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MAXIMAL AEROBIC SPEED AS A USEFUL TOOL TO UNDERSTAND SPECIFIC TRAINING DEMAND AMONG ELITE MALE VOLLEYBALL

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ABSTRACT

Aim: The study aims to study the impact of Maximal Aerobic Speed (MAS) levels on the growth of skills fitness among volleyball. **Methods:** To achieve this objective, we assess the levels of MAS for 60 elite male volleyball players (ages 22 to 25 years with +5 years' experience in elite championships). Tested by volleyball Alberta tests and standing triple jump and T agility tests to estimate the effect of coordination abilities on players body adaptations to recover from the high-intensity and fatiguing actions as a result of levels of endurance**. Results:** Backup on statistics applied, centred on MAS levels as protocol. We confirmed that a high-level of MAS enhanced skills fitness. Admitted by the inverse correlation between the levels of MAS in compares with speed, power and explosive abilities. In the benefits of players with elevated levels of MAS as a beneficial condition to improve skills fitness (Serve-attack/Spike/Block) among volleyball players.
Conclusion: our protocol supports the development of MAS at 4 + (m/s). Agreed as minimal components of physical condition allied to neuromuscular system adaptations, which permit players not only to improve their speed and power components. But also, their ability to recover from high-intensity and fatiguing actions.

Keywords: maximal aerobic speed, volleyball, elite, skill physically ability, correlation

INTRODUCTION

Admitted that volleyball is distinguished by intermittent actions of acceleration, deceleration and change of direction. Which should be evaluated by use of the measures and tests appropriate for volleyball performance (1). Performed through test physiques that can predict the utilisation of the phosphagen, glycolytic and aerobic energy systems (2). Project by Volleyball Alberta Testing Protocol (VAO) comprising Standing Reach, Vertical Jump Test (Spike Approach), Vertical Jump Test (Block), T-Test (Agility) and 20-meter Sprint. As a fundamental element to inspect indirectly the anaerobic power. Recorded in this study as an indirect measure to predict the ability of players to recover from high-intensity and fatiguing actions (3). Suggest by experts through a longitudinal carrier control based on coordination (agility), explosive strength and the vertical jump as most factors impacting the volleyball players performance (4). Upkeep by data motor activities in volleyball, through physiological capacities, which claims players to maintain highly aerobic and anaerobic fitness. Such as the ability to sprint, jump, change direction, and complete sport-specific skills (2).

Confirmed by survey research, through the motor abilities as fundamental factors directly related to the neuromuscular system training (5).

Known by experts as a significant part of the conditioning and their relationships can optimize the quality and consistency of the constituent movements. Investigated via this study through skills fitness contribute to the performance of the technical and tactical skills (Serve-attack/Spike/Block) among volleyball players (6).

Claims through the structures and the logical methods to evaluate and develop the abilities of players aimed at their initial levels acquired (5). Shown in similar studies as an exact specific model training focusing on highly trained players (7). Target to develop the motor abilities (neuromuscular function), which can boost the training process and optimize the significance needs of power and strength to obtain slight improvements in certain actions (sprint and change of direction speed) (8).

Agreed in the case of this study, within the maximal aerobic speed (MAS). As a conventional device to establish the specific player training and to allowing trainers to monitor training loads

more accurately (9). Aimed at the present study, through levels of (MAS) as a protocol to test their relations with skills fitness abilities. Bestowing on volleyball Alberta testing protocol. Supported by the use of vertical jump as valid indicators, which can be used to evaluate training players' status to prescribe the adequate training (volume and goal). Admitted in training sports studies giving to energy dominants, below the repeated bouts of high-intensity activity. Combined with brief periods of low to moderate active recovery or passive rest (4). Upkeep by video sports analysis based on volleyball competition analyses, through the repeated explosive activities, such as jumps, shuffles and rapid changes in direction (1). Inspected in this study by MAS levels as an easy tool to assess increased endurance allied to players ability to recover from high-intensity and fatiguing actions. Reported as an effective strategy that enhanced neural control of metabolic energy production and employment (10). Claims through a wide-ranging of motor actions that involve both breaking and propulsive forces (11). As well as distinct contraction modes and velocities, that depend upon all the force-velocity potential of the neuromuscular system. Interpret by Cometti G, et al., (2001) through the ability of players to perform complex multi-joint dynamic movements, e.g., jumping and sprinting actions, mainly dependent on the maximum strength and anaerobic power of the neuromuscular system, reported as essential skills (12).

