PHYSICAL EDUCATION OF STUDENTS

Maximal aerobic speed as prior reference point skills fitness capacities among elite male volleyball players

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

Abstract

Purpose: Maximal aerobic speed (MAS) levels are a prior reference point in the optimal management of effort parameters motor skills-related fitness. Typically indicated in sports literariness by improving the aerobic components that work to develop muscle flexibility, coordination of joint movements, the increase of speed and strength, which their developments advance the overall physical condition of the players.

Material: To solve the objective of this research, we establish the MAS levels of 60 elite male volleyball players (aged 22 to 25 years, ±5 years in elite championships). As well as their motor skill-related fitness, inspected by 20m speed, T-test agility and power strength volleyball test jumps (vertical or horizontal).

Results: Our results confirm maximal aerobic speed (MAS) values as essential components for the player to achieve high performance under high explosive loads. Upkeep by our protocol to be advanced at MSA upper than 3.99 (m/s). Suspected as a variation of effort energy consumption. Explained by similarity through different resistance player capacities relative to its biomechanical particular gesture activity improvements or its movement technique optimized to his boundary conditions.

Conclusions: Our protocol supports MAS levels (MAS) as an excellent test to evaluate the development of motor abilities in masculine volleyball. Upkeep by our protocol to be developed at MSA +3.99 (m/s). Claims as a minimal component of the conditioning to improve the motor volleyball skill-fitness ability. Subjected in this study as an easy volleyball-test tool to predict players' speed, agility, coordination and power developments. Challenging our trainers to access the player's anaerobic energy as a pointer of players' physical capacity skills fitness progress.

Keywords: male, volleyball, elite, training, coordination.

Introduction

Volleyball Alberta Coaching recommends the select of Volleyball talent based on the measures and tests [1]. Released by literacy in senior volleyball players below maximal effort corresponding to the stages in the energy consumption coordinates of the dynamic effort [2]. Support by data motor activity in volleyball through the physiological capacities. Demanding from players to develop a superior ability to sprint, jump, change direction, and complete sport-specific skills [3].

Admitted by scientists done the motor abilities, similar to aerobic functional improvements relative to muscle flexibility, joint mobility, coordination, force, speed and resistance training process improvements [4, 5]. Backing by Methenitis et al. via the ability of volleyball players to skill spiking, blocking and attacking [6]. Typically considered as the key characteristics of the successful volleyball player [7] in complex actions [8]. Well-known as a significant part of training exercises to develop volleyball sport-specific performances [9]. Claims by Timothy et al. through the motor or skill-related fitness including agility, reaction time, balance, coordination, power, and speed [10]. Known by Buckworth et al. via the ability of volleyball players to skill spiking, blocking and attacking [11]. Typically considered as the key characteristics of the successful volleyball player [7] in complex actions [8]. Well-known as a significant part of training exercises to develop volleyball sport-specific performances [9]. Claims by Timothy et al. through the motor or skill-related fitness including agility, reaction time, balance, coordination, power, and speed [10]. Known by Buckworth as combining ability [11].

Registered by Ashton et al. as an exact model of key development of the motor abilities, which can boost the training process and optimize the potential acquisition [12]. Tested in this study based on some coordination abilities support by Volleyball Alberta Testing Protocol (VAO) through Standing Reach (Vertical Jump Test (Spike Approach), Vertical Jump Test (Block), T-Test (Agility) and 20-meter Sprint [1]. As well as standing triple jump (TJ) to test the coordination and leg strength of the participants [13].

Despite that, all jump tests used in the present study are able to assess the athlete's anaerobic power using speed as an indirect indicator. Where the improvements of aerobic capacity also develop muscle flexibility, joint mobility, coordination, it increases force, speed and resistance, thus improving the students' overall physical condition through its aerobic functional components. Our come in this study based on maximal aerobic speed (MAS) as a meaningful tool to evaluate the specificity of training and to enable coaches to monitor training loads more accurately [12]. Adopt through the current study under three levels of MAS (-3.50m/s; +3.5 at -4 m/s and +4m/s) as a protocol to test their impact on motor skill-related fitness, such as speed, agility, coordination and power string [8]. Sustenance through the similarities as valid indicators of Volleyball game characterizes, which

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request a high number of skills repetitions for continued progressing toward game speed [11]. Well-defined as a moderate duration exercise including repeated bouts of high-intensity activity interspersed with brief periods of low to moderate active recovery or passive rest [2]. Reported via match analysis to be characterized by repeated explosive activities, such as jumps, shuffles and rapid changes in the direction [1]. Cited as most frequently components of skill fitness include agility, coordination, speed, power, and strength, usually associated with sports performance specific skills [14, 15].

