by keywords, the researchers selected the minimum number of occurrences of a keyword was 3. And off 122 keywords 12 were interconnected showed in the table 2. The most occurred keyword was COVID-19 appeared 18 times linked with 30 studies. And least key words those appeared 3 times with the different link strength were depression, football, and physical activity. Both networking map and table showed that the most interconnected keywords of these studies were COVID-19, Pandemic, sports medicine, exercise, immunity, etc. indicated that the COVID-19 pandemic has influenced negatively on the sports participation or activities as well as the life and health of sportsmen.

Term co-occurrence

Another type of analysis with VOS viewer software namely term co-occurrence conducted for finding inter-connected themes of the studies on the impact of COVID-19 pandemic on sports participation and the life and health of sportsmen presented in figure 6 and Table 3. The result of term-occurrence shows the frequent terms or texts that appeared in the title and abstract of these studies ignoring structured abstract labels and copyright statements following the full counting method. Researchers selected 10 as the minimum number of

occurrences of a term in the title and abstract. Of 1256 terms 24 meet the threshold. Of 24 terms, 14 were selected to present in this study that covered 60% of terms of these studies showed in the table. The most frequent terms were covid, athlete, sport, and player whereas the most relevant terms were depression, participants, crisis, and anxiety. The most frequent and relevant terms indicated that the COVID-19 pandemic had a negative impact on sports participation and the life and health of sportsmen like other sectors e.g., economy, education, medicine, tourism, etc. of the human being.

Table 2. The most frequent keywords of these studies

Keywords	Occurrence
COVID-19	18
Pandemic	9
Coronavirus	6
Exercise	5
Sports Medicine	4
Athletes	4
Immunity	3
Infection	3
Anxiety	3
Depression	3
Football	3
Physical Activity	3

As far as the knowledge of researchers, there was a lack of review studies on the impact of COVID-19 on sports participation and the life and health of sportsmen, this study has the limitations to compare the results with the previous literature.

Table 3. The most frequent and relevant terms in the title and abstract

Terms	Frequency
COVID	116
Athlete	84
Sport	81
Player	31
Risk	23
Exercise	21
Facemask	18
Crisis	15
Anxiety	14
Heart rate	14
Social distancing	14
Depression	13
RPE	12
Participant	11

Discussion

This study explores the impact of the COVID-19 pandemic on sports activities, life and health of sportsmen. The impact on physical activities were cancellation events, and traditional sports practice. The findings show that the impact had severely on the physical activities, training, and practice of all the staff related to the sports sector. On the other hand, the COVID-19 pandemic negatively influenced on sportsmen's physical health, mental health, and economics.

For pointing out the research trends from the existing

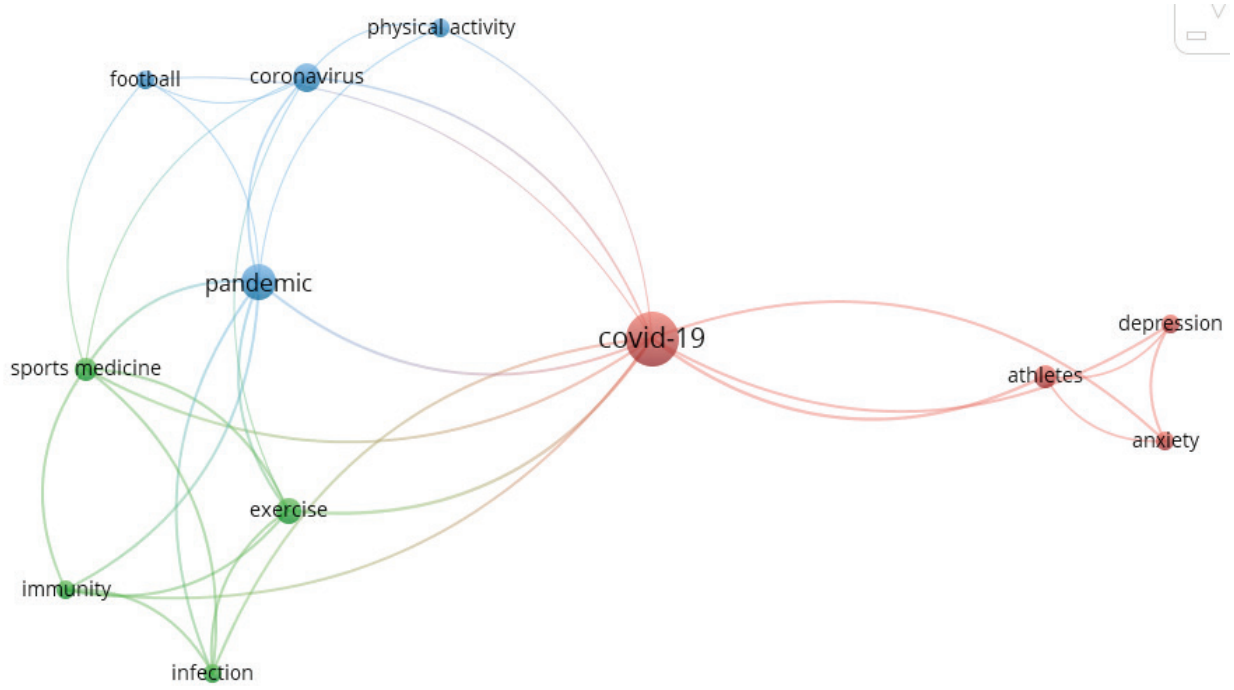

Figure 5. Network mapping on the key-word co-occurrence of these studies

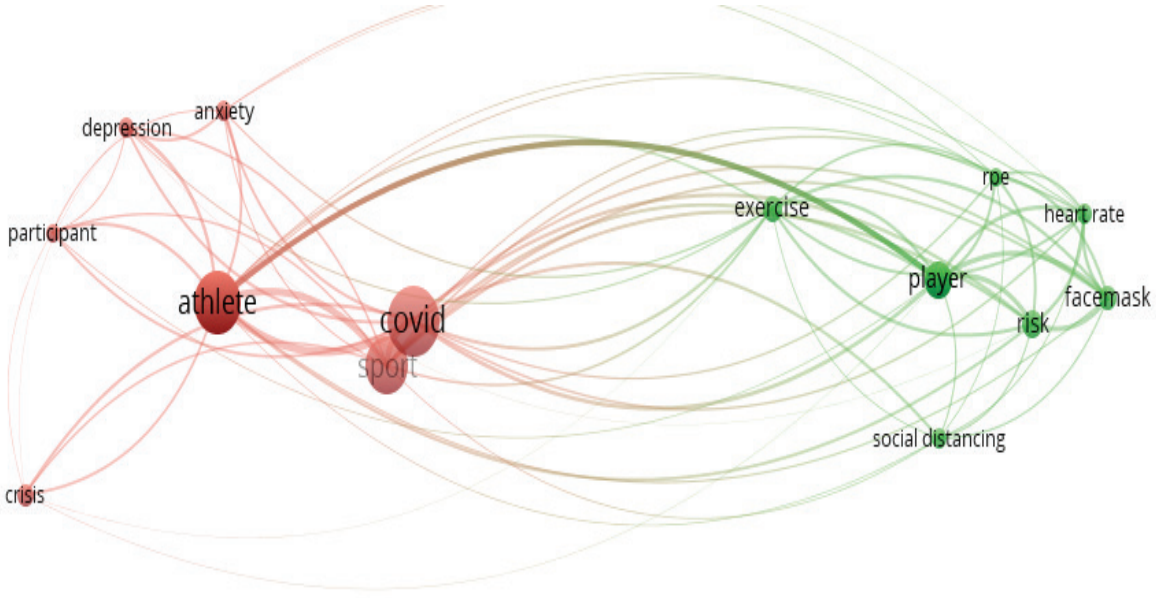

Figure 6. Network mapping of the most frequent terms in the title and abstract

literature, the result show that researches in the field sport science conducted to investigate sports' staffs' depression, crisis, and anxiety and physical activity. Most of the studies held concerning with football game. Moreover, most of the studies dealt with pandemic, sports medicine, exercise, immunity, etc. indicated that the COVID-19 pandemic has influenced negatively on the sports participation or activities as well as the life and health of sportsmen.

The results of this review study are distinguished from the other past review studies during COVID-19 pandemic on sports science. For example, this review paper dealt with team activity during pandemic [18]. The other study highlights potential strategies and approaches that may be used by strength (Power Lifting and Weightlifting) athletes during the current global crisis [31]. Another study reviews the mental health consequences of COVID-19, especially for depression and anxiety [28]. Thus, the findings of this study are clearly distinct from that of other studies on the impact of COVID-19 pandemic on sports and sportsmen.

Conclusions

This review study overviews scientifically 32 studies of 650 studies retrieved from the reputable online database of Web of Science, ScienceDirect, and Scopus 32 studies and found that the COVID-19 pandemic mostly influences making constraints on physical activities. The mental and physical life were concurrently impacted by it. Bibliometrics analysis indicates that the research trend of COVID-19 and its impact was mainly focused on COVID-19 and Mental health or physical health or economic life of the stakeholders of sports affairs. This study has insights for the players for maintaining a healthy life and for the authority of managing impacts, and researchers researching with new dimensions.

Recommendations

Recommendations from the studies are for athletes, researchers, and authorities of sports affairs. For athletes, studies suggest that players need to do regular exercise for keeping up physical and mental health such as anxiety and depression [28,32] Intensive and frequent physical activity facilitates psychological factors that encourage the wellbeing of individuals [26]. Maintaining good health and working out or being involved in daily sports seems to provide protection against mental illness [29,30]. Moreover, players could utilize the times of lockdown for one's recovery from injury, as well as setting targets to improve one's strength [31]. MAMIMCA – Multiple Assessment Multiple Importance Multiple Criteria Analysis – was adopted to choose the most suitable football club to sponsor [27]. For sports authority, set a guideline regarding personal engagement in activities, quality social dynamics, and appropriate settings and organizational structures for the resumption of sports [11,16,21,33], reducing the number of days within the matches [34]. Arranging Training for referees as well as players during the quarantine period [25,35,36]. Peña et al., 2020 pointed out the following principles for the stakeholders of sports affairs for maintaining sound health [18]:

1. In addition to the normal daily health and wellness checks of the athletes, which includes routine temperature checks, alcohol-based hand gel, and facility and accommodation facilities are maintained.
2. Provide training masks to athletes, technicians, media and event managers, as well as patients, and others with contagious diseases suitable signage are maintained in all the dressing rooms, and training equipment are also used.
3. Expanding on the basics of the subject: To be clear, a facility is supposed to be completely disinfected and

disinfected between practices and competitions and support personnel only if the fait legally or socially obligated.

4. These bans were placed in place to protect the general public's health and the safety of all from unsafe products such as water bottles and cups to ensure no one's disposable or reusable hygiene is put at risk.
5. Providing filtering and medical facilities that could assess the likelihood of cervical cancer being present in women in the group in the queue for the test of cases, for referral.

The findings of this study would pave the way for new dimensions and insights for conducting research expanding existing knowledge by future researchers.

Conflicts of Interest

The authors declare no conflict of interest.

References

1. Ibna Seraj PM, Hasan MK, Habil H. English Teacher's Views on the Barriers of Implementing E-learning during the Covid-19 Pandemic at the Private Universities in Bangladesh. *J Adv Res Dyn Control Syst.* 2020;12(08-SPECIAL ISSUE):1033– 41. https://doi.org/10.5373/JARDCS/V12SP8/20202611
2. Wong AYY, Ling SKK, Louie LHT, Law GYK, So RCH, Lee DCW, et al. Impact of the COVID-19 pandemic on sports and exercise. *Asia-Pacific J Sport Med Arthrosc Rehabil Technol,* 2020;22:39–44. https://doi.org/10.1016/j.asmart.2020.07.006
3. Pillay L, Janse van Rensburg DCC, Jansen van Rensburg A, Ramagole DA, Holtzhausen L, Dijkstra HP, et al. Nowhere to hide: The significant impact of coronavirus disease 2019 (COVID-19) measures on elite and semi-elite South African athletes. *Int J Environ Res Public Health*, 2020;17(7):1–10. https://doi.org/10.1080/00913847.2020.1807297
4. Hammerschmidt J, Durst S, Kraus S, Puumalainen K. Professional football clubs and empirical evidence from the COVID-19 crisis: Time for sport entrepreneurship? *Technol Forecast Soc Change*, 2021;165:120572. https://doi.org/10.1016/j.techfore.2021.120572
5. Beiderbeck D, Frevel N, von der Gracht HA, Schmidt SL, Schweitzer VM. The impact of COVID-19 on the European football ecosystem – A Delphi-based scenario analysis. *Technol Forecast Soc Change*, 2021;165:120577. https://doi.org/10.1016/j.techfore.2021.120577
6. Pillay L, Janse van Rensburg DCC, Jansen van Rensburg A, Ramagole DA, Holtzhausen L, Dijkstra HP, et al. Nowhere to hide: The significant impact of coronavirus disease 2019 (COVID-19) measures on elite and semi-elite South African athletes. *J Sci Med Sport*, 2020;23(7):670–9. https://doi.org/10.1016/j.jsams.2020.05.016
7. Moher D, Liberati A, Tetzlaff J and, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med.* 2009;6(7). https://doi.org/10.1371/journal.pmed.1000097
8. Ibna Seraj PM, Habil H. A Systematic Overview of Issues for Developing EFL Learners ' Oral English Communication Skills. *J Lang Educ.* 2021;7(1):229–40. https://doi.org/10.17323/jle.2021.10737
9. Ibna Seraj PM, Habil H. A critical review on oral English communication skills (OECS). In: *3rd International Language & Tourism Conference 2019. Kulliyyah of Languages and Management,* International Islamic University Malaysia, Pagoh Edu Hub, Malaysia 18th-19th October 2019 ID; 2019. P. 1–12.
10. Shadiev R, Liu T, Hwang WY. Review of research on mobile-assisted language learning in familiar, authentic environments. *Br J Educ Technol.* 2020;51(3):709–20. https://doi.org/10.1111/bjet.12839
11. Kelly AL, Erickson K, Turnnidge J. Youth sport in the time of COVID-19: considerations for researchers and practitioners. *Managing Sport and Leisure*, 2020:1–11. https://doi.org/10.1080/23750472.2020.1788975
12. McBride DL. New Guidelines for Children Returning to Sports after Covid-19. *Journal of Pediatric Nursing*, 2021;59:196–7. https://doi.org/10.1016/j.pedn.2021.01.013
13. Mutz M. Forced adaptations of sporting behaviours during the Covid-19 pandemic and their effects on subjective well-being. *European Societies*, 2021;23:S184–98. https://doi.org/10.1080/14616696.2020.1821077
14. Schnitzer M, Schöttl SE, Kopp M, Barth M. COVID-19 stay-at-home order in Tyrol, Austria: sports and exercise behaviour in change? *Public Health.* 2020;185:218–20. https://doi.org/10.1016/j.puhe.2020.06.042
15. Urbaneja JS, Pedro Julião R, Nogueira Mendes RM, Dorado V, Farías-Torbidoni EI. The impact of COVID-19 on physical activity on people who participate on running and cycling sporting events people in Spain and Portugal. *Retos*. 2020;2041(39):743–9. https://doi.org/10.47197/retos.v0i39.82564
16. Di Cagno A, Buonsenso A, Baralla F, Grazioli E, Di Martino G, Lecce E, et al. Psychological impact of the quarantine-induced stress during the coronavirus (COVID-19) outbreak among Italian athletes. *Int J Environ Res Public Health.* 2020;17(23):1–13. https://doi.org/10.3390/ijerph17238867
17. Breitbach AP, Muchow JA, Gallegos DF. Athletic trainers' unique clinical and teamwork skills contribute on the frontlines during the COVID-19 pandemic: A discussion paper. *Journal of Interprofessional Care*, 2020;34:607–13. https://doi.org/10.1080/13561820.2020.1792426
18. Peña J, Altarriba-Bartés A, Vicens-Bordas J, Gil-Puga B, Piniés-Penadés G, Alba-Jiménez C, et al. Sports in time of COVID-19: Impact of the lockdown on team activity. *Apunt Sport Med.* 2020; 56. https://doi.org/10.1016/j.apunsm.2020.100340
19. Pifarré F, Zabala DD, Grazioli G, Maura I de Y i. COVID-19 and mask in sports. *Apunt Sport Med,* 2020;55(208):143–5. https://doi.org/10.1016/j.apunsm.2020.06.002
20. Mon-López D, Riaza A de la R, Galán MH, Roman IR. The impact of covid-19 and the effect of psychological factors on training conditions of handball players. *Int J Environ Res Public Health*. 2020;17(18):1–14. https://doi.org/10.3390/ijerph17186471
21. Hughes D, Saw R, Perera NKP, Mooney M, Wallett A, Cooke J, et al. The Australian Institute of Sport framework for rebooting sport in a COVID-19 environment. *J Sci Med Sport*, 2020;23(7):639–63. https://doi.org/10.1016/j.jsams.2020.05.004
22. Erickson JL, Poterucha JT, Gende A, McEleney M, Wencl CM, Castaneda M, et al. Use of Electrocardiographic Screening to Clear Athletes for Return to Sports Following COVID-19 Infection. *Mayo Clinic Proceedings: Innovations, Quality & Outcomes* 2021;5:368–76. https://doi.org/10.1016/j.mayocpiqo.2021.01.007
23. Phelan D, Kim JH, Elliott MD, Wasfy MM, Cremer

