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Short Communication

The predict of RAST Test from WANT test in Elite Athletes

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Abstract

The purpose of this study was to evaluate the validity of between Wingate and RAST tests in youth basketball players. The subjects were 45 youth and health basketball players that participated in the study. The characteristics of subjects were consist of: training experience of the subjects equal with 5.3 ± 0.3 years, age of they were 16.46 ± 0.37 years old, body weight equal with 72.02 ± 2.5 and BMI equal with 21.62 ± 0.54. Blood samples were drawn upon arrival to the laboratory, immediately after doing of the Wingate test and after end of the RAST test, during passive recovery. Statistical significance was accepted at $p \leq 0.05$. Results of the study were shown that between of Wingate and RAST tests in amount of peak power were significant relationship($r = 0.901$; $p = 0.00$). Also, results of the study indicated significant relationship in amounts of average power between both tests ($r = 0.957$; $p = 0.00$). In addition, between Wingate and RAST tests in average power per. kg .W^{-1} statistically were significant relationship ($r = 0.543$; $p = 0.00$). In regarding of validity in blood indexes between both tests, can insinuate to amounts of pH that statistically were significant relationship between the tests ($r = 0.562$; $p = 0.029$). Also, in this study indicated significant relationship between amounts of PCO_2 in venous blood ($r = 0.644$; $p = 0.00$). In regarding of achieve results can express that between of the Wingate and the RAST tests only in average power and peak power in youth elite basketball players were a significant relationship. So, it conflict to this claim that "the RAST test can be predict drop power and fatigue indexes in elite basketball players" similar to Wingate test. Nevertheless, it recommended to basketball coaches to apply the RAST test only in direction of evaluation for average and peak powers in basketball players.

Key words: Wingate test, RAST test, peak power, fatigue index and basketball.

Introduction

The Wingate bicycle test became popular in the late 1970s[1]. It fulfilled the need for a precisely measured anaerobic power test. It may be used to test either arm or leg power, but is most commonly used to test the legs. This test can be determined performer's anaerobic power and *anaerobic capacity*. The distinction between these two-power vs. capacity-rests on the time factor; power refers to the *maximal* (or peak) *power* achieved in a 5-second period during the test, whereas capacity refers to the power during the entire 30 seconds of the test. Peak anaerobic power (Peak-AnP) mostly reflects the subject's ability to use the phosphagenic system whereas anaerobic capacity (AnC) reflects the ability to derive energy from the combination of anaerobic glycolysis and the phosphagenic system. Thus, performers of this test rely rather equally upon anaerobic phosphagenic and anaerobic glycolytic pathways for their Source of ATP. The anaerobic glycolytic Source is evidenced by the moderately high blood lactate values (ranging from 6-15 times the resting value) measured in the Wingate test subjects by various investigators[2,3,4].

The phosphagenic contribution to this test was substantiated by investigators who found that female subjects reduced their phosphagen levels to 70% of their original adenosine triphosphate values and 40% of their original creatine phosphate values after performing the Wingate test[5]. Their glycogen content decreased to about 75% of the original values and was evidenced by a greater than six-fold increase in lactate. The investigators concluded that the glycogenolytic capacity was not fully utilized due to the short 30-second duration. The fitness continuum, this predominantly anaerobic test may be appropriately referred to as a combination short and long tests. This is because its total duration 30 seconds-a point that lies in both the short (3 to 20-30 s) and long (20-30 to 60-90 s) anaerobic zones. It might be argued that for the Wingate Test to have physiological validity, the performers with the highest lactate values after the test would be expected to have the highest glycolytic capacities or anaerobic capacities[6].

The Running-based Anaerobic Sprint Test (RAST) has been developed at the University of Wolverhampton by Draper and Whyte (1997) as a sports-specific anaerobic test. It is similar to the Wingate Anaerobic 30 cycle Test (WANT) in that it provides coaches with measurements on peak power, average power and minimum power along with a fatigue index. The tests differ with regard to specificity and cost of administration[7]. The Wingate test is more specific for cyclists, whereas the RAST provides a test that can be used with athletes where running forms the basis for movement. The WANT necessitates the use of a cycle ergometer and computer which are not available for all coaches[8]. The RAST requires only a stopwatch and a calculator for some simple computations. The RAST provides a more specific test of anaerobic performance in running-based sports. The same variety of tests has not been available for assessing anaerobic performance. The most popular anaerobic test to date has been the WANT. As a cycle ergometer test it is more specific to cycle-based sports. The development of the RAST provides a running-based test of anaerobic performance. But, still not the research; evaluate validate of between the Wingate test and the Running-based Anaerobic Sprint Test (RAST) in physiological variables such as: PH, HCO_3^-, PCO_2, PO_2 and BE and anaerobic functional variables such as: Max power (W),Max power (W. Kg^{-1}), Ave power (W), Ave power (W. Kg^{-1}), Min power (W), Min power (W. Kg^{-1}), Fatigue index (W. s^{-1}) and Fatigue index (W.s. Kg^{-1}). Therefore purpose of this study was to survey relationship of between the Wingate test and the Running-based Anaerobic Sprint Test (RAST) especially in youth elite basketball players.