Material and methods

Participants.

The research was done among 58 elite male volleyball players age around 20 to 25 years, from Oran league, during Algerian Championship 2016–2017, after their pre-competitive period.

Research Design.

To solve the tasks of the research we used the following methods – tests and protocol:

In terms of tests, we based on Volleyball Alberta Testing Protocol (VAO) composed by:

- Standing Reach (V J): measuring the vertical jump height jumped.
- Vertical jump Spike Approach (VJS): athletes should attempt to touch the Vertical at the highest point of the jump (with one hand, like a volleyball spike).
- Vertical Jump Test Block (VJB): athletes should attempt to touch the vertical (with both hands like a block in volleyball).
- T-Test Agility (TA): the test includes 4 cones (A, B, C, D) Cones A and B are 10m apart, and cones C and D are 5m from cone B. Following a warm-up, the athlete stands at cone A on the command, the athlete sprints to cone B and touches the base of the cone with his/her hand and shuffles either to the left toward cone C or to the right toward cone D and touches the cone with the closest hand. The athlete faces forward at all time and cannot cross their feet. Upon touching cones C or D, the athlete shuffles to the other far cone and touches it with the closest hand. The athlete does NOT touch cone B when crossing to the other side. The athlete shuffles back to cone B and touches its base. The athlete runs backwards to cone A, and at the moment he/she crosses the cone the time is stopped.
- 20-meter Sprint (20ms): the athlete is to sprint as fast as possible from one line to the other/finish.
    - ✓ According to Volleyball Alberta Coaching, all tests used to assess the athlete's anaerobic power using speed as an indirect indicator [1].

For coordination, we applied the standing triple jump (TJ). Support by Thomas via their phases (hop, steep, and jump) [16], mainly connected with athlete coordination, according to Kostikiadis et al [17].

In terms of protocol

- Sample: we based on 1200m Shuttle Test to classify the players under their MAS.

1200m Shuttle Test was developed to measure an athlete's ability to run 1200m as quick as its possibility. It has been shown to be a valid and reliable predictor of high-intensity aerobic capacity and VO2 max among athletes from various sports and competition levels. To Calculate Maximal Aerobic Speed, we used the formula:

MAS (m/s) = 1200 / (time in seconds – BMI) [13]

- Progress: Tests were held in 2 days, separated by 48 hours
    - ✓ The first day, we applied the 1200m Shuttle Test, for the second, we practised the other tests. All participants passed the exams without difficulty [18].
    - ✓ The second day, we followed the process made by Peev:

❖ Body weight (kg) and height (cm) were measured using a digital scale calibrated against known weights to ensure its validity and reliability.

❖ Warm up consists of 8 minutes running; six minutes of exercises for the whole body; six minutes of stretching, three accelerations of 20 m.

❖ First, we held the standing triple jump. The entire participant made three consequent jumps with 1 minute between them. After the same sequences, we made the other jump test.

❖ After 12 minutes, we made the two sprinting tests (20 m running from standing start). We made two attempts, each attempt with 6–8 minutes' recovery between them). The best attempt was taken into account. The entire participant ran alone [10].

Statistical Analysis

SPSS Statistics 19 (Chicago, Illinois, IBM, USA) processed all statistical analyses.

A descriptive analysis, mean and standard deviation, was performed regarding anthropometric and fitness characteristics. ANOVA and LSD were used to inspect the differences. In addition, Levene calculates to inspect the homogeneity.