P, Johri AM, et al. Screening of Potential Cardiac Involvement in Competitive Athletes Recovering From COVID-19: An Expert Consensus Statement. *JACC Cardiovasc Imaging*, 2020;13(12):2635–52. https://doi.org/10.1016/j.jcmg.2020.10.005
24. Gilat R, Cole BJ. COVID-19, Medicine, and Sports. *Arthrosc Sport Med Rehabil*, 2020;2(3):e175–6. https://doi.org/10.1016/j.asmr.2020.04.003
25. Boschilia B, Moraes LCL, Marchi Junior W. Football and COVID-19: the effects of the pandemic on training and performance of South American and Brazilian referees. *Soccer Soc,* 2021;22(1–2):58–65. https://doi.org/10.1080/14660970.2020.1829597
26. Scerri M, Grech V. WITHDRAWN: Sports and sportsmen as role models – or otherwise – in the COVID-19 era. *Early Human Development*, 2020:105254. https://doi.org/10.1016/j.earlhumdev.2020.105254
27. Górecka D. Selecting the right football club to sponsor: Multi-criteria analysis. *J Phys Educ Sport.* 2020;20(5):2867–74.
28. Hu S, Tucker L, Wu C, Yang L. Beneficial Effects of Exercise on Depression and Anxiety During the Covid-19 Pandemic: A Narrative Review. *Front Psychiatry.* 2020;11:1–10. https://doi.org/10.3389/fpsyt.2020.587557
29. Şenışık S, Denerel N, Köyağasıoğlu O, Tunç S. The effect of isolation on athletes' mental health during the COVID-19 pandemic. *The Physician and Sportsmedicine*, 2021;49:187–93. https://doi.org/10.1080/00913847.2020.1807297
30. Pálvölgyi Á, Makai A, Prémusz V, Trpkovici M, Ács P, Betlehem J, et al. A Preliminary Study on the Effect of the Covid-19 Pandemic on Sporting Behavior, Mindfulness and Well-Being. *Heal Probl Civiliz.* 2020;14(3):157–64. https://doi.org/10.5114/hpc.2020.97898
31. Latella C, Haff GG. Global Challenges of Being a Strength Athlete during a Pandemic: Impacts and Sports-Specific Training Considerations and Recommendations. Sports 2020;8:100. https://doi.org/10.3390/sports8070100
32. Bhatia RT, Marwaha S, Malhotra A, Iqbal Z, Hughes C, Börjesson M, et al. Exercise in the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) era: A Question and Answer session with the experts Endorsed by the section of Sports Cardiology & Exercise of the European Association of Preventive Cardiology (EAPC). *Eur J Prev Cardiol.* 2020;27(12):1242–51. https://doi.org/10.1177/2047487320930596
33. Mota GR, Dos Santos IA, Arriel RA, Marocolo M. Is it high time to increase elite soccer substitutions permanently? *Int J Environ Res Public Health*. 2020;17(19):1–13. https://doi.org/10.3390/ijerph17197008
34. Buldú JM, Antequera DR, Aguirre J. The resumption of sports competitions after COVID-19 lockdown: The case of the Spanish football league. *Chaos, Solitons & Fractals*, 2020;138:109964. https://doi.org/10.1016/j.chaos.2020.109964
35. Breitbach AP, Muchow JA, Gallegos DF. Athletic trainers' unique clinical and teamwork skills contribute on the frontlines during the COVID-19 pandemic: A discussion paper. *J Interprof Care*, 2020;34(5):1–7. https://doi.org/10.1080/13561820.2020.1792426
36. Demarie S, Galvani C, Billat VL. Horse-riding competitions pre and post covid-19: Effect of anxiety, srpe and hr on performance in eventing. *Int J Environ Res Public Health*. 2020;17(22):1–10. https://doi.org/10.3390/ijerph17228648

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PHYSICAL EDUCATION OF STUDENTS

ORIGINAL ARTICLE

Effects of 6-weeks Bhastrika Pranayama Intervention on health-related components of physical fitness

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Background and Study Aim The present study investigated the effects of 6-weeks bhastrika pranayama intervention (BPI) program on health-related components of physical fitness.

Material and Methods We used a quasi-experimental design with fifty-two healthy girls (Mean ± SD; age, 23.6346±1.1551 yrs; body height, 158.0961±3.8616 cm; body weight, 55.6826±3.4002 kg) from Guru Nanak Dev University, Amritsar, Punjab, India. The subjects were divided into two groups: Group-A: Bhastrika Pranayama Intervention (BPI); (n_1=26) and Group-B: Control; (n_2=26). The sample size (N=52) was calculated using the G*Power 3.1.9.7 software. A power of 0.80 (1-β err prob) and significance level (α) of 0.05. Subjects from both groups (pranayama and control) were assessed at baseline and right after 6-weeks. Group-A: (n_1=26) subjected to BPI and Group-B: (n_2=26) with no training.

Results: As compared BPI with the control group, the BPI group had a positive effect on selected health-related components of physical fitness (maximal oxygen consumption - VO2 max 1.3%; flexibility 1.8%; muscle strength 0.2.%). The 6-weeks Bhastrika Pranayama intervention program had no effect on the BPI group with respect to the parameter muscular endurance.

Conclusions: Daily practice of Bhastrika pranayama helps to keep lungs more efficient. Additional research is required to completely comprehend the consequences of this breathing exercise. Bhastrika pranayama is known for oxygen-based breathing exercise which helps to fill up the lungs with more oxygen. Bhastrika pranayama interventions with short as well as long duration in future research studies could be beneficial for healthy individuals with respect to health-related fitness components.

Keywords: bhastrika pranayama, maximal oxygen, flexibility, muscular strength, muscular endurance.

Introduction

Yoga is a traditional Indian culture practice that is regarded to be the science of holistic life. Disciplined living (Yama and Niyama), cleaning procedures (Kriya), bodily postures (Asana), breath management (Pranayama), concentration (Dharana), and meditation are all part of the Yoga tradition (Dhyana) [1, 2]. In recent years, there has been a surge in interest in learning more about the advantages of the various Yoga practices. [3, 4]. There have been scientific researches on the effects of individual Yoga practises or their combinations on both healthy people and persons with various diseases. [5]. Yoga practice can be performed by people of any age group and gender and can be applied to children during their developmental phase of life [6].

A recent study suggested that yoga practice in school children may be an effective way to improve their health [7, 8]. It has been observed that yogic exercise practice in school setups may be useful to develop flexibility, mood and self-regulation skills related to emotion and stress among children [9]. Maharishi Patanjali, in his Ashtanga yoga, has given more importance to pranayama than asana for good health [10]. Purak (inhalation), Kumbhak (retention), and Rechak (exhalation) are the three phases of Pranayama. [11]. Thus, Pranayama means "breathing techniques" or "breathe control". The important aspects of breathing utilized in pranayama include: Puraka – Inhalation, Rechaka – Exhalation, Kumbhaka - Retention, which is further divided into Antar Kumbhaka - Inhalation Retention (after Inhaling) and Bahir Kumbhaka - Exhalation Retention (after exhaling). According to Maharshi Patanjali's Yoga Sutras state (2:49) "Pranayama is the pause in the movement of inhalation and exhalation when that is secured" (Fig. 1) [12].

Therefore, the significant parts of pranayama are essentially kumbhaka or breathe retention. In order to achieve kumbhaka effectively, the function of respiration must be gradually controlled. As a result, inhalation and exhalation are given more emphasis in the beginning of pranayama practises in order to strengthen the lungs and balance the neurological and pranic systems in preparation for the practice of kumbhaka. Prana is a subtle aspect of the body. It has a visible aspect which is the air we breathe and an invisible aspect, which is the energy that flows in the body through various channels and sustains it. Prana also connects the gross body (annamaya kosa) with the

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mental body (manomaya kosa). Hence the Upanishads describe it often as the soul of the gross body and equate it with Atman or the essence of Brahman. According to Kathopanishad (2:3:2): "This whole world- whatever there is- vibrates having originated from prana" [12]. Hence, prana controls all physical tasks including the breath, supply of oxygen, digestion and elimination. The function of the human body is much like a transformer, receiving energy from the universal flow of prana, distributing that energy, and then eliminating it. Figure 2.

In human beings, the breath is an active connection between the body and mind while the Pranayama is considered as manipulation of one own breathing [13]. Different types of pranayama produce specific physiological responses and it greatly depends on the type and duration of the practice [14, 15, 16]. Nadisuddhi, Savitri, Kapalbhati, Bhastrika, Bhramari Pranayama, and so on are well known among them. Many physiological variables are influenced by pranayama practice. Evidence suggests that it has a beneficial effect on the cardiorespiratory system. [17, 18] on the other side with slow breathing resulting in a lower heart rate and lower systolic and diastolic blood pressure. [19], while fast breathing leads to a less robust, but consistent increase in heart rate [20, 21]. In fact, a prior study found that practising Bhastrika pranayama with a low respiratory rate (RR) reduced both systolic and diastolic blood pressure while also lowering heart rate slightly. [22]. In addition, variations in heart rate variability (HRV) support the indication that pranayama improves respiratory function and cardiac sympathovagal balance, both of which are vital psycho-physiological stress-related factors. [23, 24].

Physical exercise at work has decreased significantly in emerging countries like India as the work environment has become increasingly computerised among young adults. In addition, sedentary lifestyles and eating habits have been linked to a variety of health problems. Pranayama is one of the most often practiced supplemental or alternative interventions to obtain the greatest possible physical and mental health, according to recorded studies and data. To reduce the burden of non-communicable diseases and to improve the status of health and wellness in young female adults we designed the study to observe the effects of 6-weeks bhastrika pranayama intervention (BPI) program on health-related components of physical fitness.

Material and Methods

Participants.

We used a quasi-experimental design with fifty-two healthy girls (Mean ± SD; age, 23.6346±1.1551 yrs; body height, 158.0961±3.8616 cm; body weight, 55.6826±3.4002 kg) from Guru Nanak Dev University, Amritsar, Punjab, India. The subjects were divided into two groups: Group-A: Bhastrika Pranayama Intervention (BPI); (n_1=26), and Group-B: Control; (n_2=26). The sample size (N=52) was calculated using the G*Power 3.1.9.7 software. A power of 0.80 (1-β err prob) and significance level (α) of 0.05. Subjects from both groups (pranayama and control) were assessed at baseline and right after 6-weeks. Group-A: (n_1=26) subjected to BPI program and Group-B: (n_2=26) with no training.

Research Design

Procedure:

Cooper's 12-minute run test was used to measure maximal oxygen consumption (VO_2 max), sit, and reach test was used to measure flexibility, handgrip strength test was used to measure muscular strength, while 1-minute sit-up test was used to measure muscular endurance. Subjects from both groups (pranayama and control) were assessed at baseline and right after 6-weeks.

Bhastrika Pranayama Intervention (BPI) Program:

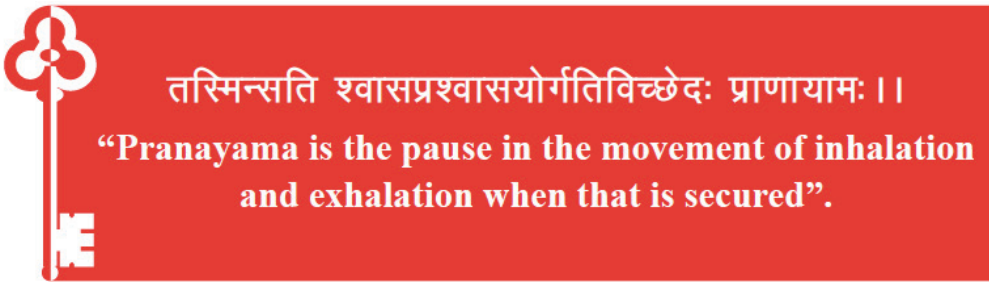


Figure 1. The actual pranayama is kumbhaka, the period of breath retention.

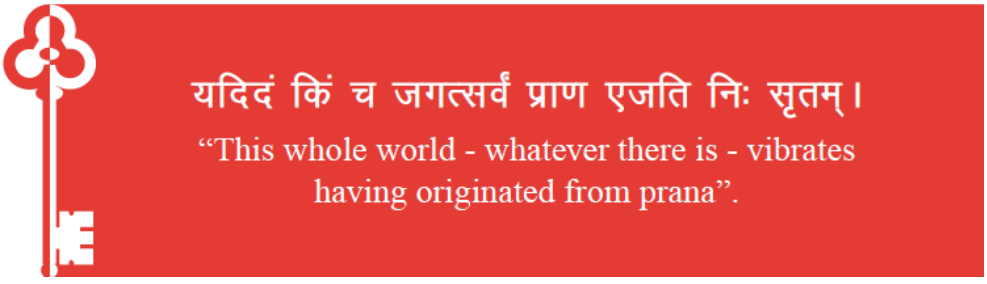


Figure 2. All this universe evolved (from prana) moves while Prana is a mighty terror, the thunderbolt uplifted; those who know this become immortal.

Participants of the Bhastrika Pranayama Intervention (BPI) group were asked to sit in a comfortable meditative posture, with their hands resting on the knees in chin mudra. Then asked to keep the head and spine straight, close the eyes and relax the whole body. They were asked to take a deep breath in through both the nostrils while making sure that their mouth does not open at all while doing this pranayama. After this, they were asked to release the filled breath through both the nostrils rapidly. They continued in this manner, counting ten breaths. They took a deep breath in and breathe out rapidly. This is one round. Participants practiced up to five rounds.

Statistical Analysis.

This study's data analysis procedure was divided into four sections: - The G*Power 3.1.9.7 software was used in the first section. The normality of data was checked by using the Shapiro-Wilk test of normality in the second section. A descriptive analysis was used in the third section to describe the data distribution. The hypothesis testing with analysis of covariance (ANCOVA) test was included in the fourth section. The level of significance was set at 0.05. The statistical techniques were used to analyze the data on Statistical Package for Social Science (SPSS) version 26.0.