Material and Methods

Subjects Characteristics: The subjects were 45 young elite basketball players, with at least 5.3 ± 0.3 years of national competition. The research was conducted during the pre-competitive season thus the values of anaerobic and aerobic capacity were at maximum or near maximum levels. All subjects were randomly chosen from between of basketball players that preparation to take a part at national competition. The Subjects characteristics were consisting of: number of subjects = 45; training experience of the subjects = 5.3 ± 0.3 years; age of they were 16.46 ± 0.37 years old; VO2max = 51.53 ± 4.46 $ml.kg^{-1}.min^{-1}$; body height (BH) = 1.82 ± 0.01 m; body mass (BM) equal with 72.02 ± 2.5 Kg; fat free mass (FFM) = 65.22 ± 5.02 Kg; fat content (FAT %) = 7.01 ± 1.33 %), and BMI equal with 21.62 ±0.54. The research project was approved by the Ethics Committee for Scientific Research at the Academy of Physical Education and sport sciences in Mashhad, Iran.

Experimental design: The experiment had two phases. Before the start of the experiment, initial values of body mass and body composition (BM, FFM, FAT% and total body water (TBW)) were evaluated with the use of electrical impedance (In body model of 720, made in South Korea). To increase the reliability and validity of body composition measurement by electrical impedance all tested subjects were evaluated under the same conditions during all 2 phases of the experiment (measurement during the same time of the day 8-9 am o'clock, active rest the day before testing, full hydration of the body, last meal at 8pm on the day before evaluation. In fact, all of subjects were 12 hours in breakfast position). Resting blood samples were drawn from the med-cubital vein to determine several biochemical variables. Blood samples were drawn upon arrival to the laboratory, immediately after doing of Wingate test and after end of the RAST test, during passive recovery. It should be noting that type of recovery in all of young elite basketball players was from type of passive recovery. In fact, the subjects immediately after execute of both test (the Wingate and the RAST tests) lying on the bedstead. Also, a progressive ergocycle test (Wingate) was administered to determine several anaerobic functions (experimental test). The second phase of the experiment included 6 days after first phase. After the first phase, the exercise tests or the Running-based Anaerobic Sprint Test (RAST) were executed to determine several anaerobic functions (filed test). For increase of accuracy in the study, both of blood sampling and analyze of body composition were executed to homogenate all of subjects in one day pre-execution of first phase.

Plasma lactate (LA) concentration was determined enzymatically by using commercial kits (Boehringer Diagnostika, Mannheim, Germany). Blood PH, standard bicarbonate (SB) and base excess (BE) were measured using a 168pH Blood-Gas Analyzer (Ciba-Corning, Basel, Switzerland). The intra and interassay coefficients of variation for lactate were 3.2 and 8.9% respectively.

Statistical Analyses: The obtained data were analyzed statistically with the use of SPSS (V18). The results were presented as means ($\overline{X}$) and standard error of mean (S.E.M). To determine relationship between of the WANT test and the RAST test, Pearson's correlation coefficients was used[9,10]. Statistical significance was accepted at p < 0/05.

Results and Discussion

The correlation coefficients between analyzed variables and amounts of significant on the athletes for the WANT and the RAST tests are present in table-1. The results indicate a significant correlation in some of the physiological and anaerobic functional variables between the WANT and the RAST tests. Positively significant correlations in among of physiological variables such as between $HCO_3^-{}_{WANT}$ & $HCO3^-{}_{RAST}$ at level of $p < 0.05$ ($r = 0.303$; $p < 0.043$), and between pH_{WANT} & pH_{RAST} ($r = 0.562$; $p < 0.00$), and between $PCO_2{}_{WANT}$ & $PCO_2{}_{RAST}$ ($r = 0.644$; $p < 0.00$), at level of $p < 0.001$, observed. Whereas, in other physiological variables such as: $Lactate_{WANT}$ & $Lactate_{RAST}$ ($r = 0.256$; $p < 0.09$), $PO_2{}_{WANT}$ & $PO_2{}_{RAST}$ ($r = 0.019$; $p < 0.899$) and BE_{WANT} & BE_{RAST} ($r = 0.029$; $p < 0.85$), not indicated a significant correlation in among of both tests.

