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Role of Genetic Polymorphisms of Angiotensin - Converting Enzyme Insertion Resistance to the Performance of Badminton Youth Athlete

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ABSTRACT

Differences in metabolism work of the body will determine what the appropriate sport for an athlete or prospective athlete. One of the gene variations that is considered determining an athlete's potential. It is a variation within the ACE gene that is symbolized by I and D. ACE D (deletion) responsible for high expression and activity of angiotensin, I converting enzyme, while the ACE I (insertion) is responsible for the low expression and this gene activity. The purpose of this study was to assess how the role of the ACE gene on the performance of athletes. The research was following the development of the ability of badminton athletes in the same exercise routine for six months, by performing a series of tests of durability and form explosive power in the first month and six months. Badminton athletes with genotype II variations of the first and second measurement results showed a significant difference in the resistant ability test of athletes compared with the genotype variation of ID and DD. Research can provide conclusions robust on relations of variation angiotensin - converting enzyme allele I, genotype II on the performance of endurance badminton athletes.

KEYWORDS: ACE, resistance, badminton athletes

INTRODUCTION

During this time, every sports coaching strategy focused on the interests and achievements of the athletes. An athlete needs to be interested in a particular sport, undergo appropriate exercises and then be monitored for achievement. Because the expression that "an athlete is not born, but he formed with intensive coaching and targeted." However, keep in mind, that the achievements of athletes with the appropriate genetic variations are likely to be better than other athletes undergoing the same exercise with the same motivation but do not have the appropriate genetic variation. Current research concentrates on finding the right genetic profile to contribute to sports performance. One of the main objectives of these studies is to help doctors and trainers to identify and guide individuals with the genetic potential to become an elite athlete.

For example, who born with a genetic variation that is suitable to be a badminton player. However, he/she was not going to be a badminton player unless undergoing appropriate training. There is no sports coaching approach mainly crawls the seeds of young athletes with an approach that utilizes genetic information on self-athlete or prospective athlete concerned on the branches of sports, especially in Indonesia. In fact, this information is very significant in providing input regarding how metabolism works. Differences in metabolism of the body of work greatly determine what the appropriate sport for an athlete or prospective athlete. (Jonathan et al. 2009) [1]

Genes are the factors that determine the inheritance of certain traits of a person to their offspring (Suryo, 2008) [2]. Also to eye and hair color, genes also play an important role in the formation of other physical characteristics that affect the health of the body. Genes may make a person inactive or not gifted perform certain skills (Suryo, 2008) [2]. The tendency of a person can perform certain sports are also caused by genes.

At this time, we are to hear about mutations or genetic variations associated with the disease. Rarely or perhaps never we did hear about the genetic variation that associated with the variability of the strength and speed of a persons' physical or talent an athlete, for example, in muscle strength that was influenced by heredity. The reason is the variation of muscle fiber types. If a person has more muscle fiber type I (slow-twitch fibers), then a person is better able to perform activities related to the body's defenses, but difficult to increase their muscle mass. In contrast, a person with type II muscle fibers (fast-twitch fibers twitch fibers) more easily raise their muscle mass, but it has

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trouble with endurance. If you find it, the hard muscle grew, it is possible to have more fibers type I (Yemima Berman et al., 2010) [3].

Success in sports requires a level of aerobic endurance or cardiorespiratory be good; it often can be represented by maximum oxygen uptake (V02 max) and resistance levels. Instead, sprint and strength sports are more likely to rely on aerobic digestion and muscle speed, both the main sporting disciplines involving various types of muscle metabolism. Sprint and sports require mainly anaerobic or electricity generation of muscle metabolism, whereas endurance exercise depends on aerobic metabolism.

Genetic polymorphisms that act as a potential mediator of someone's health and physical performance are targeted for many research groups trying to unravel their role in a genetic predisposition for superior performance and durability. There are up to 170 sequence variants of genes. Those are 17 of mitochondrial DNA markers and 25 of additional nuclear genetic markers in a genetic map of a person associated with the phenotype bodily performance as well as good physical fitness. (Rankinen T, et al. 2006) [4].

One of the most intensively studied genomic variations that are much related to the performance of a person over the last ten years, is the insertion (l) or deletion (D) of 287bp in intron 16 of the angiotensin-converting enzyme gene (ACE) (rs1799752) (Puthucheary Z, et al. 2011) [5].

The gene of ACE (Angiotensin-Converting Enzyme Converting Enzyme) is one of the several genes that affect a person's physical abilities. ACE associated with achievement in those sports which require physical endurance because the gene encoding an enzyme ACE (angiotensin I converting enzyme) which handles changing the inactive angiotensin I into angiotensin II active. Angiotensin II plays a role in triggering the downsizing of the diameter of the blood vessels that lead to increased blood pressure. Angiotensin II also serves to degrade a substance in command of raising the diameter of the blood vessels (kinins). ACE is expressed widely in skeletal muscle and plays an important metabolic role during exercise. (Guyton AC, et al. 2000) [6].

