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Physical Fitness Components: Predictive Accuracy in 400m Sprint Performance

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Introduction

Bungalows need small, 2-storey buildings demand bigger, while highest towers require the largest necessary foundations; such that height of the building is directly dependent on its foundation. Will this be also true to sports? Does it follow that: optimized sport's performance can be paralleled with a very strong foundation?Foundation in sports is commonly referred to as physical fitness components clustered into Health-Related Components (HRC) and Performance-Related Components (PRC). HRC are designated to improve health, wellness, and quality of life and enumerated as body composition, flexibility, cardiovascular endurance, muscular endurance, and muscular strength (Catapang, 2000). On the other hand, those PRC are important in performing the more technical aspects of many sports and these are agility, balance, coordination, speed, reaction time and power ("Fitness Components," n.d.). Since sports is of a wide-ranged in scope, this study focused on one of the most exciting and breathtaking event in athletics, the 400m sprint.

According to Quencetani, (2005) the 400m sprint is regarded as a "prolonged sprint" and the term appears to be appropriate, especially when one considers that Michael Johnson's 1999 world record of 43.18 is the equivalent of four consecutive 100m in 10.795 seconds. Sometimes, the event is also referred to as the "killer event" because, being just beyond the limit through which a well-trained runner can maintain his or her maximum speed, a huge stress is placed on the organism with the body invariably fatiguing, "rigging" or "tying up", especially in the closing stage. As early as 1888, this led Montague Shearman, the most famous observer of athletics in the 19th century, to refer to 440 yard (now 400 meters) runners as "runners who run themselves blind before reaching the tape". To this effect, many experts and sports personalities are studying how to improve 400m sprint performance and focused more on factors like speed, power, reaction time, etc., skill-related components only to affect 400m sprint performance.This study is a complete package and considers all the Physical Fitness Components, not only the skill-related but also the health-related, as the parameters to influence and predict 400m sprint performance.

Methodology Research Design

This study employed correlational and determination methods. The correlation method determined the significant relationship and the extent of relationships bridging the fitness components and the 400m sprint performance. The determination method established the predictive accuracy one parameter could share to 400m sprint performance.

Population

The population of this study composed of PE4-Athletics male students regularly attending and officially enrolled during the 2nd semester academic year 2014-2015 of the Mindanao State University Main Campus. A total of 59 students were included in the population.

Samples and Sampling Procedures

Complete enumeration was employed in this study. The 59 PE4-Athletics male students were distributed into 3 sections and enumerated as: PE4-FfGg4, PE4-Gg4, and PE4-Yy4 with 20, 19, and 20 regularly attending students.

Instrumentation

This study gathered data using the physical fitness standardized tests: the body mass index (BMI) for body composition by World Health Organization, the 6-min run test for cardiovascular endurance by Bolonchok (2008), The sit and reach test for flexibility by Allsen et, al. (1993), the push-up test by McGlynn, (1996), the Sargent jump test for elastic leg strength by Dudley Allen Sargent (1921), shuttle run test for agility by Mackenzie, B. (2007), Stork Stand test for balance by Johnson & Nelson (1979), the alternate wall hand toss test for coordination by American Guidance Service (1969), the standing long jump for power by Hede, et al. (2011), the ruler drop test for reaction time by Mackenzie (2004), the 50- meter sprint test for speed by AAPHERD, and the 400m dash performance. All tests excluding push-up, ruler drop and Sargent chalk jump require time monitoring so stopwatches were used. Other instruments and materials such as weighing scale, meter tape, meter stick, ruler, tennis balls, boxes, flag lets, cones, wooden blocks and chalks were used necessary for the conduct of the different tests. Tests' results were recorded individually in the sample's score card.

Data Collection Method

The study was conducted by the researcher together with the trained researcher assistants. They gave briefings to the samples regarding the procedures of the different tests and safety measures, then the conduct commenced after warm-up exercises. The samples rotated to the different stations that were created. The test results were recorded in the individual sample's score card right after a specific test with corresponding tester's signature reflected opposite to the test. The results of the tests then were finally tabulated in the quantification of data form in preparation for the statistical treatment.

Statistical Treatment

For the correlation portion, Pearson r was used. This statistical tool measured the strength of the linear relationship between two sets of interval-scaled and/or ratio-scaled variables (Lind, 2000).To give precise meaning of the findings, the coefficient of determination (r2) measured the predictive accuracy for r (Dunn, 2001). Predictive accuracy is the percentage contribution of one variable when correlated to another.

Results and Discussion

The results for the statistical analyses among compared variables were presented in the Table below.