Although no research findings and backgrounds are exist about relationship between the Wingate test (WANT) and the Running-based Anaerobic Sprint Test (RAST), this study that well controlled, supported the relationship between the WANT and the RAST tests. In case of physiological variables for the study, were relationships in some factors between the WANT and the RAST tests. The obtained results not show significant changes in lactate concentration, yet WANT test values were higher than the RAST test ($p > 0.05$), whereas, values of both tests were similar to each other (64.26 ± 2.32 Vs. 62.83 ± 3.22 mg.dl). Nevertheless, the correlation coefficients between the WANT and the RAST in values of lactate, no was significant statistically ($r = 0.256$; $p = 0.09$). This finding shown that the RAST test like to the WANT test, used form of anaerobic glycolysis system but amount of lactate in the RAST test lower than the WANT test, so that, the RAST test not achieved the athletes to bound of the fatigue (like to the WANT test)[11,12]. Also, base on finding of the study, indicate the significant difference in values of pH, that amount of it in the RAST test were higher than the WANT test ($p < 0.05$), in fact, values of the WANT and the RAST tests were similar to each other (7.14 ± 0.00 Vs. 7.17 ± 0.00). In this case, statistically significant correlation coefficients were indicated between the WANT and the RAST in values of pH ($r = 0.562$; $p = 0.00$). This result had shown that amount of H^+ ions in venous blood during the RAST test lower in comparison to the WANT test. So, like to case of lactate concentration, the RAST test notable to exhaust the athletes because in sport disciplines relying on speed endurance or strength endurance, anaerobic glycolysis provides the primary energy source for muscular contractions that total capacity of the glycolytic pathway is limited by the progressive increase of acidity within the muscles, caused by the accumulation of hydrogen ions that amount of pH and H^+ ions in the RAST test were increased and decreased, respectively[13] .Also, the increase in acidity ultimately inhibits energy transfer and the ability of the muscles to contract, force in the athletes to decrease the intensity of exercise that the study indicated high values in amount of Max power and min power during the RAST test in comparison of the WANT test[14]. In direction of it, results of the study not show significant difference in base excess (BE), that the RAST test values were very lower than the WANT test ($p > 0.05$) and values of both tests not were similar to each other (-6.71 ± 0.48 Vs. -7.31 ± 0.36). Also, statistically the no significant correlation coefficients indicated between the WANT and the RAST in values of BE ($r = 0.029$; $p = 0.85$). This finding, explanation that the RAST test not able to be a good test for indicates of fatigue index (like to the WANT test) and accumulation of hydrogen ions in the WANT test were higher than the RAST test or amounts of pH in the WANT test were lower than the RAST test.

The findings of the study indicate the significant difference in values of PCO_2 in the venous blood , that amount of PCO_2 in the WANT test were higher than the RAST test ($p < 0.05$). Increases of the PCO_2 values in fact indicate amounts of fatigue. Because high values in PCO_2 is an indicator for gain of the muscles in utilization of O_2 and produce of waste substance[14,15]. So our results shown that the muscles during the WANT test utmost use from O_2 in comparison to the RAST test. Nevertheless, values of the WANT and the RAST tests were similar to each other (67.07 ± 1.33 vs. 61.44 ± 1.25 mmol/L). In this case, statistically the significant correlation coefficients were indicated between the WANT and the RAST in values of PCO_2 ($r = 0.644$; $p = 0.00$). These findings indicate that to rate of moderate, increase of values of PCO_2 in the WANT test parallel to the RAST test. Also, again explanation that the RAST test not able to be a good test for indicates of fatigue index (like to the WANT test). In direction of it, obtained results not show significant difference in values of PO_2, yet the RAST test values were very higher than the WANT test ($p > 0.05$) and values of both tests not were similar to each other (40.78 ± 0.75 Vs. 29.67 ± 0.71 mmol/L). So, high values in PO_2 in venous blood indicate that the muscles during the RAST test not utilization from O_2 and not produce of waste substance in comparison to the WANT test. Our results had shown that the muscles during the WANT test utmost use from O_2 in comparison to the RAST test. Nevertheless, statistically no significant correlation coefficients indicated between the WANT and the RAST in values of PO_2 ($r =0.019$; $p = 0.899$). This finding again explanation that the RAST test not able to be a good test for indicates of fatigue index (like to the WANT test).