Many mechanisms underlying a person athletic performance but not investigated further, despite 12 years of research related polymorphic most studied of ACE I / D. Both of these alleles are I and D in the study by Collins M, et al., (2004) [7] with the participation of a number of triathlon elite athletes of South Africa has so far linked to the performance of elite athletes in the sport of triathlon of South Africa, as well as in research Myerson, et al (1999) [8] against the British long-distance runner, swimmer (Woods, et al., 2001) [9]and runner (Amir O, et al 2007) [10]. It followed by Montgomery et al., which shows the relationship between ACE polymorphisms and sports performance.

Gayagay who first found a significant excess of allele I and genotype II on the Australian national rowers that follow the pre-Olympic trials. They have the allele I appear to show a good performance in endurance-oriented sports activities while the allele D appears to indicate that the reverse in endurance sports. (Gayagay et al. 1998) [11]. Results of this research differ from research conducted Offer Amir, Rankinen, and Zhao, who argued their findings that V02max higher level. It indicates the oxidative capacity increases were found to be associated with the ACE allele D, increased ACE activity associated with the genotype DD can lead to increasing the production of angiotensin II. It is the dominant biological product of RAS and mediate many local effects of ACE in skeletal muscle.

In another study, Cieszczyk reported that found significant differences in allele I frequencies between population Polish rowers and controls, which showed a positive association of alleles I with endurance performance. In a study conducted with 495 respondents, were potential Olympian competitors identified by the British Olympian Associaton, 91 runners found carrying significant excess of both alleles I ($p = 0.01$) and II genotypes ($p = 0.019$) compared with controls (Cieszczyk P, et al., 2009) [12].

A recent study conducted on 230 elite runners Jamaica, and the United States found no relationship between one allele of the athlete's ability to run (Scott et al., 2010) [13]. In studies Argyro et al. (2012) [14] they observed a strong statistical trend towards polymorphism ACE (DD) among female athletes. The highest ranking group of male athletes emerged as heterozygous ID in the same polymorphism. Elsewhere, 101 of Greece Athletics (Papadimitriou, et al., 2009) [15] this study suggests that weak evidence that the presence of Angiotensin-converting enzyme genotypes (DD) can affect the performance of running on a Greek athlete.

This relatively new approach needs to be taken into consideration Ministry of Youth and Sports in determining the appropriate strategy for fostering the seeds of young athletes to boost national sporting achievement, in general, has been more often disappointing lately.

Also, it is needed to think about how to develop a long-term research on the application of this approach to the prospective young athletes of Indonesia. If the genetic information of prospective young athletes obtained earlier is expected to exert significant influence on performance in sports in general.

RESEARCH METHODS

This type of research is a retrospective cohort study using cross-sectional design or approach to illustrate the correlation between factors with effects. This study was conducted in badminton club PB Yanti Jaya Makassar in October 2014 until April 2015 in Makassar. The populations in this study are badminton athletes of PB Yanti Jaya Makassar totaling 59 people being the number of samples in the study of 54 people who trained badminton athlete of PB Yanti Jaya, age range 13-21 years. Data were analyzed using SPSS version 20. The results are displayed in the form of narrative and tables.

Measurement Procedure

Durability measurements by Harvard step test

1. High stool of 40 cm for men and 35 cm for women.
2. Rhythm step at a time up and down, the stool (NTB) is 30 steps per minute, so one step for every two seconds.
3. One step consists of 4 (four) movement / count:
   Count 1: One of the lifted legs (right or left may advance but consistent), and then stepping on the stool. (Assumption right leg)
   Count 2: The left leg lifted and stood upright on the stool.
   Count 3: Walking the first step on a stool on count 1 (assumption right leg) lowered back to the floor.
   Count 4: The left foot is lowered back onto the floor to stand tall in the first posture.
4. Change step is allowed but not more than three (3) times.
5. To order steady rhythm steps, and then used a metronome tool.
6. NTB conducted over five (5) minutes. When the cue stops, the body must be in an upright state. Then sit on the stool with relaxed for 1 (one) minute.
7. Calculate the pulse rate (DN) of the sample for 30 seconds. Recorded as DN 1
8. 30 seconds later recalculated DN sample for 30 seconds. Recorded as DN 2
9. 30 seconds later recalculated DN sample for 30 seconds. Recorded as DN 3
10. After getting the number of DN 1, DN 2, DN 3, then the data is entered on the formula fitness index that subsequently converted in accordance formula that chosen.
11. If the sample cannot do the NTB for 5 (five) minutes, then the time of NTB is recorded, and its DN measured/calculated by the instructions of the DN-making.