Results

The data from the test and the descriptive statistics are presented in Table 1. Based on MAS categories maintained via a three-class drive for players' performance in 1200m Shuttle Test. Our results confirmed based on ANOVA one way. That the levels of MSA are an acceptable evaluation tool to predict the improvements in speed, the enhancements of muscle power and strength. As well as the improvements of technique, relative to the efficiency of ground coverage. Support by Ferreira, et al as conditioning specific needs of each athlete that allows for proper musculoskeletal adaptation (i.e. jumping, sprinting, agility and endurance performance) [19].

Establish by Kostikiadis et al. as a personal level of players' aerobic fitness [17]. Assured by the enhancing of anaerobic threshold that can enhance an individual's capacity to perform sustained submaximal activities allied to repeated contraction at high level of strength or power output. Strong correlation with strength/power

Table 1. Variability of indicators that characterizes motor abilities based on MSA levels

Variables	MAS	N	Mean	S. D	F	P≤0.05	Levene	P≤0.05
Height	— 3.5m/s	20	175.81	1.75	1.81	0.17	0.16	0.84
	+ 3.51 to –3.99m/s	18	175.18	1.15				
	+3.99	22	177.32	1.09				
	Total	60	176.17	1.76				
Weight	— 3.5m/s	20	68.17	2.44	2.19	0.12	0.39	0.70
	+ 3.51 to –3.99m/s	18	69.71	2.35				
	+3.99	22	67.15	2.30				
	Total	60	66.12	2.86				
BMI	— 3.5m/s	20	22.89	2.09	0.79	0.46	0.92	0.33
	+ 3.51 to –3.99m/s	18	22.86	1.87				
	+3.99	22	21.53	2.04				
	Total	60	22.13	2.02				
MAS	— 3.5m/s	20	3.47	0.09	242.95	0.00	33.84	0.00
	+ 3.51 to –3.99m/s	18	3.89	0.13				
	+3.99	22	4.32	0.25				
	Total	60	3.69	0.54				
20ms	— 3.5m/s	20	2.57	0.24	12.13	0.00	0.07	0.79
	+ 3.51 to –3.99m/s	18	2.48	0.22				
	+3.99	22	2.23	0.25				
	Total	60	2.41	0.27				
TJ	— 3.5m/s	20	6.86	3.11	10.40	0.00	0.08	0.92
	+ 3.51 to –3.99m/s	18	7.22	2.86				
	+3.99	22	7.93	2.99				
	Total	60	7.23	3.44				
VJ	— 3.5m/s	20	51.61	5.93	11.02	0.00	0.19	0.66
	+ 3.51 to –3.99m/s	18	59.65	5.19				
	+3.99	22	62.65	5.95				
	Total	60	56.11	6.63				
VJS	— 3.5m/s	20	52.42	5.85	11.04	0.00	0.15	0.75
	+ 3.51 to –3.99m/s	18	55.24	5.24				
	+3.99	22	58.42	5.95				
	Total	60	56.83	6.62				
VJB	— 3.5m/s	20	51.57	5.93	9.38	0.00	0.03	0.98
	+ 3.51 to –3.99m/s	18	58.79	6.28				
	+3.99	22	62.62	5.95				
	Total	60	57.82	6.85				
TA	— 3.5m/s	20	4.9	0.55	10.42	0.00	0.04	0.88
	+ 3.51 to –3.99m/s	18	4.47	0.52				
	+3.99	22	4.05	0.55				
	Total	60	4.36	0.62				

MAS (M/s); BMI (kg/m2); TJ (m) VJ (cm) VJS (cm); VJB (cm); TA(s);20m(s)

and sprint performance. Extensively known by fitness trainers as agents used to boost power, speed, agility and coordination components of motor fitness primarily used to improve specific endurance and total work capacity to tolerate the physiological discomfort of anaerobic work. Challenging the coaches to consider the MSA levels differences as a tool to regulate anaerobic zone training individual programs. Regarding player baseline strength and power anaerobic capacity developments [20]. Support in the case of this study by the significance of LSD in the benefits of players with four (m/s) et+, flowed by 3.51 to 3.99 (m/s) at last the group with MAS -3.51 (m/s) in all comparisons practised.