Conclusion

In conclusion, the RAST test is a good field test for evaluate of some anaerobic functional and physiological variables. Base on the our results, the RAST test is a good predicator for validity of between the WANT and the RAST test in some of physiological variables such as; pH , HCO_3^- and PCO_2. Also, it's a good predicator for validity of between the WANT and the RAST test in some of anaerobic functional variables such as; Max power (in absolute (W) and relative (W. Kg^{-1})) and Ave power (in absolute (W) and relative (W. Kg^{-1})). But, the RAST test notable to predict values of fatigue indicators (absolute Min power, relative Min power, absolute Fatigue index & relative Fatigue index) and recommended to coaches to apply the RAST test in other to predict anaerobic powers especially Max and Ave powers.

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Table-1
Correlation coefficients considered for physiological and anaerobic functional variables in between of Wingate test and Running-based Anaerobic Sprint Test (RAST)

Paired variables (N=45)	R	*p*
$Lactate_{WANT}$ & $Lactate_{RAST}$	0.256	0.09
pH_{WANT} & pH_{RAST}	0.562	0.00^{**}
$HCO_3^-{}_{WANT}$ & $HCO_3^-{}_{RAST}$	0.303	0.043^{*}
$PCO_{2\,WANT}$ & $PCO_{2\,RAST}$	0.644	0.00^{**}
$PO_{2\,WANT}$ & $PO_{2\,RAST}$	0.019	0.899
BE_{WANT} & BE_{RAST}	0.029	0.85
Max power $_{(W)\,WANT}$ & Max power $_{(W)\,RAST}$	0.901	0.00^{**}
Max power $_{(W.\,Kg^{-1})\,WANT}$ & Max power $_{(W.\,Kg^{-1})\,RAST}$	0.319	0.032^{*}
Ave power $_{(W)\,WANT}$ & Ave power $_{(W)\,RAST}$	0.975	0.00^{**}
Ave power $_{(W.\,Kg^{-1})\,WANT}$ & Ave power $_{(W.\,Kg^{-1})\,RAST}$	0.543	0.00^{**}
Min power $_{(W)\,WANT}$ & Min power $_{(W)\,RAST}$	0.207	0.172
Min power $_{(W.\,Kg^{-1})\,WANT}$ & Min power $_{(W.\,Kg^{-1})\,RAST}$	- 0.124	0.416
Fatigue index $_{(W.\,s^{-1})\,WANT}$ & Fatigue index $_{(W.\,s^{-1})\,RAST}$	0.285	0.087
Fatigue index $_{(W.s.\,Kg^{-1})\,WANT}$ & Fatigue index $_{(W.s.\,Kg^{-1})\,RAST}$	0.201	0.186

* Statistically significant correlation coefficients in between the WANT and the RAST tests at level of $p < 0.05$. ** Statistically significant correlation coefficients in between the WANT and the RAST tests at level of $p < 0.001$.

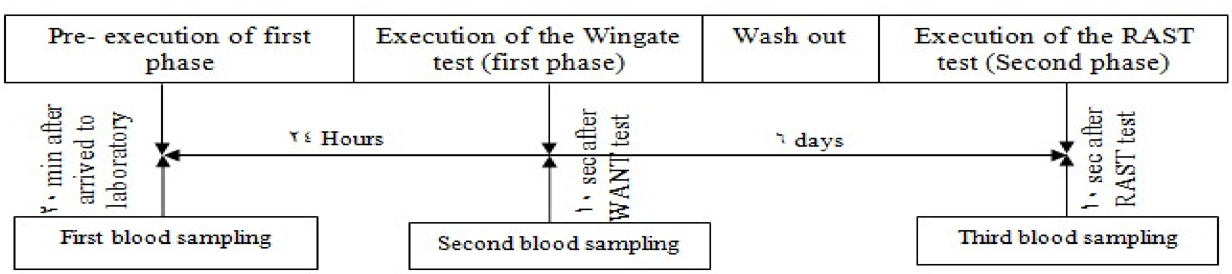

Figure-1
Protocol design .Blood samples were drawn upon arrival to the laboratory, immediately after doing of Wingate test and after end of Running-based Anaerobic Sprint Test (RAST), during passive recovery (10 seconds after each test)