The Protocol of power analysis and demographics of subjects (age, body height and body weight) is brought forth in Figure 3 & Figure 4 respectively.

Protocol of power analysis was done to get the required number of sample (n=52) for the experimental study with large effect size (0.40), as to obtain the strong impact on power (1-β err prob=0.80) of the study at α err prob=0.05 (fig.3).

Demographics of subjects showing Mean±SD; age, 23.6346±1.1551 yrs; body height, 158.0961±3.8616 cm; body weight, 55.6826±3.4002 kg (fig.4).

Table 1 shows that the pre-test & post-test data of health-related components of physical fitness including maximal oxygen consumption (VO_2 max): BPI (p = .128 & .354) and Control (p = .280 & .541), flexibility: BPI (p = .178 & .094) and Control (p = .123 & .163), muscular strength: BPI (p = .270 & .241) and Control (p = .544 & .188), muscular endurance: BPI (p = .275 & .113) and Control (p = .653 & .295) of subjects were normally distributed as evident from Shapiro-Wilk test for normality. As a result, the p-values of the bhastrika pranayama intervention (BPI) and control groups' pre-test and post-test data were statistically insignificant (p >.05), indicating that the data were normally distributed.

The summary of the descriptive statistics regarding the health-related components of physical fitness of pre-test & post-test of BPI group and pre-test & post-test of a control group for subjects is brought forth in Table 2 and Table 3 respectively.

Results

Maximal Oxygen Consumption (VO_2 max):

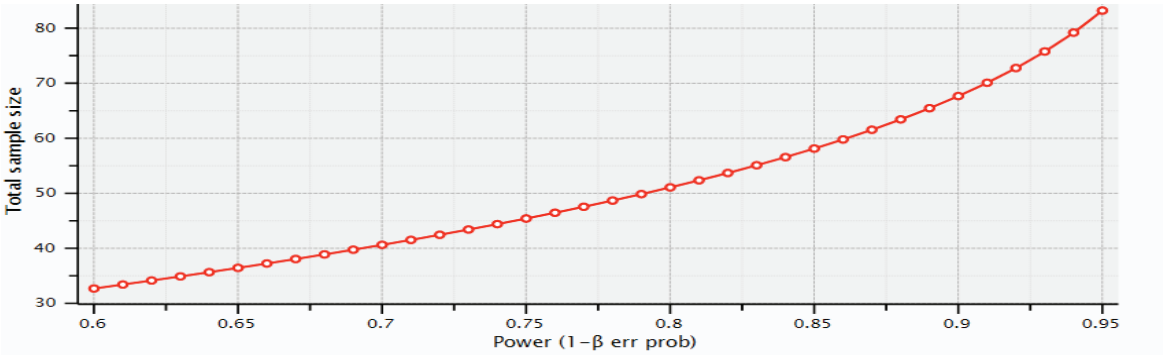
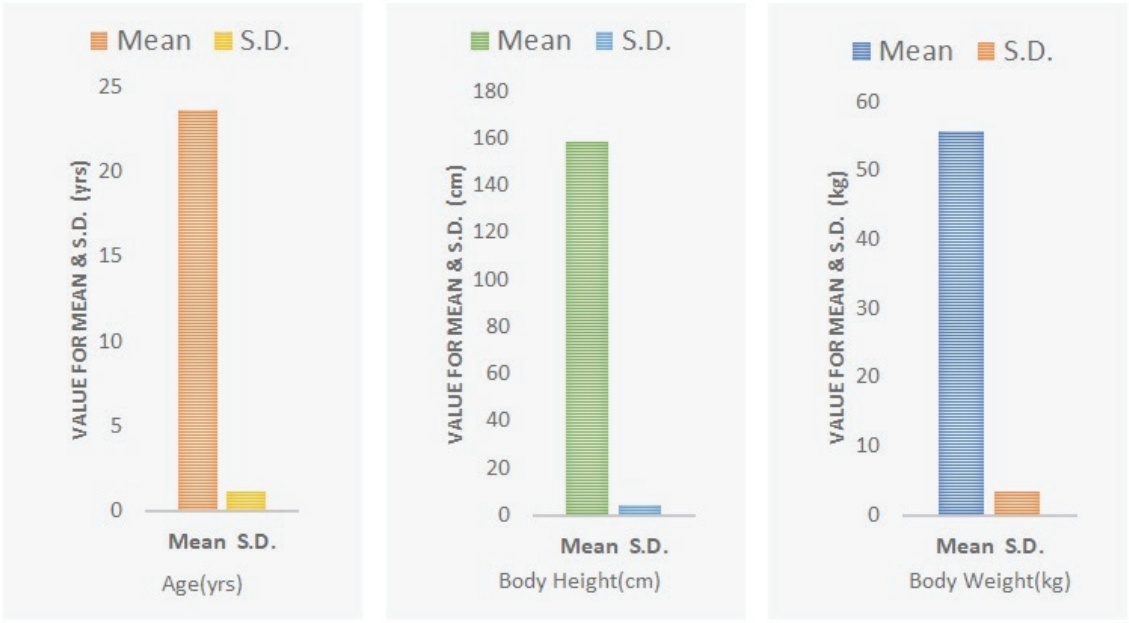


Figure 3. Protocol of power analysis

Table 1. Normal distribution of data by utilizing Shapiro-Wilk Test of Normality of bhastrika pranayama intervention (BPI) group and control group of health-related components of physical fitness.

Shapiro-Wilk Test of Normality				
Maximal Oxygen Consumption (VO_2 max) (ml/kg/min)				
	Bhastrika Pranayama Intervention (BPI) Group Pre-Test	**Bhastrika Pranayama Intervention (BPI) Group Post-Test**	**Control Group Pre-Test**	**Control Group Post-Test**
Sig.	.128	.354	.280	.541
Flexibility (cm)				
Sig.	.178	.094	.123	.163
Muscular Strength (kg)				
Sig.	.270	.241	.544	.188
Muscular Endurance (min)				
Sig.	.275	.113	.653	.295



a. **b.** **c.**

Figure 4. Demographics of subjects showing

It is evident from the results that insignificant differences were noted between BPI and Control groups of girls on Maximal Oxygen Consumption (VO_2 max) since the p-value .431 was greater than ($p>0.05$). In addition, the Partial Eta Squared value showed that 6-weeks of bhastrika pranayama intervention had a positive effect of 1.3% on the BPI group regarding the parameter Maximal Oxygen Consumption (VO_2 max).

Flexibility:

It is evident from the results that insignificant differences were noted between BPI and Control groups of girls on Flexibility since the p-value .351 was greater than ($p>0.05$). In addition, the Partial Eta Squared value showed that 6-weeks of bhastrika pranayama intervention had a positive effect of 1.8% on the BPI group regarding the parameter Flexibility.

Muscular Strength:

It is evident from the results that insignificant differences were noted between BPI and Control groups of girls on Muscular Strength since the p-value .784 was greater than ($p>0.05$). In addition, the Partial Eta Squared value showed that 6-weeks of bhastrika pranayama intervention had a positive effect of 0.2% on the BPI group regarding the parameter Muscular Strength.

Muscular Endurance:

It is evident from the results that insignificant differences were noted between BPI and Control groups of girls on Muscular Endurance since the p-value .917 was greater than ($p>0.05$). In addition, the Partial Eta Squared value showed that 6-weeks of bhastrika pranayama intervention had no effect on the BPI group regarding the parameter Muscular Endurance. The statistical analysis of results regarding health-related components of physical fitness including maximal oxygen consumption (VO2 max), flexibility, muscular strength, and muscular endurance have presented in Table 4 & percentage increase shown in Figure 5.

Discussion

Our results open an exciting new avenue of study focused on short-term effects of bhastrika pranayama intervention of six weeks on healthy girls with positive effect on health-related components of physical fitness including Vo_2 max=1.3%, flexibility 1.8%, muscle strength 0.2.%. As our study results with the positive impact of bhastrika pranayama intervention (BPI) are supported by other studies i.e., the bhastrika pranayama practiced on daily basis benefits in the maintenance of healthy lungs and can be easily incorporated into an athletic training program. This pranayama helps to strengthen the lungs' immunity [25]. Bhastrika Pranayama (breathing techniques/exercises) can be said to be advantageous to respiratory parameters for better functioning. Even in normal healthy participants, the functions of respiratory parameters, notably, were improved who participated voluntarily in this study [26]. Bhastrika exercises the diaphragm, the primary respiratory muscle that renews the residual air in the lungs [27]. In healthy University students, Anuloma-Viloma and Bhastrika Pranayama appear to be useful in enhancing physical health indices [28]. In addition, another study results showed that both slow and fast pranayamas for 12-weeks improve handgrip dynamometry characteristics, with fast pranayama being more effective than slow pranayama [29]. According to the literature, consistent hatha yoga practice can lead to enhancements in health-related aspects and could benefit to improve status of health and wellness [30]. Moreover, the present study findings acknowledged the beneficial effects of bhastrika pranayama besides the limitation of short duration in relation to health and wellness. Bhastrika

Table 2. Distribution of subject's statistics regarding the health-related components of physical fitness including maximal oxygen consumption (VO2 max), flexibility, muscular strength, and muscular endurance of pre-test & post-test of BPI group.

Statistics	Maximal Oxygen Consumption (VO_2 max)		Flexibility		Muscular Strength		Muscular Endurance	
	pre-test	post-test	pre-test	post-test	pre-test	post-test	pre-test	post-test
Minimum	min =22.23	min =24.47	min =12.00	min =12.00	min =20.00	min =21.00	min =22.00	min =23.00
Maximum	max =42.35	max =43.47	max =17.00	max =17.00	max =27.00	max 28.	max =31.00	max =29.00
Range	R =20.12	R =19	R =5	R =5	R =7	R =7	R =9	R =6
Size	n =26	n =26	n =26	n =26	n =26	n =26	n =26	n =26
Sum	sum =827.79	sum =843.86	sum =378	sum =387	sum =625	sum =626	sum =691	sum =681
Mean	$\bar{x}$ =31.838	$\bar{x}$=32.456	$\bar{x}$=14.538	$\bar{x}$=14.884	$\bar{x}$=24.038	$\bar{x}$=24.076	$\bar{x}$=26.576	$\bar{x}$=26.192
Median	$\tilde{x}$ =31.18	$\tilde{x}$ =31.85	$\tilde{x}$ =14.5	$\tilde{x}$ =15	$\tilde{x}$ =24	$\tilde{x}$=24	$\tilde{x}$ =27	$\tilde{x}$ =26
Mode	mode =37.88, 35.65, 31.18, 24.47	mode =33.41, 37.88, 35.64, 28.49	mode =14.00	mode =15.00	mode =25.00	mode =23.00	mode =27.00	mode =24.00, 27.00
Standard Deviation	s =5.8161	s =5.229	s =1.333	s =1.451	s =1.821	s =1.647	s =2.468	s =1.789
Variance	s2 =33.828	s2 =27.349	s2=1.77846154	s2 =2.106	s2 =3.31846154	s2 =2.713	s2 =6.093	s2 =3.201
Mid-Range	MR =32.29	MR =33.97	MR =14.5	MR =14.5	MR =23.5	MR =24.5	MR =26.5	MR =26
Interquartile Range	IQR =11.18	IQR =8.28	IQR =1	IQR =2	IQR =2	IQR =2	IQR =3	IQR =3
Sum of Squares	SS =845.702	SS =683.726	SS=44.4615385	SS =52.653	SS =82.961	SS =67.846	SS =152.346	SS =80.038
Mean Absolute Deviation	MAD =5.028	MAD =4.456	MAD =1.076	MAD =1.142	MAD =1.426	MAD =1.325	MAD =1.982	MAD =1.514
Root Mean Square	RMS =32.344	RMS =32.858	RMS =14.597	RMS = 14.952	RMS =24.104	RMS =24.131	RMS =26.686	RMS =26.251
Std Error of Mean	SE$\bar{x}$=1.140	SE$\bar{x}$=1.025	SE$\bar{x}$=0.261	SE$\bar{x}$=0.284	SE$\bar{x}$=0.357	SE $\bar{x}$ =0.323	SE$\bar{x}$=0.484	SE$\bar{x}$=0.350
Skewness	γ1 =0.058	γ1 =0.250	γ1 =-0.034	γ1 =-0.293	γ1 =-0.448	γ1 =0.332	γ1 =-0.333	γ1 =0.004
Kurtosis	β2 =2.139	β2 =2.449	β2 =3.096	β2 =2.926	β2 =3.140	β2 =3.198	β2 =2.812	β2 =2.276
Kurtosis Excess	α4 =-1.257	α4 =-0.947	α4 =-0.300	α4 =-0.469	α4 =-0.256	α4 =-0.198	α4 =-0.584	α4 =-1.120
Coefficient of Variation	CV =0.182	CV =0.161	CV =0.091	CV =0.097	CV =0.075	CV =0.068	CV =0.092	CV =0.068

Table 3. Distribution of subject's statistics regarding the health-related components of physical fitness including maximal oxygen consumption (VO2 max), flexibility, muscular strength, and muscular endurance of pre-test & post-test of control group.

Statistics	Maximal Oxygen Consumption (VO_2 max)		Flexibility		Muscular Strength		Muscular Endurance	
	pre-test	post-test	pre-test	post-test	pre-test	post-test	pre-test	post-test
Minimum	min =24.47	min =23.80	min =12.00	min =12.00	min =20.00	min =21.00	min =20.00	min =23.00
Maximum	max =37.88	max =39.00	max =17.00	max =18.00	max =28.00	max =28.00	max =30.00	max =30.00
Range	R =13.41	R =15.2	R =5	R =6	R =8	R =7	R =10	R =7
Size	n =26	n =26	n =26	n =26	n =26	n =26	n =26	n =26
Sum	sum =809.18	sum =818.99	sum =385	sum =383	sum =639	sum =630	sum =671	sum =678
Mean	$\bar{x}$ =31.122	$\bar{x}$=31.499	$\bar{x}$=14.807	$\bar{x}$=14.730	$\bar{x}$=24.576	$\bar{x}$=24.230	$\bar{x}$=25.807	$\bar{x}$=26.076
Median	$\tilde{x}$ =31.17	$\tilde{x}$ =31.63	$\tilde{x}$ =15	$\tilde{x}$ =15	$\tilde{x}$ =24.5	$\tilde{x}$ =24.5	$\tilde{x}$ =26	$\tilde{x}$ =26
Mode	mode =31.17	mode =35.65	mode =16.00, 14.00	mode =15.00	mode =23.00, 24.00, 26.00	mode =25.00	mode =25.00, 26.00, 28.00, 27.00	mode =26.00
Standard Deviation	s =3.876	s =4.195	s =1.296	s =1.343	s =1.942	s =1.557	s =2.400	s =1.895
Variance	s2 =15.029	s2 =17.598	s2 =1.681	s2 =1.804	s2 =3.773	s2 =2.424	s2 =5.761	s2 =3.593
Mid-Range	MR =31.175	MR =31.4	MR =14.5	MR =15	MR =24	MR =24.5	MR =25	MR =26.5
Interquartile Range	IQR =4.47	IQR =7.61	IQR =2	IQR =1	IQR =3	IQR =2	IQR =4	IQR =3
Sum of Squares	SS =375.728	SS =439.970	SS =42.038	SS =45.115	SS =94.346	SS =60.615	SS =144.038	SS =89.846
Mean Absolute Deviation	MAD =3.05	MAD =3.272	MAD =1.068	MAD =1.023	MAD =1.576	MAD =1.230	MAD =1.914	MAD =1.479
Root Mean Square	RMS=31.353	RMS=31.767	RMS =14.862	RMS =14.789	RMS =24.650	RMS =24.278	RMS =25.914	RMS =26.143
Std Error of Mean	$SE\bar{x}$=0.760	$SE\bar{x}$ =0.822	$SE\bar{x}$=0.254	$SE\bar{x}$ =0.263	$SE\bar{x}$=0.380	$SE\bar{x}$=0.305	$SE\bar{x}$=0.470	$SE\bar{x}$=0.371
Skewness	γ1 =0.036	γ1 =0.01	γ1 =-0.209	γ1 =0.213	γ1 =-0.161	γ1 =-0.003	γ1 =-0.450	γ1 =0.186
Kurtosis	β2 =2.583	β2 =2.619	β2 =2.833	β2 =3.813	β2 =3.295	β2 =3.693	β2 =3.332	β2 =2.764
Kurtosis Excess	α4 =-0.813	α4 =-0.777	α4 =-0.563	α4 =0.416	α4 =-0.101	α4 =0.296	α4 =-0.064	α4 =-0.63
Coefficient of Variation	CV =0.124	CV =0.133	CV =0.0875	CV =0.091	CV =0.079	CV =0.064	CV =0.093	CV =0.072

Table 4. Analysis of covariance (ANCOVA) results regarding the health-related components of physical fitness including maximal oxygen consumption (VO2 max), flexibility, muscular strength, and muscular endurance.