METHODS

Description of the methods

Our investigation based on:

For data collected: The research was done among 60 elite male volleyball players age around 20 to 25 years, from Oran league, during Algerian Championship 2016-2017, after the pre-competitive period. Voluntarily accept to participate in this experience.

For tests:

We centred on Volleyball Alberta Testing Protocol (VAO) composed by Standing Reach, Vertical Jump Test (Spike Approach), Vertical Jump Test (Block), T-Test (Agility) and 20-meter Sprint (3). Inspected by Peev P., et al (2017) (5) through 3 forms: (a) 20 m running from standing start (20 mst) to assess the athlete’s anaerobic power using speed as an indirect indicator. (b) 20 m running from flying start (20 m sf): informed by Peev P., et al (2017) (5) through 10 meters as an optimal sprinting distance to estimate the accelerative abilities and maximal sprinting ability (9). Confirmed by Shepherd J et al., (2010) (6) as valid distance to measure the real difference of sprint abilities. (c) speed endurance, we refer to 3x50 m shuttle run from standing start (3x50m) (5). The test is performed on a track with a length of 50 m that is marked with two cones. The requirement for all the subjects is to pass the distance with two turns for a

shorter time. The time (speed) is measured with an electronic stopwatch, Model - HS-80TW-1DF (Casio Computer Co, LTD, Shibuya, Tokyo, Japan).

For power abilities with explosive character, we based on Standing Reach (VJ) for measuring athletes' overall vertical jump. For Vertical Jump Test (VJS) Spike Approach, the athlete takes a 3-step approach similar to spike volleyball skill. As well as Vertical Jump Test Block (TJB) athlete to squat and hold for 2 seconds, then jump vertically as high as possible using both arms and legs to assist in projecting the body upwards. In addition, to the above tests, we use standing triple jump (TJ). The first phase in the test is a hop, requires the athlete to take-off from a two-footed stand, split in mid-air, and land on the convenient foot (depends on the strength of the legs and the preference of the athlete). The next phase is a long-stretched step, and the athlete lands on the opposite foot. The last phase is the jump, where the athlete lands on both feet. The distance of the jump is measured with manual tape on the closest mark toward the starting line (usually on the heels). Every subject of research makes three jumps in all jump tests. Support by users as neural abilities control. Affirmed by Peev P., et al (2017) (5) through their high correlation closer to the running locomotion (13).

For protocol:

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 in athletes from various sports and competition-levels. To Calculate Maximal Aerobic Speed, we used the formula:

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

For the progress of the experiment

All particles Tests were held in the sports complex of Oran around to 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 (14).

Second phase or test day: we follow the process made by Peev P., et al (2017) (5):

1. Body weight (kg) and height (cm) were measured using a digital scale calibrated against known weights to ensure its validity and reliability.
2. Warm up consists of 8 minutes running; six minutes of exercises for the whole body; six minutes of stretching, three accelerations of 20 m.
3. 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.
4. After 12 minutes, we made the two sprinting tests (20 m running from standing start and

20 m running with flying 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.

5. After 15 minutes of active recovery with stretching exercises, we held the 3x50m shuttle run test. We made one attempt on the test. The entire participant ran two by two.

Statistical Analysis

SPSS Statistics 19 (Chicago, Illinois, IBM, USA) processed all statistical analyses. The homogeneity in tests was calculated based on ANOVA one-way and Levene Statistic. Pearson Correlation analysis was used to analyse the relationship between MAS levels and tests practised.