Claims in this study based on MSA levels in the benefits of its superiority, which permit players to perform high-intensity actions with speed power, agility and coordination [8]. Admitted by similarities as a skill-related component of physical fitness allied to aerobic power,

Table 2. Present differences between MAS levels and players levels skill volleyball physically ability.

MAS	(I) SMP	(J) SMP	Mean Difference (I-J)	Std. Error	P≤0.05
MAS	-3.5m/s	3.51to3.99m/s	-0.64*	0.06	0.00
		+3.99m/s	-1.19*	0.05	0.00
	3.51to3.99m/s	-3.5m/s	-0.64*	0.06	0.00
		+3.99m/s	-0.56*	0.05	0.00
20ms	–3.5m/s	3.51to3.99m/s	0.09	0.08	0.25
		+3.99m/s	0.34*	0.07	0.00
	3.51to3.99m/s	–3.5m/s	0.08	0.08	0.23
		+3.99m/s	0.26*	0.07	0.00
TJ	-3.5m/s	3.51to3.99m/s	-0.63	0.97	0.52
		+3.99m/s	-3.92*	0.92	0.00
	3.51to3.99m/s	-3.5m/s	-0.63	0.97	0.51
		+3.99m/s	-3.29*	0.95	0.00
VJ	-3.5m/s	3.51to3.99m/s	-1.95	1.86	0.29
		+3.99m/s	-7.95*	1.77	0.00
	3.51to3.99m/s	-3.5m/s	-1.95	1.86	0.30
		+3.99m/s	-5.99*	1.82	0.00
VJS	-3.5m/s	3.51to3.99m/s	-2.17	1.85	0.24
		+3.99m/s	-8.00*	1.77	0.00
	3.51to3.99m/s	-3.5m/s	-2.17	1.85	0.24
		+3.99m/s	-5.83*	1.82	0.00
VJB	-3.5m/s	3.51to3.99m/s	-2.78	1.96	0.16
		+3.99m/s	-7.95*	1.86	0.00
	3.51to3.99m/s	-3.5m/s	-2.78	1.96	0.16
		+3.99m/s	-5.17*	1.92	0.00
TA	-3.5m/s	3.51to3.99m/s	0.23	0.17	0.20
		+3.99m/s	0.74*	0.18	0.00
	3.51to3.99m/s	–3.5m/s	0.23	0.17	0.20
		+3.99m/s	0.51*	0.17	0.00

*. The mean difference is significant at the 0.05 level.

maximal oxygen consumption, and cardiorespiratory endurance capacity that are related to the rate at which player can perform work or movement within a short period of time [11].

Discussion

The key finding of the present study procures that the levels of anaerobic energy are associated with volleyball sport-specific motor skills (spiking, blocking and attacking). In the favours of superior MAS in all tests practised. Conclude by Peev through the development of the speed endurance that depended on the maximal sprint abilities and "speed reserve" [7]. Judged by Edward., [18] owed to the levels of anaerobic energy supply system player developments. Interpret by Rikberg et al [21] not only in the improvements of the result in the test but also in technique skills execution. The case of this study support by T-test Agility. As the ability of players to combine movements enables relations between automated motor skills, the technical elements and processes specific motorsport demands [11]. See Figure 1.

Although base on parameters of maximal effort corresponding to the stages in the energy consumption and coordinates of the dynamic effort. Our results confirm that improvements of maximal aerobic speed (MAS) growth aerobic and anaerobic players capacity, the developments' of muscle flexibility, joint mobility, coordination, force, speed and muscle resistance [2]. See Figure 2.

Confirmed by Pion et al through its linearity with speed, agility, coordination and power [22]. Admitted by our protocol as differences players' anaerobic level energy release. Upkeep by Peev through the technique of power tests and speed [4] extra of the neural adaptations quality of Max strength, sprint time, Max anaerobic power and strength performance [9].