Maximal Oxygen Consumption (VO_2 max) (ml/kg/min)				
Group	**Mean± S.D.**	**F**	**Sig.**	**Partial Eta Squared**
BPI Post-Test	32.45 ± 5.22	.630	.431	.013
Control Post-Test	31.49 ± 4.19			
Flexibility (cm)				
BPI Post-Test	14.88 ± 1.45	.885	.351	.018
Control Post-Test	14.73 ± 1.34			
Muscular Strength (kg)				
BPI Post-Test	24.07 ± 1.64	.076	.784	.002
Control Post-Test	24.23 ± 1.55			
Muscular Endurance (min)				
BPI Post-Test	26.19 ± 1.78	.011	.917	.000
Control Post-Test	26.07 ± 1.89			

NOTE: p value (p≥.05) considered as insignificant.

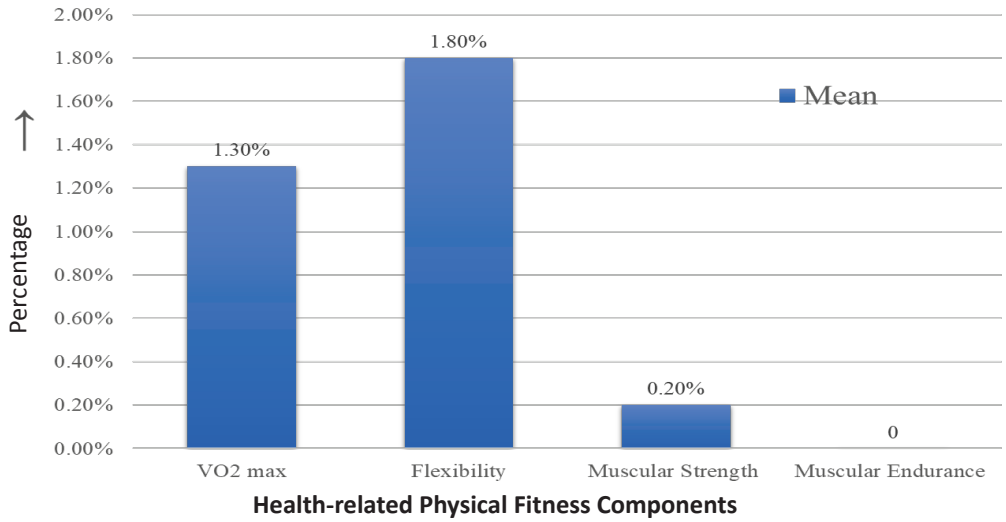


Figure 5. The increasing results in percentage % of 6-Weeks bhastrika pranayama intervention (BPI) on each variable of health-related components of physical fitness for BPI group as compared to control group.

pranayama is known for oxygen-based breathing exercise which helps to fill up the lungs with more oxygen and exhale carbon dioxide (CO_2) from the body through nostrils. In the nutshell, Bhastrika pranayama interventions with short as well as long duration in future research studies could be beneficial for healthy individuals with respect to health-related fitness components.

Conclusions

According to the findings of our study, the daily practice of Bhastrika pranayama helps to keep lungs more efficient, but additional research is required to completely comprehend the consequences of this breathing exercise. Bhastrika pranayama can be easily incorporated into an athletic training program. However, it may be necessary to practice, experience for longer than six weeks to experience improvements. It's also likely that the effects of bhastrika pranayama are restricted by one's fitness or activity level; future research should investigate this more in-depth and evaluate a longer duration of pranayama practice.

Consent

Informed consent was obtained from all individual participants included in the study.

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Conflict of interests

The authors declare no conflict of interest.

References

1. Taimni IK. *The science of yoga: the yoga-sutras of Patanjali in Sanskrit with Transliteration in Roman,* Translation and Commentary in English. Theosophical Publishing House; 1999.
2. Muktibodhananda S. *Hatha yoga Pradipika: light on hatha yoga.* 2nd ed. Bihar: Yoga Publication Trust; 2002.
3. Jeter PE, Slutsky J, Singh N, Khalsa SBS. Yoga as a Therapeutic Intervention: A Bibliometric Analysis of Published Research Studies from 1967 to 2013. *J Altern Complement Med,* 2015;21(10):586–92. https://doi.org/10.1089/acm.2015.0057
4. Sengupta P, Chaudhuri P, Bhattacharya K. Male reproductive health and yoga. *Int J Yoga,* 2013;6(2):87–95. https://doi.org/10.4103/0973-6131.113391
5. Sengupta P. Health Impacts of Yoga and Pranayama: A State-of-the-Art Review. *Int J Prev Med,* 2012; 3(7): 444–458.
6. Saoji AA, Raghavendra BR, Manjunath NK. Effects of yogic breath regulation: A narrative review of scientific evidence. *J Ayurveda Integr Med,* 2019;10(1):50–58. https://doi.org/10.1016/j.jaim.2017.07.008
7. Khalsa SB, Butzer B. Yoga in school settings: A research review. *Ann N Y Acad Sci,* 2016;1373(1):45–55. https://doi.org/10.1111/nyas.13025
8. Frank J, Seifert G, Schroeder R, Gruhn B, Stritter W, Jeitler M. Yoga in school sports improves functioning of autonomic nervous system in young adults: A non-randomized controlled pilot study. *PLoS One,* 2020;15(4): e0231299. https://doi.org/10.1371/journal.pone.0231299
9. Khalsa SB, Hickey-Schultz L, Cohen D, Steiner N, Cope S. Evaluation of the mental health benefits of yoga in a secondary school: A preliminary randomized controlled trial. *J Behav Health Serv Res,* 2012;39(1):80–90. https://doi.org/10.1007/s11414-011-9249-8
10. Veerabhadrappa SG, Baljoshi VS, Khanapure S, Herur A, Patil S, Ankad RB, Chinagudi S. Effect of yogic bellows on cardiovascular autonomic reactivity. *J Cardiovasc Dis Res,* 2011;2(4):223–7. https://doi.org/10.4103/0975-3583.89806
11. Saraswati SN. *Prana, Pranayama, Prana Vidya*. Yoga Publications Trust; 1994.
12. Nirajanananda SS. *Prana and Pranayama.* 2009.
13. Chodzinski J. The effect of rhythmic breathing on blood pressure in hypertensive adults. *J Undergrad Res,* 2000;1 (6): 78–98.
14. Sharma VK, Trakroo M, Subramaniam V, Rajajeyakumar M, Bhavanani AB, Sahai A. Effect of fast and slow pranayama on perceived stress and cardiovascular parameters in young health-care students. *Int J Yoga,* 2013 ;6(2):104–10. https://doi.org/10.4103/0973-6131.113400
15. Turankar AV, Jain S, Patel SB, Sinha SR, Joshi AD, Vallish BN, Mane PR, Turankar SA. Effects of slow breathing exercise on cardiovascular functions, pulmonary functions & galvanic skin resistance in healthy human volunteers – a pilot study Indian. *J Med Res,* 2013; 137(5): 916–921.
16. Sharma V, Trakroo M, Subramaniam V, Sahai A, Bhavanani A, Rajajeyakumar M. Effect of fast and slow pranayama on perceived stress and cardiovascular parameters in young health-care students. *Int J Yoga,* 2013;6:104. https://doi.org/10.4103/0973-6131.113400
17. Kjellgren A, Bood SA, Axelsson K, Norlander T, Saatcioglu F. Wellness through a comprehensive yogic breathing program - a controlled pilot trial. *BMC Complement Altern Med*, 2007;7:43. https://doi.org/10.1186/1472-6882-7-43
18. Telles S, Vishwakarma B, Gupta RK, Balkrishna A. Changes in Shape and Size Discrimination and State Anxiety After Alternate-Nostril Yoga Breathing and Breath Awareness in One Session Each. *Med Sci Monit Basic Res,* 2019; 25: 121–127. https://doi.org/10.12659/MSMBR.914956
19. Zaccaro A, Piarulli A, Laurino M, Garbella E, Menicucci D, Neri B, Gemignani A. (2018). How Breath-Control Can Change Your Life: A Systematic Review on Psycho-Physiological Correlates of Slow Breathing. *Front Hum Neurosci,* 2018;12:353. https://doi.org/10.3389/fnhum.2018.00353
20. Pal GK, Velkumary S. Madanmohan. Effect of short-term practice of breathing exercises on autonomic functions in normal human volunteers. *Indian J Med Res,* 2004;120(2):115–21.
21. Vk S, T D, M R, B G, Ab B. Impact of Fast and Slow Pranayam on Cardio Vascular Autonomic Function among Healthy Young Volunteers: Randomized Controlled Study. *Altern Integr Med,* 2018;07. https://doi.org/10.4172/2327-5162.1000265
22. Pramanik T, Sharma HO, Mishra S, Mishra A, Prajapati R, Singh S. Immediate effect of slow pace bhastrika pranayama on blood pressure and heart rate. *J Altern Complement Med,* 2009;15(3):293–5. https://doi.org/10.1089/acm.2008.0440
23. Santaella DF, Devesa CRS, Rojo MR, Amato MBP, Drager LF, Casali KR, et al. Yoga respiratory training improves respiratory function and cardiac sympathovagal balance in elderly subjects: a randomised controlled trial. *BMJ Open*, 2011;1:e000085–e000085. https://doi.org/10.1136/bmjopen-2011-000085
24. Tyagi A, Cohen M. Yoga and heart rate variability: A comprehensive review of the literature. *Int J Yoga*, 2016; 9(2): 97–113. https://doi.org/10.4103/0973-6131.183712
25. Chetan DK, Pawan SL, Pravin RK, Deepak MV, Suchita GS. Effect of Bhastrika Pranayama on "Shwasan Karma". *Int. J. Res. Ayurveda Pharm*, 2021;12(1):59. https://doi.org/10.7897/2277-4343.120114
26. Lau C, Yu R, Woo J. Effects of a 12-Week Hatha Yoga Intervention on Cardiorespiratory Endurance, Muscular Strength and Endurance, and Flexibility in Hong Kong Chinese Adults: A Controlled Clinical Trial. *Evidence-Based Complementary and Alternative Medicine*, 2015;2015:1–12. https://doi.org/10.1155/2015/958727
27. Baghel P, Shamkuwar S. Physiological Review of Qualitative Impact of Pranayama on Respiration. *International Journal of Innovation and Research in Educational Sciences*, 2017;4(1): 105–107.
28. Anand A, Patwardhan K, Singh R, Awasthi H. Effects of Pranayama on mental health and physical fitness in healthy University students. *Yoga Mimamsa*, 2018;50:27. https://doi.org/10.4103/ym.ym_15_17
29. Thangavel D, Gaur GS, Sharma VK, Bhavanani AB, Rajajeya kumar M, Syam SA. Effect of Slow and Fast Pranayama Training on Handgrip Strength and Endurance in Healthy Volunteers. *Journal of Clinical and Diagnostic Research,* 2014, 8(5): BC01–BC03. https://doi.org/10.7860/JCDR/2014/7452.4390
30. Gaurav V. (2011). Effects of Hatha Yoga Training on the Health-Related Physical Fitness. International *Journal of Sports Science and Engineering,* 2011;05(03):169–173.

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ORIGINAL ARTICLE

Examining the professional career values and career awareness of athlete- students: the sample of the faculty of sports sciences

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Abstract

Background and Study Aim Athlete-students continue their athletic careers at a professional level during their education, or many try to pursue alternative career paths. While much attention has been given to Athlete-students' academic progress and graduation rates in the literature, little attention has been paid to their attitudes towards career values and career awareness. Therefore, this study aimed to determine the career awareness and career values of athletes-students according to some demographic variables.

Material and Methods This cross-sectional descriptive-correlational study was performed in the Sports Science Faculty of Kahramanmaras Sutcu Imam University of Turkey which forms the universe of the study. A total of 334 (162 female and 172 male) athletes-students who were undergraduate students in the sports sciences faculty of the university participated in the research. The data collection tool in the study "Professional Career Awareness Scale", and "Career Values Scale" was used. T-test and One-Way ANOVA tests were used to perform the differential analysis and Pearson Correlation analysis was used to determine the correlation between variables.

Results: According to the results of the research, it was found that scores of the professional career values and career values of the athletes-students were at a moderate level. It was observed that the students' career values dimensions perception scores differed according to their perception scores and gender, department, class, age variables; there was no difference between the variable of being a licensed athlete and the dimensions. Differences were observed between career awareness dimensions, professional development disposition, and department and age variables. There was no difference between career awareness dimensions and gender, status of being a licensed athlete, and class variable. In addition, it is seen that there is a low and moderate relationship between professional career awareness and career values sub-dimensions.

Conclusions: According to these results, it can be said that due to the lack of standardized measures of athlete-student career development, career awareness and career values are at a moderate level and their perceptions differ according to their demographic characteristics.

Keywords: athlete, student, professional development, profession.

Introduction

Today, with the changing and developing business life, many important concepts have emerged. Undoubtedly, one of these concepts is the concept of career because young people choose a profession and plan the rest of their lives according to the profession they choose. However, over time, the profession preferred by the individuals in their lives goes beyond being a job and becomes a phenomenon that covers their aims, expectations and skills. Here, the concepts of career and career values become important because the concept of career in its most general definition is expressed as the work experiences, skills, expertise areas and knowledge of individuals gained in time. In addition to this, a large number of career definitions can be made since individuals have different needs, values and talents and personal traits of individuals are at the forefront of the concept of career [1]. When the concept of career value is considered, it is defined as the combinations of individuals' needs, motives, attitudes, values and skills [2]. These combinations develop in line with individuals' personality traits, motives, needs and skills and create professional career values. Since these professional career values are shaped according to individuals' expectations, interests and professional experiences, a new concept expressed as career awareness emerges. The concept of career awareness emerges as the most important building block of individuals' career development because after individuals make their career choices, they act with career awareness in determining career opportunities, being aware of talents and being directed and managed correctly in their business life [3]. However, it is seen that there are many sub-titles within the concept of career awareness. These are called basic knowledge, education and skill requirements about the profession, requirements of jobs in their natural environment and expectations about professional choices. Therefore, the concept of career awareness is evaluated as a concept covering individuals' abilities to make plans and researches about their careers, their knowledge about career opportunities and decision making process [4]. In a summary of literature related to occupational careers among former athletes [5]. noted that sport is connected to career success when it increases opportunities to complete academic degrees or develop job-related skills, increases support for growth and development not limited to athletic development and progression, and expands experiences, identities, and abilities unrelated to sports.