RESULTS

The data from the tests and the descriptive statistics are presented in Table 1. Based on MAS, our sample is classified under nine MSA categories, giving to their performances realised in the 1200m Shuttle Test. Claiming in this study, based on the elevated levels of MSA as key elements allowing the players to succeed in speed (liners or agility) and power strength(vertical or horizontal) tests. Support by their improvements in volleyball techniques tests (Serve-attack/ Spike/Block). Interpret in the case of elevated MAS as acceptable MAS level permitting players to recover rapidly from repetition notable achievements (15) above the tests used. Support by this study owing to levels of MSA as anaerobic energy release allied to players' adaptations neuromuscular/musculoskeletal and aerobic fitness developments. Reported in the efficiency of players MAS development because of increased endurance relative to muscle functional properties. Support by the enhancement of neural control of metabolic energy production and utilisation (10). Understand by Comet G, et al., (2001) as an ability that permits players to perform complex multi-joint dynamic movements, e.g., jumping and sprinting actions. Depending on the maximum strength and anaerobic power of the neuromuscular system players level developments, reported as essential skills (12).

Controlled in this study by players levels in agility and triple jump performance. Requiring from players to coordinate sequencing of large muscle groups to perform specific tasks under high loads or in an explosive technique. Support by our outcomes as the ability of the neuromuscular system to improve maximum coordination (16). In the benefits of players with upper MAS permitting these players to control their balance, agility, coordination, reaction time, and proprioception (8). Via specific tasks under high loads or in an explosive technique, according to this study. See table 1 and 2.

Table 1. *Variability of indicators that characterizes motor abilities of total sample*

MAS		BMI	20mst	20msf	TJ	VJ	VJS	VJB	3x50m	TA	Height	Weight
3,57	Mean	21,72	2,94	2,59	7,38	50,69	51,51	50,66	24,37	5,72	176,00	72,44
	S.D	4,30	0,24	0,30	0,75	0,97	0,89	0,95	0,88	0,55	3,78	3,42
	N						16					
3,71	Mean	21,23	2,71	2,42	7,78	52,28	53,04	51,25	21,72	5,14	175,00	72,10
	S.D	0,77	0,20	0,24	0,36	0,66	0,70	0,87	0,57	0,44	0,11	0,46
	N						4					
3,82	Mean	20,18	2,53	2,38	7,96	54,70	54,46	53,67	20,84	4,96	177,00	70,60
	S.D	0,37	0,26	0,25	0,15	0,18	0,08	0,08	2,04	0,57	1,41	0,44
	N						2					
3,94	Mean	19,90	2,58	2,19	8,23	56,19	55,95	54,16	20,68	4,85	174,56	68,00
	S.D	1,06	0,20	0,19	0,33	0,43	0,63	0,53	1,55	0,43	2,01	2,65
	N						10					
4,06	Mean	20,55	2,56	2,06	8,92	59,64	57,40	54,61	18,48	4,55	177,00	67,10
	S.D	1,06	0,20	0,19	0,33	0,44	0,63	0,61	1,22	0,43	1,05	0,65
	N						2					
4,18	Mean	20,71	2,45	1,95	9,02	60,61	57,66	56,58	18,81	4,33	175,50	63,82
	S.D	0,39	0,23	0,23	0,77	0,52	0,56	5,51	1,15	0,51	1,83	1,71
	N						5					
4,32	Mean	20,94	2,36	1,90	9,09	61,94	56,70	56,91	17,25	4,09	176,54	65,21
	S.D	1,91	0,18	0,18	0,19	0,38	0,35	0,35	1,06	0,40	1,18	5,79
	N						13					
4,47	Mean	20,97	2,28	1,85	9,22	63,16	57,92	57,13	19,00	3,94	179,00	63,80
	S.D	1,13	0,36	0,36	0,28	0,52	0,52	0,52	0,86	0,79	1,77	1,29
	N						6					
4,56	Mean	21,23	2,22	1,81	9,26	66,27	56,03	57,44	20,04	3,77	178,00	62,40
	S.D	1,92	0,36	0,36	0,33	0,67	0,61	0,61	0,89	0,80	1,41	0,95
	N						2					
Total	Mean	19,75	2,42	2,04	8,23	59,11	58,83	50,83	20,34	4,16	176,17	65,12
	S.D	3,52	0,28	0,31	3,44	6,63	6,62	6,85	2,22	0,62	2,76	5,86
	N						60					
MAS(M/s) ; BMI (kg/m2); TJ(m) VJ(cm) VJS(cm); VJB(cm) 3*50m(s); TA(s);20m(s) and 20sf(s)												