Record at present in the benefits of players with elevated MAS able to increase their power explosive speed abilities. Claims by Kostikiadis et al. [17] through the adequate physical condition, training programs aim to improve anaerobic and aerobic metabolism and specific endurance. Which should be included in technical and strength-related Muscular anaerobic Power training. Incorporate in their coaching programs as skills that enable players to perform the maximum effort in a short period. Affirmed by Fuchs et al as functional movement exercise components of skill-related fitness include the development of speed, recovery time, muscular endurance, anaerobic and aerobic fitness [23].

Conclusions

Support that anaerobic power represents the highest rate of anaerobic energy released essential for developing

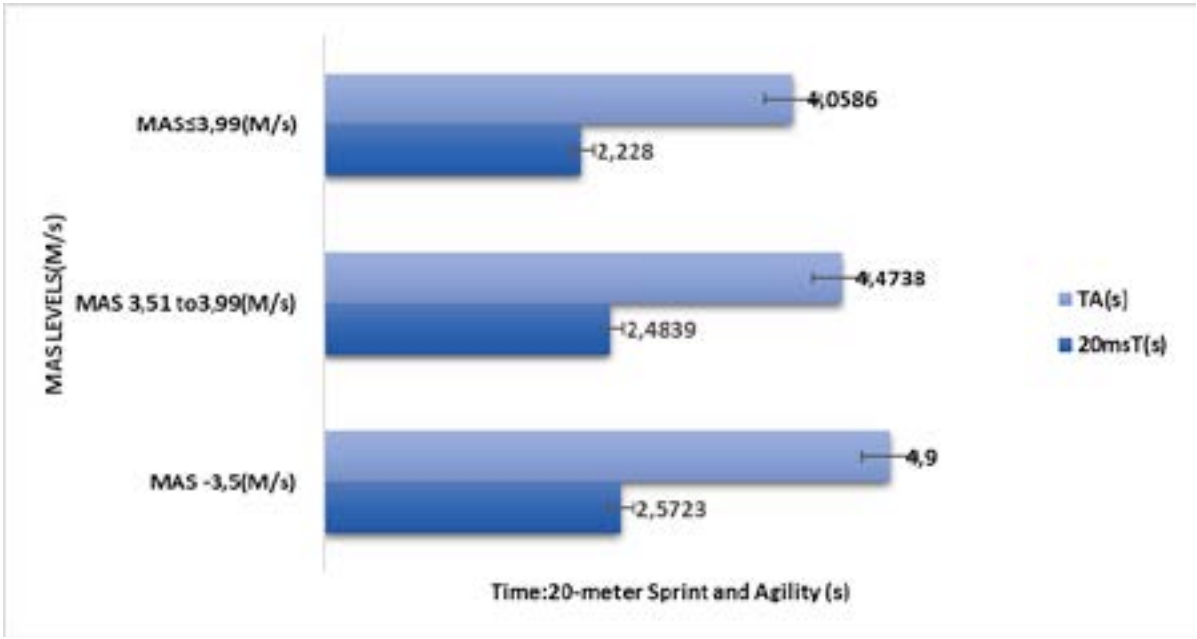

Figure1. Present the levels of Maximal Aerobic Speed (MAS) with •20-meter Sprint and T-agility test