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In the last two decades, researchers have conducted many researches to understand academic progress and graduation rates of athlete-students [6] and found that they graduated in consistently higher rates than non-athlete university student [7]. However, this does not mean that they are ready for a career after graduation. In 1987, Kennedy and Dimick stated [8] that more attention should be paid to the career development of athlete-students because these athletes were generally lower in career development criteria when compared with non-athlete students. From this point of view, it can be said that athlete-students may not have time to participate in extracurricular activities such as developing career values and awareness and therefore they generally miss relevant professional development opportunities [9].

Ackerman [10] stated that some of the negative effects of participation of athlete-students in sports as an amateur or professional on career development were lack of time, stress and mental fatigue, low grades as a result of not attending classes. On the other hand, Ackerman [10, pp.45-46] stated being an athlete also had many valuable advantages such as athlete-students' transferrable characteristics, scholarships, strong social relationships and professional network. When the literature is reviewed, it can be seen that there are very few studies conducted by using the concepts of professional career value and career awareness together in university students who are athletes. It can be seen that studies on career value are mostly studies in which career values of participants are examined according to their personality traits or in which university students' career values are examined [11, 12, 13]. It can be seen that studies conducted on professional career awareness are mostly studies in which career awareness levels of participants studying in different educational levels and different areas have been measured [14, 15, 16]. Therefore, it is very important for athlete-students to start planning career from the first years of their educational lives in the process of getting a job, developing skills about their jobs and adapting easily to their job after their student life ends [17]. This is because career value is formed by the combination of life experiences and professional experiences [18]. For this reason, it is very important to increase the career value and professional career awareness of university students and to lead them in this regard. Therefore, the aim of this study is to examine university students' professional career values and career awareness levels in terms of some variables to make a case analysis and to make some recommendations about the professional career values and career awareness levels of athletes who are university students in line with the results obtained.

Material and Methods

Participants

This research is a cross-sectional study and its sample consists of 273 athletes-students, 115 females and 158 males, studying at Kahramanmaraş Sütçü İmam University Faculty of Sports Sciences in Turkey in the spring semester of 2019-2020 academic year.

Research Design

Data Collection Tools

Survey method was used in this study as data collection tool. "Personal Information Form" was used in the first part of the survey which consisted of three parts, while "Career Awareness Scale (CAS)" was used in the second part and "Career Values Questionnaire (CVQ)" was used in the third part.

*Career Awareness Scale (CAS): "*Career Awareness Scale" developed by Yaşar and Sunay [3] is a 5-Likert type scale with 4 dimensions and 18 items and it aims to measure the career awareness of university students in the field of sports sciences. Dimensions of career awareness were named as "Professional Development Susceptibility", "Professional Readiness", "Professional Consciousness", "Professional Self-Confidence". The lowest score that can be obtained from the scale is "18", while the highest score is "90". Cronbach Alpha value of the data was found as .921. In the present study, Cronbach Alpha value was found as .855.

*Career Values Questionnaire (CVQ): "*Career Values Questionnaire" which was developed by [Schein 19] is a 5-Likert type scale with 5 dimensions and 14 items. These dimensions were formed as follows in terms of career values or career goals. In the first factor, career is a tool for "self-realization", in the second factor, career mediates "creating value"; in the third factor, career is a way to "gain power"; in the fourth factor, career provides "autonomy" to create richness for the individual and in the fifth factor, career is a way to "gain respect" [20]. The scale was adapted into Turkish by Halis [20]. In the present study, Cronbach Alpha value was found as .957.

Statistical Analysis

The data of the research were analysed with SPSS 22 statistical package program. Frequency and percentage values were used to determine the demographic characteristics [gender, department, class, age, and Licensed Athlete] of the students in the faculty of sports sciences. In addition to that, arithmetic mean and standard deviation data were presented to determine students' Career Awareness Scale and Career Values levels. In addition to descriptive statistics; Normality analyses of the distribution of the research data were evaluated using the skewness and kurtosis tests. It was decided to use parametric tests since normal distribution was found. T-test was conducted to test whether the difference between the two unrelated sample averages was significant in terms of the variables of gender and Licensed Athlete. At the same time one-way analysis of variance (ANOVA) was used to determine whether there was a significant difference between the variables of department, class and age and whether there was a difference between the averages of the groups. Pearson correlation coefficient was calculated to determine the direction and amount of the correlation between Career Awareness Scale and Career Values levels of students.

Results

The data collected from the sample, its demographical

and descriptive information about the of athlete- students were as follows (table 1): 42.1% female, 57.9'% male; Regarding the class variable: 31.9% are 1st grade, 21.2% (135) are 2nd grade, 24.2% (65) are 3rd grade and 22.7%, It was determined that studied in the 4th grade; 44.3% of the participants study in the coaching department, 44.7% in the teaching department, 11.0% in the sports management department. When the age variable distribution was examined, it was determined that 59.0% of the participants were 18-21 years old, 29.7% were 22-24 years old, and 11.4% were 25 and over. 48.4% of the participants stated that they were licensed athletes and 51.6% were not licensed athletes.

When Table 2 is examined, the arithmetic means and standard deviations of the sub-dimensions of the Career Assessment Scale are found to be 20.42 ± 5.51 in the self-actualization sub-dimension; The benefit creation sub-dimension is 7.96 ± 2.17 '; Power gain sub-dimension; 8.07 ± 2.06; Autonomy sub-dimension is 11.39 ± 3.10; The sub-dimension of gaining prestige 7.23 ± 2.04 was found to be.

The sub-dimensions and standard deviations of the Professional Career Awareness Scale are: professional development disposition sub-dimension was 21.92±3.89; Occupational readiness sub-dimension was 16.07±2.84; Occupational consciousness sub-dimension was 16.58±2.82; Occupational self-confidence sub-dimension was found to be 14.92±2.81.

When Table 3 is examined, a statistically significant difference was found in the sub-dimensions of self-actualization, creating benefits, autonomy and dignity of the CAS according to the gender variable of the participants ($p<0.05$). When the arithmetic averages were examined, it was seen that this difference was in favor of male participants. No statistically significant difference was observed in any of the sub-dimensions of CVS ($p>0.05$).

When Table 4 is examined, there was no statistically

Table 1. Participants' Demographic Characteristics

Predictor (Variable)	Participants'	f	%
Gender	Female	115	42.1
	Male	158	57.9
Class	1st Class	87	31.9
	2nd Class	58	21.2
	3rd Class	66	24.2
	4th Class	62	22.7
Department	Coaching	121	44.3
	Physical Education	122	44.7
	Sport management	30	11.0
Age	18-21 Age	161	59.0
	22-24 Age	81	29.7
	25 Age and +	31	11.4
Licensed Athlete	Yes	132	48.4
	No	141	51.6
Total		**273**	**100**

Table 2. Descriptive statistics of teachers' CVS and CAS sub-dimensions

Sub Dimensions	X̄	sd	Min.	Max.
SR	20.40	5.51	5.00	25.00
CB	7.96	2.17	2.00	10.00
GP	8.07	2.06	2.00	10.00
AMY	11.39	3.10	3.00	15.00
ER	7.23	2.04	2.00	10.00
CVS TOTAL	3.93	0.57	1.00	5.00
PDS	21.92	3.89	8.00	30.00
PR	16.07	2.84	4.00	20.00
PC	16.58	2.82	4.00	20.00
PSC	14.92	2.81	4.00	20.00
CAS TOTAL	3,8618	,51578	1.61	4.83

*N:273, Self-Realization (SR): Creating Benefit (CB): Gaining Power (GP): Autonomy (ATMY): Earn Reputation (ER): Career Values Scales (CVS): Professional Development Susceptibility (PDS); Professional Readiness PR: Professional Consciousness (PC); Professional Self-Confidence (PSC): Career Awareness Scale (CAS).

Table 3. CVS and CAS sub-dimension t-test results of the participants in terms of the type of Gender

Scale	Sub Dimensions	Gender	N	X̄	ss	t	p
CVS	SR	Female	115	19.68	5.86	-1.89	0.05
		Male	158	20.96	5.19		
	CB	Female	115	7.65	2.32	-2.02	0.04
		Male	158	8.18	2.04		
	GP	Female	115	7.81	2.19	-1.75	0.08
		Male	158	8.25	1.96		
	AMY	Female	115	10.76	3.38	-2.88	0.00
		Male	158	11.84	2.79		
	ER	Female	115	6.91	2.30	-2.20	0.02
		Male	158	7.46	1.80		
CAS	PDS	Female	115	21.53	3.87	-1.42	0.15
		Male	158	22.20	3.89		
	PR	Female	115	15.87	2.90	-0.96	0.33
		Male	158	16.21	2.80		
	PC	Female	115	16.56	2.89	-0.12	0.90
		Male	158	16.60	2.77		
	PSC	Female	115	14.82	3.10	-0.49	0,62
		Male	158	15.00	2.58		

*N:273, Self Realization (SR): Creating Benefit (CB): Gaining Power (GP): Autonomy (ATMY): Earn Reputation (ER): Career Values Scales (CVS): Professional Development Susceptibility (PDS); Professional Readiness PR: Professional Consciousness (PC); Professional Self-Confidence (PSC): Career Awareness Scale (CAS).

Table 4. CVS and CAS sub-dimension t-test results of the participants in terms of the type of Licensed Athlete

Scale	Sub Dimensions	Licensed Athlete	N	X̄	s	t	p
CVS	SR	Yes	132	19.80	5.87	-1.81	0.07
		No	141	21.00	5.09		
	CB	Yes	132	7.75	2.21	-1.56	0.11
		No	141	8.16	2.13		
	GP	Yes	132	7.85	2.04	-1.68	0.09
		No	141	8.27	2.07		
	AMY	Yes	132	11.03	3.14	-0.97	0.06
		No	141	11.72	3.03		
	ER	Yes	132	7.10	1.95	-1.83	0.33
		No	141	7.34	2.13		
C÷AS	PDS	Yes	132	21.77	3.87	-0.61	0,53
		No	141	22.06	3.89		
	PR	Yes	132	16.30	2.90	1.29	0,19
		No	141	15.85	2.80		
	PC	Yes	132	16.66	2.89	0.43	0,66
		No	141	16.51	2.77		
	PSC	Yes	132	15.01	3.10	0.50	0,61
		No	141	14.84	2.58		

*N:273, Self Realization (SR): Creating Benefit (CB): Gaining Power (GP): Autonomy (ATMY): Earn Reputation (ER): Career Values Scales (CVS): Professional Development Susceptibility (PDS); Professional Readiness PR: Professional Consciousness (PC);Professional Self-Confidence (PSC): Career Awareness Scale (CAS).

significant difference in any of the sub-dimensions of CVS and CAS according to the variable of being licensed athletes (p>0.05).

When Table 5 is examined, a statistically significant difference was found in the sub-dimensions of career values, such as self-actualization, creating benefit, gaining strength and autonomy, according to the department variable of the athlete-students (p<0.05). A statistically significant difference was found in the professional development disposition sub-dimension of the career awareness scale (p<0.05). There was no difference in other dimensions.

When Table 6 is examined, a statistically significant difference was found in CVS' self-actualization, creating benefits, gaining power, gaining autonomy and gaining prestige sub-dimensions according to the class variable of the participants (p<0.05). No statistically significant difference was found in any of the sub-dimensions of CAS (p>0.05).

When Table 7 is examined, a statistically significant difference was found in the CVS' strength gain sub-dimension according to the age variable of the participants (p<0.05); no difference was found in the sub-dimensions of self-actualization, creating benefit, gaining autonomy and dignity (p>0.05). A statistically significant difference was found in CAS' professional development disposition sub-dimension according to the age variable (p<0.05), but no difference was found in the Professional Readiness, Professional Consciousness and Professional Self-Confidence sub-dimensions (p>0.05)

When Table 8 is examined, it has been determined that there is generally a low and medium level positive

Table 5. Anova-Test results of participants' CVS and CAS sub-dimensions in terms of the variables of department

Scale	Sub-Dimensions	Department	N	X̄	ss	F	p	Sig. Diff.
CVS	SR	1.Coaching	121	21.25	5.30	5.745	0.00	1*-2 2*-3
		2.Physical Education	122	19.21	5.88			
		3.Sport management	30	22.00	3.52			
	CB	1.Coaching	121	8.14	2.27	4.598	0.01	3*-2
		2.Physical Education	122	7.58	2.16			
		3.Sport management	30	8.80	1.42			
	GP	1.Coaching	121	8.13	2.31	4.639	0.01	3*-2
		2.Physical Education	122	7.77	1.91			
		3.Sport management	30	9.03	1.12			
	AMY	1.Coaching	121	11.72	3.04	6.327	0.00	1*-2 3*-2
		2.Physical Education	122	10.73	3.30			
		3.Sport management	30	12.70	1.46			
	ER	1.Coaching	121	7.25	2.23	2.158	0.11	-
		2.Physical Education	122	7.04	2.00			
		3.Sport management	30	7.90	1.09			
CAS	PDS	1.Coaching	121	21.48	3.97	13.575	0.00	3*-2 3*-1
		2.Physical Education	122	21.53	3.80			
		3.Sport management	30	25.26	1.87			
	PR	1.Coaching	121	15.84	3.04	1.039	0.35	-
		2.Physical Education	122	16.16	2.77			
		3.Sport management	30	16.63	2.22			
	PC	1.Coaching	121	16.66	2.94	0.236	0.79	-
		2.Physical Education	122	16.46	2.80			
		3.Sport management	30	16.80	2.36			
	PSC	1.Coaching	121	14.77	2.68	0.929	0.39	-
		2.Physical Education	122	15.17	2.95			
		3.Sport management	30	14.53	2.75			

The groups in favor of the significant difference are shown with (*). *N:273, Self Realization (SR):Creating Benefit (CB): Gaining Power (GP): Autonomy (ATMY): Earn Reputation (ER): Career Values Scales (CVS): Professional Development Susceptibility (PDS); Professional Readiness PR: Professional Consciousness (PC); Professional Self-Confidence (PSC): Career Awareness Scale (CAS);

relationship between the sub-dimensions of CVS and CAS.

Discussion

As a result of the analysis of data obtained from the study, male participants' perceptions of self-realization, creating value, autonomy and gaining respect sub-dimensions of career values were found to be high. No difference was found in terms of gender in any sub-dimensions of professional career awareness scale (Table 3). In their study conducted to find out the factors affecting career values, Başol, et al., [21]; Koca [22]; Pala [23] found differences between the variable of gender and career values sub-dimension in favor of male participants.