Support by the significant of ANOVA owed to levels of MAS, not BMI as factors affect athletic

performance. Denied in our case via the initial level of players anaerobic fitness that is associated with strength/power developments allied to players sprint speeds times (17). Challenging the coaches to consider those variables in planning the adequate training regimes (neural and morpho-functional). Admitted as factors associated with muscle functional properties improved relative to endurance training stimulus (combine or solo). Approving through their dependents on anaerobic fitness level. That permit players to recover from high-intensity and fatiguing efforts (18). Suspected via this study through MAS levels as physiological and functional limits resulted in the improvement of players anaerobic fitness and neuromuscular adaptations. Upkeep by data motor activities in volleyball through biomechanical and physiological muscles functional capacities that drill players to maintain highly aerobic and anaerobic fitness. Such as the ability to sprint, jump, change direction, and complete sport-specific skills (2).

Table 2. *Present ANOVA and Correlative between MAS levels and players skill volleyball physically abilities.*

P≤ 0,05 N=60			MAS	BMI	20mst	20msf	TJ	VJ	VJS	VJB	3x50m
MAS	Pearson Correlation		1	-,407**	-,425**	-,367**	-,387**	-,391**	-,374**	-,417**	-,386**
			,001	,001	,001	,004	,002	,002	,003	,001	,002
	N		60	60	60	60	60	60	60	60	60
	ANOVA WAY	ONE		,883	3,522	3,785	3,485	3,33	3,81	3,61	3,43
				,562	,001	,001	,004	,002	,002	,003	,001

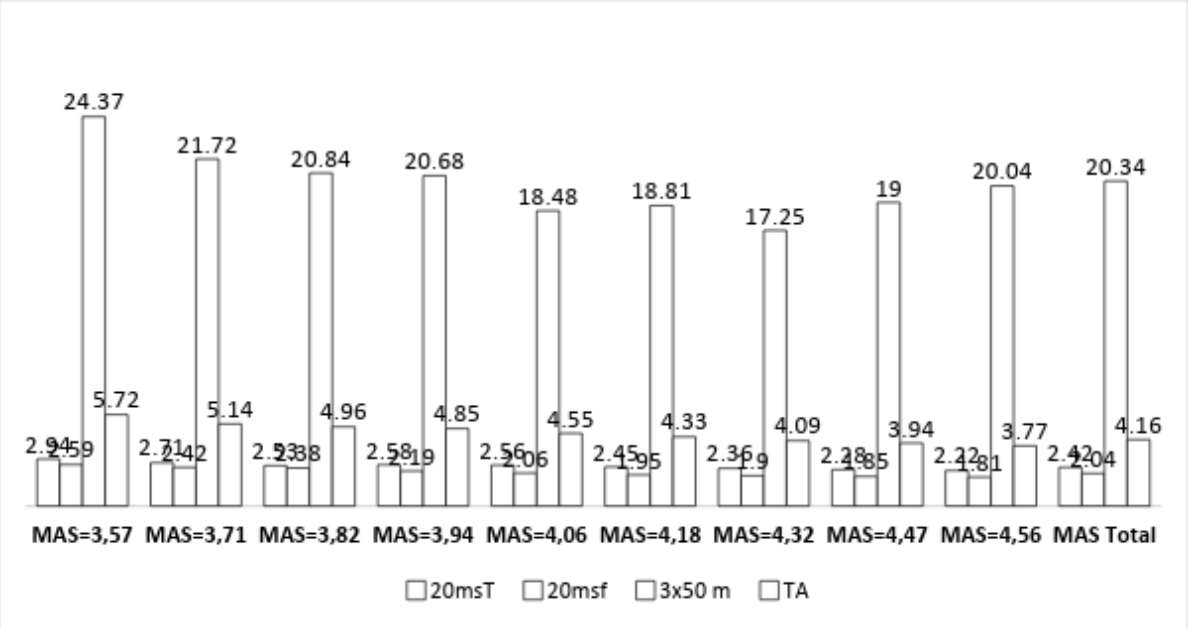
**Significance at 0,05 level, **Significance at 0,01 level*

