Development of an agility test for badminton players and assessment of its validity, reliability, and specificity

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Introduction

Agility is one of most important physical capacities for sport performance. However, in most sports fast whole-body motion is preceded by the selection of "where to run". Hence, sports successful performance depends not only on the time spent to move the body but also on the athlete's ability to quickly and effectively determine the direction he/she should run. Some testing protocols have been created to evaluate agility in sports taking into consideration perceptual aspects, but they present some methodological issues (e.g., use of expensive devices, limited in field application). Also, to our knowledge there is no specific agility test for badminton players. Therefore, the aims of this research were (1) to develop an agility test that simultaneously assesses perception and motor capacity, (2) to examine the test's concurrent and construct validity, and its test-retest reliability, and (3) to evaluate the specificity of this test to badminton players.

Methods

To reach the first two aims of the study (i.e. validity and reliability assessment) we recruited 43 badminton players (age 17-32 years, 29 males and 14 females) who had at least two years of experience in the sport and were participating in the Brazilian Championship tournament. To complete the third aim (i.e. test specificity) 64 young athletes (age 14-16 year, 8 males and 8 females) who were engaged in 4 different sports (badminton, tennis, track and field, and collective sports) were assessed. The agility test was named Badcamp and it is described as follows. During the Badcamp test the athletes were asked to stay in the middle of a rectangle area (L=5.6m | W=4.2m) (Fig 1A) that has six inflatable targets (Fig 1D) placed in the 4 corners and in the middle points of the larger sides of the rectangle. Next, they were instructed to run towards one target and return to the starting position, run towards the second one, return to starting position, and so on until touching the sixth target and return to the start position for the last time. The target sequence was uncertain and the athletes knew the direction they should run only when they pressed a push button switch (Fig 1C) placed in the starting position. The running direction was determined by arrows composed by LEDs and placed in a panel (Fig 1B) in front of the athletes and it was controlled by a pre-programmed microcontroller that randomized the sequence of arrows lighting. The time to complete this task was recorded and analyzed.

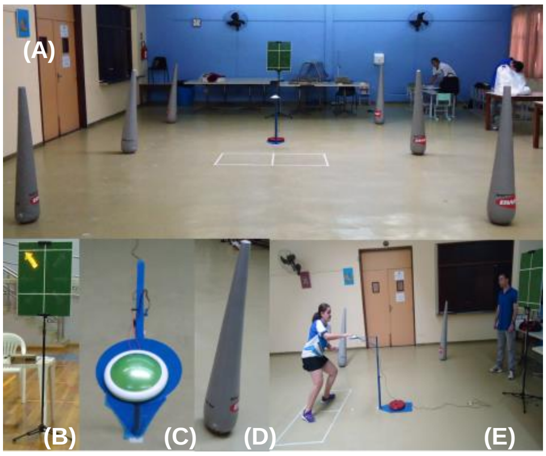

Fig. 1: Experimental setup. (A) Rectangular Area, (B) LED Panel, (C) Push button switch (D) Target, and (E) Athletes' initial position

Results
For concurrent validity, Spearman's rho test between the performance in Badcamp and in shuttle run revealed $\rho=.83$ ($p < 0.001$). For construct validation, one-way ANOVA revealed better performance in Badcamp for expert (14.01±1.01s) than for non-expert players (15.58±0.92s) (p< .01]. For reliability, Spearman's rho test revealed a very strong relationship between test and re-test performance in Badcamp ($\rho = 0.92$, $p <.001$), also the Wilcoxon test revealed no differences between test (14.31±1.29s) and retest (14.12±1.14s). For specificity, ANOVA revealed effect of group on the time to complete the Badcamp ($p<.01$) and the shuttle run ($p < 0.01$). Post hoc tests showed that in Badcamp badminton players presented better performance (14.07±0.84s) than collective sports players (14.73±0.67s), tennis players (15.22± 0.68s), and track and field athletes (16.57±1.02), but in shuttle run badminton players (18.37±1.23s), collective sport (18.75±0.73 s), and tennis players (18.19±1.09 s) presented similar performances. Badminton players were only better than track and field athletes (19.38±1s).

Discussion
The results of the study regarding concurrent validity indicate that Badcamp had similarities with a traditional agility test (i.e., shuttle run). However, the correlation coefficient of 0.83 indicates that some differences between tests exist. Namely, 31% of the variability in the results of Badcamp could not be explained by the variability in the results of shuttle run. This 31% non-explained variability could be accounted for the additional requirements of this new test, i.e. stimulus detection and decision making. Regarding construct validity, results indicate that Badcamp can be used to distinguish performance levels of badminton players. The better performance of expert badminton players compared to non-expert players confirms Badcamp construct validity. The strong relationship between Badcamp performances in two distinct occasions (test and re-test) and the lack of difference between test and re-test indicate that this test is reliable and can be used to assess badminton players. Regarding test specificity, this feature was evidenced because we found that badminton players performed better this test than collective sport and tennis players and track and field athletes whereas when we compared the performance of these athletes in the performance of shuttle run, these differences vanished.

Conclusion
The findings confirm that Badcamp is a valid test for agility, shows high level of reliability and can be used to distinguish badminton players from athletes from other sports, indicating that it could become important tool for badminton coaches to assess agility in a condition close to real game situations, to assess training effectiveness, and to talent identification for this sport.

References
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