Table 6. Anova-Test results of participants' CVS and CAS sub-dimensions in terms of the variables of Class

Scale	Sub Dimensions	Class	N	X̄	ss	F	p	Sig. Diff.
CVS	SR	1st Class	87	22.26	4.85	8.303	0.00	1*-4 3*-4
		2nd Class	58	20.00	5.86			
		3rd Class	66	20.72	4.89			
		4th Class	62	17.91	5.75			
	CB	1st Class	87	8.54	1.93	6.966	0.00	1*-4 3*-4
		2nd Class	58	7.86	2.56			
		3rd Class	66	8.21	1.62			
		4th Class	62	6.98	2.32			
	GP	1st Class	87	8.64	1.97	6.622	0.00	1*-4 3*-4
		2nd Class	58	7.93	2.51			
		3rd Class	66	8.27	1.49			
		4th Class	62	7.19	2.00			
	AMY	1st Class	87	12.13	2.74	9.533	0.00	1*-4 3*-4
		2nd Class	58	11.06	3.40			
		3rd Class	66	12.18	2.49			
		4th Class	62	9.80	3.26			
	ER	1st Class	87	7.50	2.01	8.138	0.00	1*-4 3*-2 3*-4
		2nd Class	58	6.84	2.44			
		3rd Class	66	7.98	1.27			
		4th Class	62	6.40	2.02			
CAS	PDS	1st Class	87	21.50	4.45	2.407	0.06	-
		2nd Class	58	21.15	3.62			
		3rd Class	66	22.78	3.38			
		4th Class	62	22.30	3.66			
	PR	1st Class	87	15.54	3.34	2.132	0.09	-
		2nd Class	58	15.93	2.77			
		3rd Class	66	16.62	2.24			
		4th Class	62	16.37	2.65			
	PC	1st Class	87	16.37	3.53	1.089	0.35	-
		2nd Class	58	16.31	2.80			
		3rd Class	66	17.10	2.04			
		4th Class	62	16.59	2.37			
	PSC	1st Class	87	14.94	3.07	2.169	0.09	-
		2nd Class	58	14.17	2.82			
		3rd Class	66	15.42	2.70			
		4th Class	62	15.08	2.43			

The groups in favor of the significant difference are shown with (*). *N:273, Self Realization (SR): Creating Benefit (CB): Gaining Power (GP): Autonomy (ATMY): Earn Reputation (ER): Career Values Scales (CVS): Professional Development Susceptibility (PDS); Professional Readiness PR: Professional Consciousness (PC); Professional Self-Confidence (PSC): Career Awareness Scale (CAS).

Table 7. Anova-Test results of participants' CVS and CAS sub-dimensions in terms of the variables of Age

Scale	Sub Dimensions	Age	N	X̄	ss	F	p	Sig. Diff.
CVS	SR	1. 18-21	161	20.71	5.49	2.613	0.07	-
		2. 22-24	81	19.35	5.87			
		3. 25 and above	31	21.70	4.10			
	CB	1. 18-21	161	8.01	2.19	1.588	0.20	-
		2. 22-24	81	7.66	2.30			
		3. 25 and above	31	8.45	1.60			
	GP	1. 18-21	161	8.19	2.10	3.003	0.05	3*-2
		2. 22-24	81	7.64	2.15			
		3. 25 and above	31	8.58	1.43			
	ATMY	1. 18-21	161	11.42	3.12	1.163	0.31	-
		2. 22-24	81	11.00	3.34			
		3. 25 and above	31	12.06	2.15			
	ER	1. 18-21	161	7.31	2.05	1.741	0.17	-
		2. 22-24	81	6.91	2.20			
		3. 25 and above	31	7.64	1.45			
CAS	PDS	1. 18-21	161	21.49	3.81	5.051	0.00	3*-1 3*-2
		2. 22-24	81	22.03	3.91			
		3. 25 and above	31	23.87	3.73			
	PR	1. 18-21	161	15.93	2.91	0.886	0.41	-
		2. 22-24	81	16.11	2.86			
		3. 25 and above	31	16.67	2.42			
	PC	1. 18-21	161	16.62	2.81	1.202	0.30	-
		2. 22-24	81	16.28	2.99			
		3. 25 and above	31	17.19	2.27			
	PSC	1. 18-21	161	15.03	2.66	0.301	0.74	-
		2. 22-24	81	14.76	3.13			
		3. 25 and above	31	14.77	2.75			

The groups in favor of the significant difference are shown with (*). *N:273, Self Realization (SR): Creating Benefit (CB): Gaining Power (GP): Autonomy (ATMY): Earn Reputation (ER): Career Values Scales (CVS): Professional Development Susceptibility (PDS); Professional Readiness PR:Professional Consciousness (PC); Professional Self-Confidence (PSC): Career Awareness Scale (CAS).

These results support the study results. Unlike the results of the present study, in their studies they examined the factors affecting career values of associate degree students Şentürk and Buran [24] reported that female participants had higher perceptions between the variable of gender and career values. Eratlı Şirin and Aydın [25] examined the career values of students in the faculty of sports sciences and reported that there were no differences between the variable of gender and sub-dimensions of career values scale. Dinç [14, pp:139] and Öztürk [15, pp. 78-79] examined the career awareness of university students and did not find any differences between the variable of gender and career awareness Lacole [26] found that female athlete-students had higher career awareness and they may have had more diverse and broader past experiences guiding them in making career decisions.

Another result of the study was that no differences were found between the variable of being a licensed athlete and career values and sub-dimensions of professional career awareness (Table 4). There are studies in literature which show that being a licensed athlete has no effect on career development [27]. When the literature on career values is examined, in their study examining career values of students of sports sciences faculty, Eratlı Şirin and Aydın [25, p.42] found perceptions of female athletes higher. This result was found to be different than the results of our study. In a study on career differences, Dinç [14, p.140] reported that there were no differences between the variable of being an active athlete and career awareness.

In terms of the departments of students, it was found that in general students in the department

Table 8. Pearson's Correlation Analysis Results of CVS and CAS sub-dimensions

		CAS			
Scale	**Sub Dimensions**	**PDS**	**PR**	**PC**	**PSC**
CVS	SR	0.27**	0.31**	0.46**	0.24**
	CB	0.23**	0.28**	0.38**	0.19**
	GP	0.22**	0.31**	0.45**	0.21**
	AMY	0.25**	0.33**	0.36**	0.33**
	ER	0.25**	0.28**	0.40**	0.26**

n=273 **. Correlation is significant at the 0.01 level [2-tailed]. Self Realization (SR):Creating Benefit (CB): Gaining Power (GP): Autonomy (ATMY): Earn Reputation (ER): Career Values Scales (CVS): Professional Development Susceptibility (PDS); Professional Readiness PR: Professional Consciousness (PC); Professional Self-Confidence (PSC): Career Awareness Scale (CAS).

of sport management had higher career values and professional development tendency than the students of other departments. The reason for this result may be the fact that in general students in the department of sport management prefer this department as the second university and therefore they have higher career values and career awareness. Eratlı Şirin et.al [28], in their study on the social entrepreneurship of the students of the faculty of sports sciences, concluded that the dimensions of risk taking and self-confidence that affect the career awareness of the students are high. When the literature on career values is examined, Koca [22, pp.59]; Şentürk and Buran [24, pp.168]; [Eratlı Şirin and Aydın [25, pp.325] reported difference between career values and academic departments in career choice. In their study they examined the career values of university student athletes, Karakaya et al., [29] reported that there were no differences between the participants' faculties and career values. When the literature on professional career awareness was examined, in a study which examined the effect of university career development program on students' career awareness, Öztürk [15, pp.85] reported difference between participants' faculties and career awareness levels; while Dinç [14, pp.145] did not report any differences between the variable of department and career values. It can be seen that these results are different from study results. As a result of the study, it was found that student athletes in their first year of study had higher career values than the other students, while no difference was found in career awareness. It can be said that they have high career values since they are in the first year of their education life studying in a department they chose and it can be said that since students choose their careers, they are aware of their talents and they will act with career awareness from then on. Eratlı Şirin and Aydın [25, pp.227] reached similar results. When the literature about professional career awareness was examined, Öztürk [15, pp.90] found that participants' career awareness levels increased as their year of study increased. As another result of the study, it was found that older students had higher career values gaining power sub-dimension perceptions and professional development tendency sub-dimension in professional career awareness. In their studies examining the factors affecting career values of students, Şentürk and Buran [24, pp.170]; Eratlı Şirin and Aydın [25, pp.327] examined the differences between the variable of age and career values and found that participants who were 25 and older had higher career value perceptions than the participants who were 20 and younger. When the literature about professional career awareness was examined, Öztürk [15, pp.90] found that university students who were 26 and older had higher career awareness levels than students who were younger.

Conclusion

The results of the study showed a low and moderate positive association between career values scale and professional career awareness scale sub-dimensions (Table 8). As a result of this analysis, a direct proportion was found between the participants' career value perceptions and professional career awareness levels.

As a conclusion, it was found that while the variables of gender, department, year of study and age were partly effective on career values and professional career awareness, the variables of being licensed and monthly income did not have any effects on career values and professional career awareness. In addition, it was found that university student athletes' professional career awareness levels increased as their career values perceptions increased.

Based on the results of the research, it can be suggested that the instructors guide and support the students in order to increase the career values and awareness of the students. In their research, Eratlı Şirin and Şahin [30] stated that the creation of a school environment based on the counseling of instructors in institutions that train physical education teachers is a very important factor in terms of mutual trust, communication and support, which students need, in terms of awareness of students.

Conflict of interests

The authors state that there is no conflict of interest

References

1. Schein, EH. *Career Anchors and Career Paths: A Panel Study of Management School Graduates*. Cambridge: Organizational Studies Group, Sloan School of Management, Massachusetts Institute of Technology; 1974.
2. Batur HZ, Adıgüzel O. A research based on factors effectıng students' carrıer decısıons from the perspectıve of schemı's carrıer anchors: sample case of scıence hıgh schools ın the cıty of Isparta. *Dumlupınar University Journal of Social Sciences,* 2014; (42): 327–348.
3. Yaşar O, Sunay H. Development of sports awareness scale: validity and reliability study. *The Journal of Physical Education and Sport Sciences,* 2020; 18(1): 46–58. https://doi.org/10.33689/spormetre.672441
4. Nasir R, Lin LS. The relationship between self-concept and career awareness amongst students. *Asian Social Science,* 2013; 9(1): 193–197. https://doi.org/10.5539/ass.v9n1p193
5. Coakley J. *Sports in society: Issues and controversies*. New York, NY: McGraw-Hill Education; 2015.
6. Paskus TS. A summary and commentary on the quantitative results of current NCAA academic reforms. *Journal of Intercollegiate Sport,* 2012; 5: 41–53. https://doi.org/10.1123/jis.5.1.41
7. Petr TA, McArdle JJ. Academic research and reform: A history of the empirical basis for NCAA academic policy. *Journal of Intercollegiate Sport*, 2012; 5: 27–40. https://doi.org/10.1123/jis.5.1.27
8. Kennedy SR, Dimick KM. Career maturity and professional sports expectations of college football and basketball players. *Journal of College Student Personnel*, 1987; 28(4): 293–297.
9. Weisberg, S. NCAA survey delves into practice time, coaches' trust. USA Today. [Internet]. 2011 [updated 2010 Jan 10; cited 2020 Apr 10]. Available from: http://usatoday30.usatoday.com/sports/college/2011-01-14-ncaa-survey_N.htm
10. Ackerman C. *Exploration of Factors Related to Development of Vocational Identity in Collegiate Student Athletes*: (615202013-001) 2013. https://doi.org/10.1037/e615202013-001
11. Bayram N, Gürsakal S, Aytaç S. The Influence of Personality on Students' Career Values. *Journal of Social Sciences*, 2012; 12(2): 181–189.
12. Kim J, Lee M. The Effects of career development based on university & college students' work experience on career values. *The Journal of Career Education Research,* 2018; 31(3): 135–157. https://doi.org/10.32341/jcer.2018.09.31.3.135
13. Jackson D, Tomlinson M. Career values and proactive career behaviour among contemporary higher education students. *Journal of Education and Work*, 2019;32(2):449–464. https://doi.org/10.1080/13639080.2019.1679730
14. Dinç A. Investigating the relationship between ethical values and career awareness of Iğdır University sports science students. *African Educational Research Journal (Special Issue),* 2020; 8(2): 137–141. https://doi.org/10.30918/AERJ.8S2.20.040
15. Öztürk M. *The effects of university career development program on students' career awareness, decision-making self-efficacy, and stres*. Istanbul: Marmara Üniversity. Press; 2020.
16. Lee J, Kim A. An exploratory study on the career awareness of high school students: Focusing on the impact of cultural capital and social capital. *The journal of Educational Studies,* 2020; 51(3): 171–191. https://doi.org/10.15854/jes.2020.09.51.3.171
17. Akoğlan Kozak M, Dalkıranoğlu T. Career perceptions of new graduates: Anadolu University Example, *Anadolu University Journal of Social Sciences Institute,* 2013; 13(1): 41–52.
18. Erdoğmuş N. *Career development theory and practice.* Ankara: Nobel Publishing. Press; 2003.
19. Schein EH. Career Anchors Revisited: Implications for career development ın the 21th century, *Academy of Management Executive,* 1996;10(4): 80–88. https://doi.org/10.5465/ame.1996.3145321
20. Halis M, Cumaliyeva D. The effects of spiritual values on career values in career choice: A research on students, *Route Educational and Social Science Journal*, 2016; 3(2):17–30. https://doi.org/10.17121/ressjournal.514
21. Başol O, Bilge E, Kuzgun Ş. A research for determining of career values of students: Personal values, *Ejovoc (Electronic Journal of Vocational Colleges,* 2012; 2(2): 57–68.
22. Koca Aİ. The relationship of students' career preferences to personal values and demographic characteristics at Cukurova University, *Çukurova University Faculty of Economics and Administrative Sciences,* 2010; 14(1): 56–70. https://doi.org/10.25204/iktisad.429513
23. Pala A. Factors of affecting students' career values: The example of faculty of sports science, *International Journal of Human Sciences,* 2016; 13(1): 1897–1905. https://doi.org/10.14687/ijhs.v13i1.3707
24. Şentürk EE, Buran KA. Study on factors affecting the associate degree student's career anchors*, Ejovoc (Electronic Journal of Vocational Colleges),* 2015; 5(1): 162–180.
25. Eratlı Şirin, Y, Aydın Ö. Investigation of career values of faculty of sports sciences students, *Mediterranean Journal of Sport Science*, 2021; 3(2): 317–330. https://doi.org/10.38021/asbid.833906
26. Lacole LH. *Athletic Identity, Vocational Identity, and Occupational Engagement in College Student-Athletes and Non-Athletes.* Kansas. Kansas Universty, Press; 2010.
27. Finch J. The importance of clinical academic careers in nursing. *Journal of Research in Nursing*, 2009; 14(2): 103–105. https://doi.org/10.1177/1744987108101143
28. Eratlı Şirin Y, Bilir FP, Öz G. Universty students social entrepreneurship trends: The example of school of physical education and sport, *Gaziantep University Journal of Sports Sciences*, 2018; 3(3): 35–47.
29. Karakaya YE, Karataş Ö, Özdenk Ç, Karataş F. University sports students' perceptions of career value, *Dogus University Journal,* 2013; 14(1): 86–94. https://doi.org/10.31671/dogus.2018.98
30. Eratlı Şirin Y, Şahin M. Investigation of factors affecting the achievement of university students with logistic regression analysis: School of physical education and sport example, *SAGE Open,* 2020:1–9. https://doi.org/10.1177/2158244020902082

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ORIGINAL ARTICLE

The coordination abilities development in female students based on dance exercises

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Abstract

Background and Study Aim The physical fitness of students is characterized by the level of their abilities development to perform movements of varying complexity. One of the important components in the system of movements is coordination skills. The aim of the study is to identify the level of special and general coordination of students majoring in "Choreography" and provide recommendations for the development of coordination skills in the process of studying modern-jazz dance.

Material and Methods The study involved students of the first and second year of study (n = 10, at the beginning of the study (1 year) age - 17.4 ± 0.7 years) majoring in "Choreography". Tests were used to determine the level of development of general and special coordination skills. The level of coordination readiness at the beginning of training and after three semesters of training was determined. The study was conducted over three semesters (September 2019 - December 2020). Curricula for students' training do not include the discipline "Physical Education". The development of physical qualities is the task of special subjects in the course of professional training: 16 hours per week. The workload of students in modern-jazz dance was 2 hours a week. Forms of study for a certain period - full-time (70%), online learning (10%), mixed (20%). In September 2019 and in December 2020, the same students passed selected tests.