Physical Fitness Components	400m Sprint Performance		
Health-Related	p-value	r-value	r^2-value
Body Composition	*0.004*	*0.365***	*0.1332*
Cardiovascular Endurance	*0.000*	*-0.576***	*0.3318*
Flexibility	*0.091*	*-0.222*	*0.0493*
Muscular Endurance	*0.152*	*-0.189*	*0.0357*
Muscular Strength	*0.642*	*-0.062*	*0.0038*
Skill-Related			
Agility	*0.000*	*0.494***	*0.2440*
Balance	*0.084*	*-0.227*	*0.0515*
Coordination	*0.004*	*-0.367***	*0.1347*
Power	*0.000*	*-0.555***	*0.3080*
Reaction Time	*0.164*	*-0.184*	*0.0339*
Speed	*0.000*	*0.699***	*0.4886*

Findings

Based from the statistical treatment results, these findings were recognized: 18 Body Composition has positive linear (r = 0.365) significant relationship (p = 0.004) to 400m sprint performance. Body mass index (mass/height2) increases with elapsed time in 400m dash, meaning lighter and taller samples ran faster than the heavier and shorter ones. Moreover, body composition could share 13.32% (r2=0.1332)to the 400m dash performance. Cardiovascular endurance has significant (p = 0.000) inverse (r = -0.576) relationship to 400m sprint performances and follows that as cardiovascular endurance increases, the time of the 400m sprint performance decreases. So that those samples of better cardiovascular endurance run faster in 400m dash than those with poor. Furthermore, cardiovascular endurance contributes 33.18% (r 2=0.3318) to 400m dash performance. Agility confirmed positive linear (r = 0.494) significant relationship (p = 0.000) 400m dash and declares that those samples with superior agility travel faster in all sprinting events than those of inferior agility, and predicts 24.40% (r 2 = 0.2440) of the 400m dash performances. Coordination played an inverse (r = -0.367) significant relationship (p = 0.004) to 400m dash performance and is capable of contributing 13.47% (r 2 = 0.1347). Finding expounds that good hand coordination could lead to faster 400m sprint performance. Power revealed inverse (r = -0.555) significant relationship (p = 0.000) to the 400m sprint performance. Longer jumps correspond to lesser time (faster run) and proclaim that those who could jump longer distances are also capable of running fast in 400m dash. Leg power predicts 30.80% (r 2 = 0.3080) of the performance. Speed expressed linear (r = 0.699) significant relationships (p = 0.000) to 400m dash performance and proclaims that those who have faster speeds are also performing well in sprints. Speed could share 48.86% (r 2 = 0.4886) of the 400m dash performance. Flexibility, Muscular endurance, Muscular strength, Balance and Reaction time have no significant relationship to 400m sprint performance. Conclusion Based from the findings of the study, the following conclusions are driven: Body Composition, Cardiovascular endurance, Agility, Coordination,Power, and Speed are significant predictors of the 400m sprint performance. Speed is the best predictor, Cardiovascular Endurance2ndbest, Power3rd, Agility4th, Coordination5th, and Body Composition6th .

Recommendations

Based on the findings of the study, the researcher presents the following recommendations:

To the Physical Educators

From the findings: the best predictor-speed (48.86%), 2nd best-cardiovascular endurance (33.18%), 3rd best-power (30.80%), 4th best-agility (24.40%), 5th best- coordination (13.47%), and 6th bestbody composition (13.32%); it is recommended that physical educators should disseminate these new information to their students and co-teachers.

To the Coaches, Trainers and Athletes

The findings of the study could be the bases in the identification and selection of potential sprinters by letting them undergo the fitness tests both for the health-related and performance-related components. Moreover, performances on sprints could be maximized by developing training programs including: 1) speed (1st), cardiovascular endurance (2nd), leg power (3rd), agility (4th), coordination (5th), and body composition (6th) for the 400m sprint in addition to the techniques and tactics on the different sprinting events. In situations where time duration in training is not sufficient to include all specified variables, the first 4 of the fitness components of speed (1st), cardiovascular endurance (2nd), leg power (3rd), and agility (4th) shall be given more priorities for they could contribute highest percentage to sprinting performances.

For further Studies

The subjects involved in this study are PE 4 male students and non-experienced, it is then recommended that further similar studies shall be conducted to include skilled and highly skilled athletes.It is also recommended that another similar study shall be conducted on females. Such study

will provide additional information and can be utilized for comparison.Lastly, parameter such as: leg length, stride length, no. of strides, height, weight, frequency and duration of training, training attitude, motivation, diet, and lifestyle shall be looked into for future studies.

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