Index of Fitness Harvard test:

Long formula: NTB duration (second) x 100/2 (DN 1+DN 2+DN 3)
Index of fitness, Fitness category< 55 very poor, 55-64 poor, 65-79 fair, 80-89 good ≥90 very good.
Short formula: NTB duration x 60 x 100 / 5,5 x DN 1
Index of fitness, Fitness category < 50 poor, 50-80 fair, >80 good.

RESULTS AND DISCUSSION

This study was conducted from September 2014 to April 2015. A selection of respondents by age category and period joining the badminton club PB Yanti Jaya Makassar. In this study involving 54 teenage athletes trained PB Yanti Jaya Makassar by ages 13 to 21 years old with an average exercise two years commencing from joining in the PB Yanti Jaya Makassar, most athletes live in the same neighborhood of the election was collected from 54 respondents then at the end of the test remaining of 52 respondents. Characteristics of research subjects include age, weight, and height.

Table1.Generalcharacteristicsofresearchsubjects

No.	Variable	Average ± sb	Min-max	P
1	Age	18,31 ± 2,18	13 - 21	0,000
2	Weight	54,19 ± 8,79	38 – 83	0,176
3	Height	164 ±7,824	142 – 177	0,059

Source: Primary Data, 2014

Table 1 above present information on average age of sample 18.31 years old with a range of 13 to 21 years old, average weight of 54.19 kg with a range of a minimum weight of 38 kg and a maximum weight of 83 kg, the average height of 164cm with the range of 142 to 177 cm

Table2.Characteristicsofthesubjectgenevariation

No.	Gene Variation	n	%
1.	DD	7	13.5
2.	ID	15	28.8
3.	II	30	57.7
	Total:	**52**	**100**

Source: Primary Data

Table 2 provides information on the gene variations angiotensin-converting enzyme found among the sample population. There are three variations of the ACE gene in which athletes with a variation within the gene I (insertion) had the greatest amount in the overall sample is composed of 52 athletes.

Table 3. Harvard step score 1

	N	Average ± sb	P
Gene Variation DD	7	64,57 ± 12,985	0,442
ID	15	65,77 ± 18,314	
II	30	71,63 ± 17,733	

One-Way Anova test with the significance level p<0.05

Based on Table 3 above by using seen that the value of the average score in the category of DD gene variation with the number of respondents as many as seven athletes are 64.57 with standard deviations of 12.615. ID gene variations in the number of respondent as many as 15 athletes average score of 65.77 with standard deviations of 18.314 and variations in gene II with the highest number of respondents namely 30 athletes with the average score of 71.63 and standard deviations of 17.773.

Table 4. Harvard step score 2

Gene Variation	N	Median (min-max)	P
DD	7	53 (16-86,5)	0,009
ID	15	76 (33-109)	
II	30	87 (17-126)	

Kruskal Wallis test with the significance level p<0.05

Based on the table above shows that the median for the category DD gene variation in the number of respondent as many as seven athletes was 2.25 with a range of 2 to 3.75. The median value of gene variation ID with the number of respondents as many as 15 athletes were 3 with a value range of between 1.85 to 3.80, and variations in the gene II with the highest number of respondent were 30 athletes median value of 3 with a range of 1.90 to 3.60.

Table5.Comparisonofthefirstandsecond Harvard scorestests.

	Median (min-max)	P
Harvard 1	70,5 (26 – 96)	0,001
Harvard 2	80,5 (16 – 126)	

Wilcoxon Test

Based on the table above shows that there is a general increase in the Harvard ability of third genotype variation in the median value of the first measurement was 70.5 with a minimum value of 26 and a maximum value of 96 and the second measuring its median value was 80.5 with a minimum value of 16 and a maximum value of 126.

Statistical test results obtained significance value of 0.001 (P <0.005), thus concluded there are differences in the Harvard score in the first measurement with the score of the second measurement.

CONCLUSION

In some previous, studies proposed distribution of three gene variations that angiotensin-converting enzyme II, ID, DD in the Caucasian population is approximately 25%, 50%, and 25% respectively. It is different from the Asian population in Korea (each 23% , 66% and 11%), whereas in this study actually shows where the different distribution of the 52 participants who are badminton athletes aged 13 to 21 years old assisted PB Yanti Jaya Makassar gained genotype II of 57.7%, genotype ID of 28.8% and DD genotype of 13.5%.

Based on the results of the study by measuring the ability of the performance of endurance athletes with genotype II variation in the ability of endurance can be concluded that there is a relationship between the ability of endurance with I (insertion) gene variation, genotype II in Angiotensin-converting enzyme gene for endurance athletes with P value <0, 05.

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