Results: The following significant changes in increasing the coordination level of the abilities were determined: to control temporal and spatial factors of movements; coordination of movements in combination; vestibular stability; musical-rhythmic coordination ($p < 0.01$). The proposed technique assumes that at the first stage of studying modern jazz dance two, three, four centers are coordinated in simultaneous parallel movement.

Conclusions: The need to improve the curriculum of modern jazz dance, the introduction of additional courses to the educational program in the major "Choreography". The technical and lexical base of modern jazz dance in combination with special physical training provides opportunities for the coordination skills development in choreographers.

Keywords: physical fitness, choreography, professional training, professional disciplines, teacher.

Terminology [1]

Bounce: Principle of execution of movements, characterized by mobility, especially of the gluteal and hamstring muscles in a way that resembles bouncing while keeping the feet on the ground.

Sauté: Is a classical ballet term that can be used alone or with another term to mean the step is performed while jumping.

Plie: Bent, bending. A bending of the knee or knees. This is an exercise to render the joints and muscles soft and pliable and the tendons flexible and elastic, and to develop a sense of balance.

Temps sauté: This can be executed with both feet from first, second, third, fourth, or fifth position starting with a demi-plié, leading to a jump in the air that lands with the feet in the same position as they started.

Contraction: A contracting of the abdominal muscles so the lower spine becomes rounded and the abdominal area hollowed out. The shoulders remain directly above the hips.

Arch: Position in which the whole or upper body is extended, creating the form of an arch.

Point та flex: Straightened state of body parts. To bend slightly or relax a portion of the body.

Pas chaine: In dance it is a two-step turn which can be performed in plie or releve. The body rotates 180 degrees on each step.

Swinging movements: A movement quality that is characterized by a reaction to the force of gravity. A lifted body part releases and drops along a curved path. Energy is added to the momentum of the drop to carry the body part upward on an arc where it suspends before returning on a downward path.

Modern-jazz dance: Modern-jazz dance is a term used in the academic dance world. It refers to a modern style that combines ballet technique with elements of contemporary and African - derived dances.

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Introduction

The physical fitness of students is characterized by the level of development of their abilities to perform movements of varying complexity. One of the important components in the system of movements is coordination skills. Their development requires considering the level of general physical fitness of students. The purpose of developing coordination skills can be: to improve or maintain health at the appropriate level; raising the level of mastery of movements to the standards of the future profession. It is professional standards that determine the approaches to the development of students' coordination skills. Therefore, for students majoring in "Choreography" an important component of professional development is the level of coordination skills development.

Problems of coordination abilities development are profoundly presented in researches of various directions. Bernstein emphasized that coordination is the overcoming of excessive degrees of freedom of the organs of movement and their transformation into controlled systems [2]. Matveev defines coordination abilities as the ability to appropriately coordinate movements in the construction and reproduction of new movements [3].

Logan et al. analyzed research on the problems of fundamental motor skills (FMS) [4]. The authors recommend it because FMS are the "building blocks" of more advanced, complex movements.

Opportunities and effectiveness of the students' coordination skills development depend on their previous training at school. Marchenko and Bezpalko studied the method of complex control of coordination abilities in 7-year-old boys [5]. It is determined that the development of coordination skills is an important part of the educational process in school. The lessons at school create the basis for new motor skills. This is a prerequisite for the successful development of other motor skills.

Boutios et al. studied the skills of movements coordination in children engaged in taekwondo [6]. The authors found out that coordination indicators improve with age and are positively affected by sports. Other studies have shown that the level of coordination indicators development is closely correlated with the effectiveness of competitive activities in volleyball [7] and handball [8].

In the physical training programs of students, it is necessary to consider the initial level of their coordination training. Barylko studied the dynamics of the coordination abilities level in students of I-II years of study [9]. It is established that it is possible to classify students according to the level of coordination preparedness according to their age. This is of practical importance for the development of effective physical education programs for students. Chien et al. investigated the role of errors in teaching motor skills of students [10]. The authors propose a scheme in teaching motor skills, which gives teachers a basis for its implementation by students.

The subjects of professional training in higher educational institutions of choreographic direction are the basis for the acquisition of professional skills of dancers [11]. This requires the future teacher to master a high level of dance movements. Nyberg et al. investigated the problems of showing motor exercises by a teacher during dance games [12]. The authors emphasized the teacher's ability to move as an integral educational goal of a physical education lesson.

Coordination is an important component of training in the art of dance. Vaganova notes that the achievement of full coordination of all movements of the human body forces to inspire the movement of thought, meaning, mood [13].

Another study examined a model of sports dance training based on flexibility and coordination [14]. The authors found that the development of a special training regime for sports dance based on flexibility and coordination should correspond to the physical condition of students.

Busol et al. studied stage movement in the acting profession [15]. The authors define coordination as the basis of agility and recommend approaches to its development. This is a guarantee of the optimal ratio of time and energy during the performance of the actor's movement on the stage.

Ou Tsin studied the development of masters' coordination skills through the means of "contemporary" dance. The author emphasizes the peculiarities of choreographic coordination in the coherence of movement, music, and artistry in a single time-space [16].

The works of specialists in rhythmic gymnastics deserve special attention [17, 18]. This complex coordination sport is very close to modern choreography.

The art of dance in schools and the corresponding training of students in physical education classes have been studied in several areas.

Orbaek et al. studied the experience of student teachers from teaching creative dance in their practical physical education classes in Norwegian schools [19]. The authors recommend introducing creative dance as a subject in school education.

Other authors studied dance-based physical education programs based on students' creative abilities [20]. This study provides additional support for the place of dance and creativity in the physical education curriculum.

Other authors agree with this statement. Amado et al. confirmed that schools should focus on encouraging teachers to teach motivational strategies to develop students' adaptive behavior [21]. This will develop a motivational style during dance classes at school.

Another study demonstrates that there is no aesthetic view on movement in physical education and research tasks for learning are rare [22]. It is confirmed that expressive dance tasks are well suited for the research method of teaching. This interaction can challenge the existing logic of competition and ranking in physical culture.

The next study focused on understanding the experience of undergraduate students in gymnastics and dance education in the context of modular education in

higher education [23]. The authors concluded that the opacity and transparency of the person can be important in student life's development.

Gibbs et al. investigated different ways of using dance exercises to teach dance in high school physical education [24]. It is confirmed that dance exercises can be used from a pedagogical point of view to teach dance. This allows the teacher to focus on observing, supporting, assigning tasks and providing feedback.

Another study recommends paying special attention to the knowledge of dance and pedagogical content in student training programs [25].

There is a lot of information about coordination and a sense of rhythm in research on the art of choreography. The types of coordination that are necessary to perform the elements of modern dance have not been sufficiently studied. There is an obvious need to conduct research considering the level of general and special physical training of students. Thus, the main task of the study is to develop a methodology for the development of the physical qualities of dancers. In particular, methods of development and improvement of their coordination skills.

The purpose of the study is to identify the level of special and general coordination of students majoring in "Choreography" and provide recommendations for the development of coordination skills in the process of studying modern jazz dance.

Material and Methods

Participants.

The study involved students of the first or second year of study (n = 10), majority "Choreography". At the beginning of the study, the average age of participants was 17.4 ± 0.7 years.

The study was conducted following the World Medical Association Declaration of Helsinki [26] and approved by the ethics committee of H. S. Skovoroda Kharkiv National Pedagogical University (Ukraine).

Research Design.

The study was conducted over three semesters (September 2019 - December 2020). Curricula for student training do not include the discipline "Physical Education". The development of physical qualities is the task of special subjects in the course of professional training: 16 hours per week. The workload of students in modern dance was 2 hours a week. Forms of study for a certain period - full-time (70%), online learning (10%), mixed (20%). In September 2019 and in December 2020, the same students passed selected tests.

Information on the individual physical fitness of female students was collected and summarized. A program for coordination skills development by means of modern jazz dance has also been designed.

Tests were chosen to determine the condition of coordination abilities.

Test №1. 4x9 m Shuttle test, s. - determination of the ability to control temporal, spatial factors of movements.

Test № 2. "Static equilibrium test according to Bondrevskij method with closed eyes, s" [27] - determination of the ability to maintain balance.

The author's tests include exercises for forced swing movements of modern jazz dance; performing turns on two legs with a stop in position; exercises for coordination on the principle of "control".

Test №3. "Test for performing forced swing movements of modern jazz dance" - determining the ability to coordinate movements in one combination.

Description:

– Starting position – the second position of the legs, hands over the body.
– On one hands go up. The knees perform "Bounce" (free swing). At the same time the hands, head, body turn to the right. Then the hands go down, the legs straighten.
– On two hands go up. The knees perform "Bounce" (free swing). At the same time the hands, head, body turn to the left. Then the hands go down, the legs straighten.
– On three hands go up. The knees perform "Bounce" (free swing). At the same time the hands, head, body turn to the right. Then the hands go down, and the jump sauté is performed in the second position.
– On four hands go up. The knees perform "Bounce" (free swing). At the same time the hands, head, body turn to the left. Then the hands go down, and the legs jump sauté legs in the second parallel position. Return to the starting position.

Note: in swinging hands together with the body, pay attention to the exact return to the starting position from which the swinging begins. The head is not put back. The knees perform "bounce", not a muscular plié. The arms are free, but not completely relaxed. Their natural form is kept, ie "included in the work". Landing after the jump is soft, without touching the floor with your heels, feet free. Bending at the knees performs exactly in the direction of the toes.

The test is performed using the display method. The teacher shows the exercise 2 times in slow motion, then 1 time in medium and 1 time in fast. Then students are given 7 minutes for self-training. For control performance students were divided into subgroups according to the list - 1 group - 5 people, 2 group - 5 people.

Evaluation: on a 5-point system:

- "5" - for accurate and correct execution of the sequence and the movements themselves;
- "4" - for insufficiently accurate execution of individual elements;
- "3" - for mistakes in the sequence of movements;
- "2-1" - for significant mistakes in the execution of movements and their sequence.

The test is not credited if the student cannot complete the combination at all.

Test № 4. "Performing turns on two legs with a stop in the 4th position" - determination of vestibular stability.

Description: At the teacher's command, the student performs 3 turns on both legs with the right foot, hands over the body, then stop in 4th free position: right leg in

front on the toes, left leg bent at the knee. A left hand raises upward.

Note: turns must be performed on one line, during the stop in the 4th position the body should be kept still.

Evaluation: on a 5-point system:

– "5" - accurate and correct execution of turns on one line, a clear stop;
– "4" - insufficiently accurate execution of turns, but a clear stop;
– "3" - non-compliance with one line during turns, not a clear stop;
– "2-1" - significant mistakes in the execution of turns, not a clear stop. The test is not credited if the student cannot complete the combination at all.

Test № 5. "Exercise for coordination on the principle of "control"- determining the ability to musical-rhythmic coordination.

Description: female students were divided into 2 subgroups as in test №3. The exercise was performed in 3 stages: the first time at a slow motion, the second time at a medium motion, the third time at a fast motion.

Evaluation: on a 5-point system:

– "5" - accurate and correct performance of movements according to the rhythmic pattern of musical accompaniment;
– "4" - insufficiently accurate performance of individual elements and correct performance of movements according to the rhythmic pattern of musical accompaniment;
– "3" - mistakes in the performance of movements and non-compliance with the rhythmic pattern;
– "2-1" - significant mistakes in the performance of movements and lack of sense of rhythm. The test is not credited if the student cannot complete the combination at all.

Students majoring in "Choreography" from the first semester master the technique of modern dance movements for 2 hours per week. However, the technique of modern jazz dance performing is introduced only after acquiring certain complex motor skills. In classes on the subject "Theory and methods of teaching modern dance" students participated in the preparation of choreographic compositions for performances of the dance ensemble (2 hours 2 times a week). Distance learning took place in the period from March 13 to May 29, 2020, and from October 15 to November 20, 2020. The peculiarities of the university's work during the COVID-19 pandemic provided an opportunity to conduct classes in a mixed form. For the period of online learning, students were offered the following tasks:

1. Make videos of warm-up combinations (plié, bt. tendu, bt. tendu jete);
2. Make videos of cross-turn combinations;
3. Make a complex for stretching muscles;
4. Make a report on the topic "Creativity of Martha Graham".

A method of the coordination abilities development in future choreographers was developed. The purpose of this approach is to try to increase the level of mastery of complex movements of modern jazz dance and professional skills.

At the first stage, paired rhythms were used in musical accompaniment: 2/4, 4/4, 6/8. Gradually moved to a polyrhythm of a more complex level: odd rhythms: 5/4, 7/8, 9/8; introduction of complex rhythmic patterns. The structure of the training is shown in Table 1.

It should be noted that paragraphs 2-5 (Table 1) were changed by:

Change combinations:

2. *Parterre*. Starting position - "Star"; pass to the position of "embryo"; then the "embryo" sitting position. Position sitting on bent knees, back straight. Move to the position of the legs forward (as a fold, the body is flat), the body bends freely to the side, the legs swing in the ring.
3. Cross (steps, jumps, turns). Adding and transforming the jump temps sauté:
1. To perform in parallel positions.
2. To start from the reverse position, and during landing move the feet to a parallel position.
3. During the jump, bend your knees, put your shin back and touch your buttocks with your heels.
4. To bend one leg during the jump to the "knee" position.
5. To perform a contraction to the center of the body during the jump.
6. At flight, perform arch of body.
7. To bend both knees and join the feet ("frog").
8. To spread straight legs apart.
9. To bend your knee to the chest.

4. *Dance composition (study of combinations).* Starting position - legs in the first parallel position, hands over the body. Triplet. (Tombe right leg forward, simultaneously straightens and rises to the first position of the left hand, the right hand is moved to the second position. Two steps on the toes of the left and right foot, hands down and swing over the body).
5. *Cooldown*. Introduction of sphinx poses, plow; bending to straight legs (feet point and flex).

The proposed method assumes that at the first stage of modern jazz dance studying two, three, four centers are coordinated in simultaneous parallel movement. The process of studying coordination is created from simple to complex. First, there is an explanation of how to distribute attention between the movement of the two centers. For example, one of the centers may be in a swing. Then it does not need attention but needs to focus on the movement of another center.

Statistical analysis.

The statistical analysis program SPSS 20 was used. For each variable was calculated: X - arithmetic mean; s – is the standard deviation; Δx – is the marginal sampling error for the mean; t – Student's criterion; p – is the level of significance. The significance of differences in the groups was assessed using parametric indicators (Student's test) and nonparametric indicators (Wilkinson-Mann-Whitney, Rosenbaum tests).

Table 1. The tasks structure of three semesters performance by students

No	Type of work	Duration	Content
1	Warm up	15-20 min	It begins with the use of various forms of pore de bra, including swings, spirals, small slides, turns. Then pass to the traditional lesson plie, bt. tendu, bt. tendu jete, rond, adajio, grand battement (in parallel and inverted positions with the work of the body, head arch, drop, baunce-rebounce, releve). To these combinations are added: swing, pulses, deviations from the axis, twisting, small parterre motions, falls.
2	Parterre	15 min	This part of the lesson is used to solve the following tasks: exercises to prepare and perform stunts and falls; performing acrobatic elements. The parterre consists of the following elements: fall; «book»; «Flight» - rolling through the shoulder blades; swing in the parterre; overturning, over the shoulder back; stand on the shoulder.
3	Cross (steps, jumps, turns)	15 min	In this part of the lesson were used: steps in a jazz manner; steps with animation (triplet); study of slide steps; performance of crosses with jumps of classical dance jete, sisson; crosses with swing (tour, shene) in large poses.
4	Dance composition (study of combinations)	20-25 min	1. Combination using bends, body spirals, contraction and realise. At the same time the «working» leg is raised by 90 degrees and above. 2. Combination with the use of tour lent and other types of parterre tours, fouette en tournant and pirouettes. 3. Combination with the use of different angles, level changes, moved around the classroom space. Combinations are formed into a dance composition considering the passed material and individual features of students.
5	Cooldown	5 min	Stretching exercises on the parterre (fold, butterfly, twine, pulsating body bends, the leg opening with hands). Use of yoga poses (downward-facing dog pose; cobra pose; bow pose; stretching pose).