DISCUSSION

Support volleyball game is typified by intermittent actions made of acceleration, deceleration and change of direction. As their direct relationships to the neuromuscular system indicator of the ability of players to recover from high-intensity and fatiguing efforts. Record via this study in the benefits of elevated levels of MSA. Indicate as elements allowing the players not only to increase their power, strength and speed. But also muscle functional properties improved as a result of increased endurance. Documented in similar studies as conditioning associated with improves of

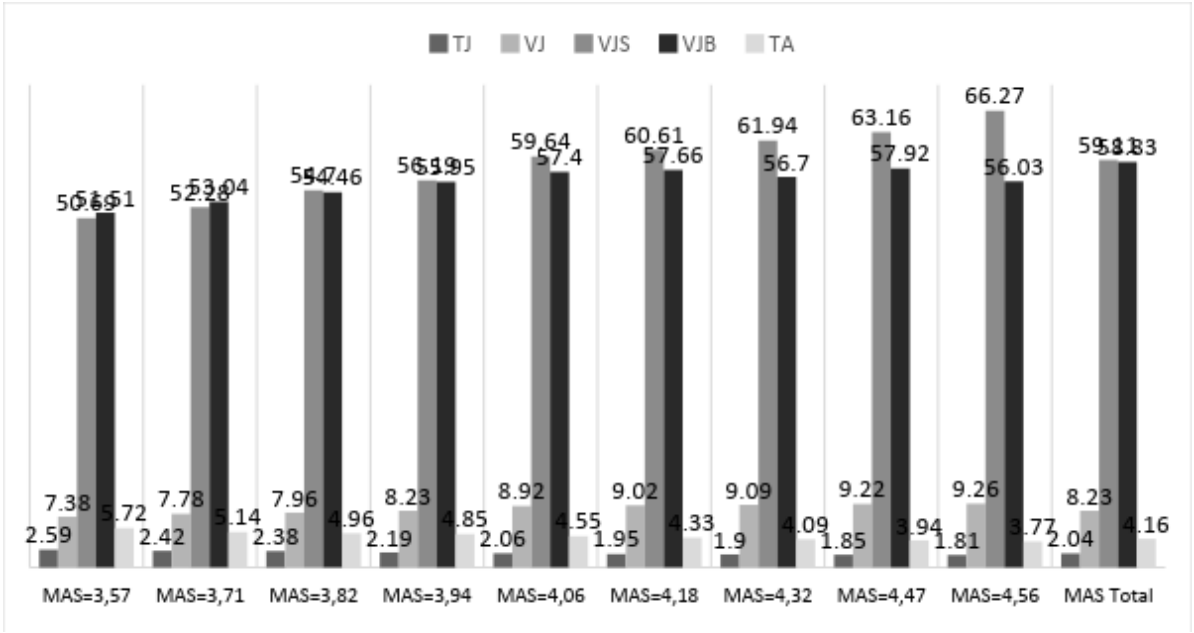
players physical skills fitness. Made known by our data presented in figure 1, tables 1 and 2. In the benefits of upper MAS as fundamental keys physical and psychological components qualifying the player to recover from high-intensity and fatiguing actions. Conclude in this study in one hand, through the levels of improvements of the various forms of speed abilities, especially maximal sprinting abilities to increase “speed reserve” (5). Owing to the levels of anaerobic energy supply system player developments (1). Interpret by similar studies, not merely in the improvements of the result in the physical field tests (19). But also, in technique skills execution (8).

