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The validity of between Wingate test and Running-based Anaerobic Sprint Test (RAST) in young elite basketball players

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Abstract: The purpose of this study was to evaluate the validity of between the Wingate and the RAST tests in young basketball players. The subjects were 45 young and health basketball players that participated in this study. The characteristics of the 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. Results of the study were shown that between of the Wingate and the RAST tests in amount of peak (max) power was significant relationship($r = 0.901$; $p = 0.00$). Also, results of the study indicated significant relationship in amounts of average power between, average power per kg .W^{-1} ,pH and PCO_2 in both tests ($p = 0<05$). In regarding of achieved results can express that between of the Wingate and the RAST tests only in average power and peak power in young 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 Bike Test became popular in the late 1970s (Bar-Or, 1978). 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. 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 (Jacobs et al., 1982; Pate et al., 1983; Perez et al., 1986; Song et al., 1988; Tamayo et al., 1982; Thompson et al., 1986).
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. 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. The RAST requires only a stopwatch and a calculator for some simple computations. 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. Therefore purpose of this study was to survey relationship of between the Wingate test and the Running-based Anaerobic Sprint Test (RAST) especially in young elite basketball players.

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Methods

Subjects characteristics

The subjects were 45 young elite basketball players, with at least 5.3 ± 0.3 years of national competition. 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. Resting blood samples were drawn from the med-cubital vein to determine several biochemical variables. In fact, the subjects immediately after execute of both test (the Wingate and the RAST tests) lying on the bedstead. Plasma lactate (LA) concentration was determined enzymatically 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 obtained data were analyzed statistically with the use of SPSS (V18). The results were presented as means ($\bar{X}$) 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. Statistical significance was accepted at $p < 0/05$.

Results

The correlation coefficients between analyzed variables and amounts of significant in the tested athletes for the WANT and the RAST tests are presented 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.

Table1. Correlation coefficients considered for physiological and anaerobic functional variables in between of the Wingate test (WANT) and the Running-based Anaerobic Sprint Test (RAST).

Paired variables	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 $p < 0.001$.

Discussion

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 showed insignificant 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 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 (Jacobs et al., 1982; Pate et al., 1983; Perez et al., 1986; Song et al., 1988; Tamayo et al., 1982; Thompson et al., 1986; Fatouros IG et al 2011) 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). 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 the 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 (Verbitsky et al., 1997 ; Adam Zajac and et al (2009)) also, the increase in acidity ultimately inhibits energy transfer and the ability of the muscles to contract, forcing the athlete to decrease the intensity of exercise (Costill et al., 1984; Harrison and Thompson, 2005; McNaughton, 1992; Carvalho HM et al 2011) that the study indicated high values in amount of Max power and min power during the RAST test in comparison of the WANT test. In direction of it, results of the study showed insignificant 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). 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).

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