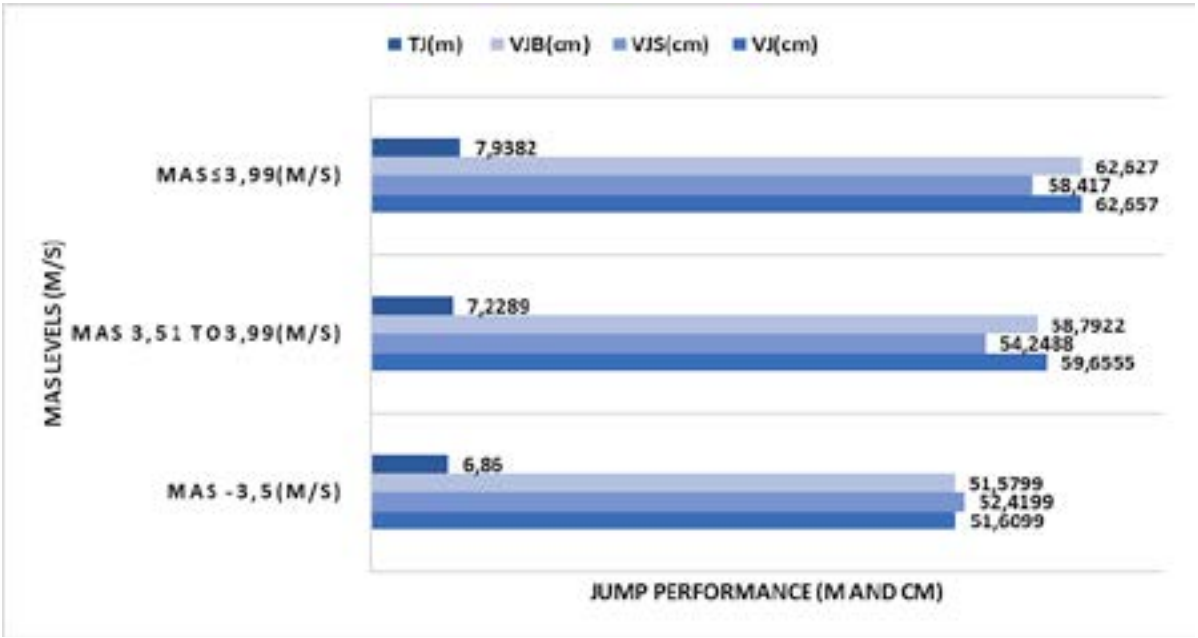

Figure2. Present the levels of Maximal Aerobic Speed (MAS) with jumping Tests used

sprint, power, strength, quick acceleration and deceleration. The data of the present study recommended our volleyball players to develop their MAS levels upper than ≤ 3,99m/s. Advanced through this study as physiological parameters proper to improve maximal aerobic capacity muscle flexibility, joint mobility, coordination, force, speed and muscle resistance. Mention in similar studies as a handy tool indicator of anaerobic ability to monitor players' training physical fitness. Appropriate to their techniques progress at higher levels effectively used in competition activity.

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Conflicts of interest

There are no conflicts of interest.