Table 2. Dynamics of coordination readiness indicators of female students

№	Tests	Female students (n = 10)		
		The beginning of the experiment	The end of experiment	p
1.	Test 1. 4x9 m Shuttle test, s.	11.17 ±0.39	10.95±0.41*	0.00025 < 0.01
2.	Test 2. Static balance according to the Bondrevskij method, s. :			
	Stand on the right leg, s.	4.6±2.32	5.2±2.68*	0.04 < 0.05
	Stand on the left leg, s.	4.9±1.52	5,4±1,52*	0.026 < 0.05
	Among the best indicators, s.	6±1.8	7 ±1.8*	0.0042 < 0.01
3.	Test 3. Performing forced swing movements of modern jazz dance	2.6± 0.72	3.4±0.8*	0.0015 < 0.01
4.	Test 4. Performing turns on two legs with a stop in the 4th position	3.2±0.68	4±0.8*	0.0015 < 0.01
5.	Test 5. Exercise for coordination on the principle of «control»	2.9±0.54	3.7±0.7*	0.0015 < 0.01

* - differences are significant according to Student's t-test

Results

It was determined that at the beginning of the study, the majority of female students showed low and medium scores on all tests. At the end of the study, there were positive changes in all test indicators. The results of coordination training in the dynamics of three semesters are presented in Table 2.

The results of the study showed significant changes: in the ability to manage temporal and spatial factors; coordination of movements in a single combination, vestibular stability, musical-rhythmic coordination ($p<0.01$). There was an increase in the average statistical indicators for maintaining balance ($p <0.05$).

There is a tendency to increase coordination skills.

As a result, there is an expansion of the arsenal of motor capabilities and faster assimilation of educational material.

Discussion

Our research was aimed at determining the level of special and general coordination of future choreographers. In choreography, it is accepted to distinguish: coordination, aplomb, sense of rhythm. The results obtained generally confirm the opinion of other researchers [2, 3, 28]. The authors noted that coordination abilities depend on the characteristics of the central nervous system, its physiological conditions, and the restructuring of individual muscles and the whole body. The effectiveness of constant monitoring of choreographers' physical fitness is proved and is emphasized in our previous work [11].

The analysis of other studies on the development of coordination skills and dance structure of motor actions allows us to mainly and partially agree with their authors [29-31]. The authors noted that coordination in modern jazz dance is performed out in two ways: by impulse (two or more centers are moved simultaneously) or by the principle of control (centers have joined the movement sequentially). Jazz-modern dance combines elements of jazz choreography; modern style and classical dance technique; expression and complex emotions. Different centers can coordinate. For example head and shoulders, hands and head, shoulders and head, etc.

In general, we agree with the opinion of researchers Nikitin [32] and Kolumbet [28] on the classification of coordination skills development. However, we det6ermined the following components of specific coordination in modern jazz dance:

Ability to balance - maintaining the stability of posture (balance) in certain static positions of the body during the movement (body bend movements, flat back or tabletop, Deep body bend, which are used throughout the lesson in the "warm-up", "Adagio", " Parterre "and" Cross ").

Ability to musical-rhythmic coordination (sense of rhythm) - the ability to coordinate a given movement with music rhythm and image. The student hears the rhythm and can clap or perform exercises according to the musical accompaniment.

Ability to restructure motor actions - the speed of transformation of the performed forms of movements or switching from one motor action to another in changing conditions (cross combinations, etc.).

Vestibular stability - the ability to accurately and stably perform motor actions in conditions of vestibular stimuli (overturns, throws, turns, etc.).

Arbitrary muscle relaxation - the ability to optimally balance the relaxation and contraction of certain muscles at the given time (Roll down and roll up, drop, swing, etc.).

The ability to coordinate movements - the combination of individual movements and actions into integral combinations.

We agree with Hua [14] on the development of a special training regime for sport dance for students. However, we propose to create it considering the sets of exercises for all physical skills development and with an emphasis on the implementation of complex coordination exercises.

The most difficult test for students was the Bondrevskij test with closed eyes. That is why we emphasize the need to perform dance elements with closed eyes in class and suggest the use of elements of ideomotor training.

Conclusions

Professional coordination abilities of dancers are readiness for optimal control of separate specific tasks: on maintenance of vestibular balance; ability to react quickly; muscle relaxation; orientation in time and space; possibility to restructure the rhythmic scheme; ability to work in harmony with all parts of the body. The main principles of the methodology of coordination abilities development in choreographers are the principles of individualization and differentiation. It is recommended to pay attention to the development and maintenance of the physical skills of dancers.

The results of the study confirmed the effectiveness of the author's program for the coordination skills development in future choreography teachers through jazz-modern dance. They also identified the need to improve the curriculum for the study of jazz-modern dance, the introduction of additional courses (disciplines chosen by students) to the program in the major "Choreography". It is recommended to consider the demand for highly qualified specialists in modern choreography. It is also necessary to increase the number of hours devoted to the study of jazz-modern dance. The technical and lexical base of jazz-modern dance in combination with special physical training provides opportunities for the coordination skills development in choreographers.

Practical recommendations

To improve the coordination skills of choreographers in the process of modern jazz dance studying, we offer the following practical recommendations. To include the following exercises into the process of training choreographers:

- *Circuit training.* Set of various motor tasks that exert a multifaceted effect on the body. These are exercises with a predominant focus on the formation of muscular feelings. For example, jumping crosswise (forward - to the side, back - to the side), lunge back to "curtsy"; 15-20 repetitions - 3 times and 1.5 minutes of rest.
- *"Mirror" exercises.* Performance in pairs of separate elements, movements, combinations (students stand opposite each other - "mirror reflection"). The exercise duration is from 10 to 20 minutes. For example music size 2/4. Starting position: female students sit in a full squat in 6 poses; hands over the body; the arms barely touch the floor. *1st-2nd bars* - run around on the floor (left) with the left upper arm support on the floor. *3rd bar* - step with the left foot to the side, left hand bent at the elbow, the right hand opens under the left hand, hands close at the same time as the body wave. *4th bar*

- pas chaine to the 2nd point of the hall, jump, lunge with open hands.

• *Exercises to develop flexibility.* The required level of flexibility provides optimal amplitude, freedom, and efficiency of movements. Such exercises should be regular – at least 3-4 times a week. The technique should consider the individual, age, anatomical and physiological characteristics of dancers. We recommend keeping the following rules: class duration – at least 10 min and not more than 35-40 min; complexity increases gradually; the system of exercises ends with complete relaxation (duration - from 5 to 10 s).

• *Exercises for stability and balance.* Maintaining balance is an important condition for the quality performance of motor actions. To maintain a certain posture, it is recommended to increase the static stability of the body: performing motor tasks in light conditions; gradually move to more complex movements. For example a) training balance in the rack on one leg (bend the other back, arms at the waist); b) gradually complicate the program of action - training to maintain high stability of the body in a high position on the toes on a gymnastic bench, deck (with different positions of the arms, body and free leg). Increasing the stability of the body in dynamic exercises is much more difficult to achieve. This is due to the need to overcome a group of translational reflexes. We recommend performing: run exercises along one line; acceleration and a series of acrobatic jumps along a specially marked corridor (narrow line of 10-15 cm); completion of a series of acrobatic jumps with stable landing poses.

• *Rhythmic exercises*. When performing dance exercises, include motor actions with different tempos and rhythms. This will help applicants to determine their easily and quickly their rhythm. Performing the contrasting movements with an unexpected change in their direction, amplitude, tempo, speed, dynamics. This will make the overall scheme of motor action bright, expressive, spectacular, and attractive. considering the sets of exercises for all physical skills development and with an emphasis on the implementation of complex coordination exercises.

• *Exercises to develop plasticity*. Plasticity is characterized by movements performed together (without pauses, without a visible tension, with a smooth distribution of forces). To improve plasticity, it is recommended to form in students the skills of mentally creating motor actions: mentally reproduce several motor actions to avoid unjustified stops, pauses, sharp contrasting movements. The development and improvement of plasticity are more effective when acquainting students with the basic requirements of choreographic composition: slow start; in the middle of the composition there is an increase in effort, culmination; the end of the motor task is indicated by a fixed pose.

Conflict of interest.

The authors declare no conflict of interest.

References

1. *Modern dance technique language / terminology* [Internet]. 2021 [updated 2021 Jun 01; cited 2021 Jun 25]. Available from: https://www.stolaf.edu/depts/dance/faculty/anthony/courses/Modern-Dance-Language.htm
2. Bernstein NA. *The co-ordination and regulation of movements*. Oxford, New York, Pergamon Press; 1967.
3. Matveev LP. *Theory and methods of physical culture.* Moscow: Physical culture and sport; 2008. (In Russian).
4. Logan SW, Ross SM, Chee K, Stodden DF, Robinson LE. Fundamental motor skills: A systematic review of terminology. *Journal of Sports Sciences*. 2018;36(7):781–796. https://doi.org/10.1080/02640414.2017.1340660
5. Marchenko S, Bezpalko D. Control and Assessment of 7-Year-Old Boys' Coordination Abilities at the Initial Training Stage in Kyokushin Karate. *Journal of Learning Theory and Methodology*, 2020;1:82–8. https://doi.org/10.17309/jltm.2020.2.06
6. Boutios S, Fiorilli G, Buonsenso A, Daniilidis P, Centorbi M, Intrieri M, et al. The Impact of Age, Gender and Technical Experience on Three Motor Coordination Skills in Children Practicing Taekwondo. *International Journal of Environmental Research and Public Health*. 2021;18(11). https://doi.org/10.3390/ijerph18115998
7. Solovey O, Hunchenko V, Solovey D, Wnorowski K. Influence of static balances level on competitive performance indicators of athletes 17-21 years old in beach volleyball. *Physical Education of Students*. 2020;24(6):332–9. https://doi.org/10.15561/20755279.2020.0605
8. Hermassi S, Fadhloun M, Chelly MS, Bensbaa A. Relationship between agility T-test and physical fitness measures as indicators of performance in elite adolescent handball players. *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports*. 2011;5:125–131.
9. Barylko MG. Comparative Overview of Functional and Motor Preparedness of First- and Second-Year College Students. *Teorìâ Ta Metodika Fìzičnogo Vihovannâ,* 2019;19:14–22. https://doi.org/10.17309/tmfv.2019.1.02
10. Chien KP, Chen S. The Influence of Guided Error-Based Learning on Motor Skills Self-Efficacy and Achievement. *Journal of Motor Behavior*. 2018;50(3):275–284. https://doi.org/10.1080/00222895.2017.1341377
11. Limanskaya O, Kriventsova I, Podrigalo L, Yefimova O, Jagiello M. The influence of professional training disciplines on the physical fitness level of the folk dance department students. *Pedagogy of Physical Culture and Sports*. 2020;24(5):248–54. https://doi.org/10.15561/26649837.2020.0505
12. Nyberg G, Meckbach J. Exergames "as a teacher' of movement education: exploring knowing in moving when playing dance games in physical education. *Physical Education and Sport Pedagogy*. 2017;22(1):1–14. https://doi.org/10.1080/17408989.2015.1112778
13. Vaganova V. *Basics of classical dance.* St. Petersburg; 2000. (In Russian).
14. Hua W. Research on the special training model of sports dance based on flexibility and coordination. *Agro Food Industry Hi-Tech*. 2017;28(3):981–985.

15. Busol A, Busol V, Kronshtal' G, Cibul's'kij M. Stage movement as a part of professional training of students majoring in physical acting. *Fizichna kul'tura, sport ta zdorov'ia nacii,* 2014; 17: 34–41. (In Ukrainian).
16. Ou Tsin. Development of coordination skills of masters in the process of studying the dance style "contemporary". In: *Current issues of contemporary art education in the context of European integration: choreographic art, April 12, 2020*. Kharkiv: KhNPU; 2020. P. 85–89.
17. Agopyan A. An analysis of movements with or without back bend of the trunk or large hip extension in 1(st) Juniors' Rhythmic Gymnastics World Championship-2019. Is there injury risk for gymnasts? *International Journal of Performance Analysis in Sport*. 2021;21(1):108–125. https://doi.org/10.1080/24748668.2020.1850038
18. Sierra-Palmeiro E, Bobo-Arce M, Fernandez-Villarino M, Alonso-Tajes F, Gonzalez-Martin MC, Gomez-Rivas L. Association foot morphology and performance in rhythmic gymnastics. *Revista Internacional De Medicina Y Ciencias De La Actividad Fisica Y Del Deporte*. 2020;20(79):567–583. https://doi.org/10.15366/rimcafd2020.79.012
19. Orbaek T, Engelsrud G. Teaching creative dance in school - a case study from physical education in Norway. *Res Danc Educ*. 2020;15. https://doi.org/10.1080/14647893.2020.1798396
20. Neville RD, Makopoulou K. Effect of a six-week dance-based physical education intervention on primary school children's creativity: A pilot study. *European Physical Education Review*. 2021;27(1):203–220. https://doi.org/10.1177/1356336x20939586
21. Amado D, Molero P, Del Villar F, Tapia-Serrano MA, Sanchez-Miguel PA. Implementing a Teacher-Focused Intervention in Physical Education to Increase Pupils' Motivation towards Dance at School. *Sustainability*. 2020;12(11):13. https://doi.org/10.3390/su12114550
22. Mattsson T, Larsson H. 'There is no right or wrong way': exploring expressive dance assignments in physical education. *Physical Education and Sport Pedagogy*. 2021;26(2):123–136. https://doi.org/10.1080/17408989.2020.1752649
23. Ward G, Scott D. Lived experiences of undergraduate physical education students studying gymnastics and dance education. *Sport Education and Society*. 2020;25(2):213–229. https://doi.org/10.1080/13573322.2019.1571485
24. Gibbs B, Quennerstedt M, Larsson H. Teaching dance in physical education using exergames. *European Physical Education Review*. 2017;23(2):237–256. https://doi.org/10.1177/1356336x16645611
25. Marquis JM, Metzler M. Curricular Space Allocated for Dance Content in Physical Education Teacher Education Programs: A Literature Review. *Quest*. 2017;69(3):384–400. https://doi.org/10.1080/00336297.2016.1256223
26. World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. *JAMA*, 2013;310:2191. https://doi.org/10.1001/jama.2013.281053
27. Bondrevskij E.Ia. Age features of the development of balance functions in schoolchildren. In: Kuznecova ZI (ed.). *Motor skill development of school children***.** Moscow: Enlightenment; 1987. (In Russian).
28. Kolumbet OM. *Coordination skills development*. Kiev: Education of Ukraine; 2014. (In Ukrainian).
29. Slapsys R. International Dictionary of Modern Dance. *Reference & User Services Quarterly,* 1999;38(4): 418.
30. Jadranka Vlašić, Goran Oreb, Damir Vučić. Basic motor abilities and dancing efficiency of the female students at faculty of kinesiology in Zagreb. *8th International Scientific Conference on Kinesiology.* Opatija, Croatia. 2017. P. 829–833.
31. Srhoj Ljerka, Ratko Kati, Andreja Kaliterna. Motor Abilitiesin Dance Structure Performance in Female Students. *Original scientific paper,* 2006; 2: 335–341.
32. Nikitin VIu. *Modern-jazz dance: Stages of development. Methodology. Technique.* Moscow: Publishing house "One of the best"; 2004. (In Russian).

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