Figure 1. Present the levels of Maximal Aerobic Speed (MAS) with speed tests sprint endurance and agility



Record via power and steering tests as the critical component of neural adaptations optimal of neural recruitment for maximal performance and high training quality. Permitting the players to perform under fatiguing conditions in competition. Claims by National Strength & Conditioning Association (U.S.) (2008) as prerequisites for each metabolic component to be trained specifically for optimal results (20). Confirmed by this study through muscle functional properties improved as a result of increased endurance allied to MAS players levels. Registered as unversed strong correlations with sprint times liner or agility speed as well as power technical skills fitness tests, according to tests used. Certify by Kostikiadis I.N, et al., (2018) (17) in the benefits of strength/power training resulting in improvements of the individual anaerobic threshold and muscle/power.

Figure 2. Present the levels of Maximal Aerobic Speed (MAS) with power and strength test and agility.



Confirmed by Peev (2017) (5) in a horizontal jump plane. Support the case of this study, in both vertical planes VS horizontal plane. Where our protocol based on the validity of triple jump and agility tests. As a complex movement, requiring coordinated sequencing of large muscle groups. Allied to developments of motor competence, such as (sensory abilities, motor abilities/condition, motor abilities/coordination and body experience). In addition to an increase in neuromuscular performance and the anabolic environment (11). Established by the significance of ANOVA one-way as differences players anaerobic energy release allied to their physiological adaptations (motor and functional). Claims through the levels of specific technique game demand developments, which demanded the improvements of skills physically abilities contribute to the performance of the technical and tactical skills (21). Confirmed by Peev (2017) (5) through the technique of the power tests and speed remaining the neural adaptations. Allied to speed reserve and systematic development of the anaerobic capacity (17).

Affirmed by this study through the increase of MAS associated with improvements of intramuscular and intermuscular coordination. As well as muscle functional properties improved as a result of increased endurance. Allowing athletes to utilise their a-lactic energy over a more extended period. Admitted by (Peev, 2017) (5) via the rapid force that its generation will

stimulate reflex muscle activity and reflect the demands of maximal velocity sprinting. Established by Kostikiadis I.N, et al., (2018) (17) as neural-muscular skeletal adaptations allied to maximal strength simultaneous to running time and players performance. Claims by Pion J. A. et al., (2015) (22) via an initial level of aerobic fitness that is similar to anaerobic energy, especially at the highest. Proclaiming by Paul L & Martin B. (2018) (23) as an approach allows coaches in choosing the GBHIIT exercises that satisfy both technical/tactical and physical goals. Confirmed by the present as a valuable tool to inspect and adjust the players' training regimens. Based on their baseline strength, speed, power and anaerobic fitness levels (14). Proclaimed by Buchheit M and Laursen L.B. (2013) (24) to be trained above 100% MAS, which has been shown to be more effective. Record in this study to be developed at ≤ 3,99 of MAS levels. Approved as minimal components of the physical condition to improve all types of speed, power and strength similar to volleyball players' motor abilities proper to physical technique game demands.

CONCLUSIONS

Improving power abilities with exclusivity represent critical and beneficial components in the development of volleyball players' motor physical functional abilities. Recommended the volleyball players to improve their MAS levels at ≤ 3.99 (m/s) of Max aerobic speed. Recorded in this study as a minimal component of the physical condition, in order, to enhance speed power and strength as specific skills-fitness loads in volleyball. Support in this study as a systematic approach, to adjust players' training programs based on their coordination abilities like their adaptation's neuro-musculoskeletal and aerobic fitness development. Predictable based on the protocol used. As expressive detail of anaerobic fitness training realized, which must be trained above 100% MAS to improve muscle functional properties improved as a result of increased endurance relative to VO2max, anaerobic performance and other variables, such as the deceleration, changes of direction, jumping and mental fatigue. Acknowledged by Strudwick T. (2016) (25) in the employment of the maximal intensity exercise as a protocol to identify potential mechanisms of players. A valued result to appraisal the effects of exercise intensity on psychomotor and decision-making tasks, according to Ronald J. M. (2009) (26).

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