References

1. *V. A. O. Volleyball Alberta Coaching*. [Online]. 2017 [cited 2017 June 5]. Available from: http://www.volleyballalberta.ca/sites/default/files/sites/Indoor/Team_AB/VA%20Testing%20Protocols%20-15.pdf
2. Datson N, Hulton A, Andersson H, Lewis T, Weston M, Drust B, Gregson W. Applied physiology of female soccer. *Sports Medicine*, 2014; 44(8): 1225- 1240. https://doi.org/10.1007/s40279-014-0199-1
3. Ion-Silviu B, Sorin G, Paul M, Tiberiu P, Eugen B. Postural differences of volleyball players. *Timisoara Physical Education & Rehabilitation Journal*. 2016; 9(17): p. 41- 45. https://doi.org/10.1515/tperj-2016-0014
4. Peev P. *Methodological approaches to impact on speed dangers in 13-14 year olds*. [PhD thesis]. Sofia; 2017. (In Bulgarian)
5. Kalina RM, Jagiełło W. Non-apparatus, Quasi-apparatus and Simulations Tests in Diagnosis Positive Health and Survival Abilities. In: Ahram T, editor. *Advances in Human Factors in Sports, Injury Prevention and Outdoor Recreation, vol. 603,* Cham: Springer International Publishing; 2018, p. 121–8. https://doi.org/10.1007/978-3-319-60822-8_12
6. Methenitis S, Zaras N, Spengos K, Stasinaki AN, Karampatsos G, Georgiadis G, Terzis G. Role of Muscle Morphology in Jumping, Sprinting, and Throwing Performance in Participants With Different Power Training Duration Experience. *The Journal of Strength & Conditioning Research*. 2016; 30(3): 807-817. https://doi.org/10.1519/JSC.0000000000001147
7. Sobko IN, Ulaeva LA, Kozina ZhL, Grinchenko IB, Glushko K. Recovery of the physical performance of young volleyball players at the stage of specialized basic training using aerobic fitness tools. *Health, sport, rehabilitation*, 2018; 4(3): 120-134. (in Russian)
8. Cristina-Elenaa M, Liliana-Elisabetaa R. Aspects regarding the level of coordination abilities in both athletes and non-athletes. *Procedia - Social and Behavioral Sciences*. 2014; 117: 162 – 166. https://doi.org/10.1016/j.sbspro.2014.02.195
9. Andrzejewski M, Chmura J, Pluta B, Konarski J. M. Sprinting Activities and Distance Covered by Top Level Europa League Soccer Players. *International Journal of Sports Science and Coaching*. 2015; 11(1): 39-50. https://doi.org/10.1260/1747-9541.10.1.39
10. Timothy JS, Sophia N, Michael HS. The Importance of Muscular Strength in Athletic Performance. *Sports Medicine*. 2016; 46(10): 1419–1449. https://doi.org/10.1007/s40279-016-0486-0
11. Buckworth J, Rod KD, Patrick JO'C, Phillip DT, Janet Buckworth Rod K, Dishman Patrick JO'Connor, Phillip DT. *Exercise Psychology*. Champaign, IL: Human Kinetics; 2013.
12. Ashton MC. *Personality Structure*, Elsevier; 2013, p. 57–80. https://doi.org/10.1016/B978-0-12-416009-5.00003-7
13. Shepherd J, Antoniades M. *101 youth fitness drills: age 7-11*. London: A & C Black; 2010.
14. Giorgos PP, Zacharogiannis E, Mandila D, Smirtiotou A, Argeitaki P, Cooke CB. Multi-Stage 20-m Shuttle Run Fitness Test, Maximal Oxygen Uptake and Velocity at Maximal Oxygen Uptake. *Journal of Human Kinetics*. 2014; 41: 81-87. https://doi.org/10.2478/hukin-2014-0035
15. Jagiełło W, Marina J, Maciej KR, Jan BB, Artur L, Jarosław K. Properties of body composition of female representatives of the Polish national fencing team – the sabre event. *Biology of Sport,* 2017;34:401–6. https://doi.org/10.5114/biolsport.2017.70526
16. Thomas R. *Advances in Sport, Leisure and Ergonomics*. London: Routledge; 2003.
17. Kostikiadis IN, Methenitis S, Tsoukos A, Veligekas P, Terzis G, Bogdanis GC. et al. The Effect of Short-Term Sport-Specific Strength and Conditioning Training on Physical Fitness of Well-Trained Mixed Martial Arts Athletes. *J Sports Sci Med*. 2018; 17(3): 348-358.
18. Edward S. *The science of volleyball practice development and drill design: from principles to applications*. Bloomington, IN: iUniverse; 2012.
19. Ferreira A, Enes C, Leao C, Goncalves L, Clemente FM, Lima R, et al. Relationship between power condition, agility, and speed performance among young roller hockey elite players. *Human Movement*, 2019;20:24–30. https://doi.org/10.5114/hm.2019.79040
20. Stamm R, Stamm M, Thomson K. Role of adolescent female volleyball players' psychophysiological properties and body build in performance of different elements of the game. *Percept Mot Skills*. 2005; 101(1): 108–120. https://doi.org/10.2466/pms.101.1.108-120
21. Rikberg A, Raudsepp L. Multidimensional performance characteristics in talented male youth volleyball players. *Pediatr Exerc Sci*. 2011; 23(4): 537–548. https://doi.org/10.1123/pes.23.4.537
22. Pion JA; Fransen J, Deprez DN, Segers VI, Vaeyens R, Philippaerts RM, Lenoir M. Stature and Jumping Height Are Required in Female Volleyball, but Motor Coordination Is a Key Factor for Future Elite Success. *Journal of Strength and Conditioning Research*. 2015; 29(6): 1480–1485. https://doi.org/10.1519/JSC.0000000000000778
23. Fuchs PX, Fusco A, Bell JW, von Duvillard SP, Cortis C, Wagner H. Movement characteristics of volleyball spike jump performance in females. *Journal of Science and Medicine in Sport* 2019. https://doi.org/10.1016/j.jsams.2019.01.002

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