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Angiontensin converting enzyme insertion/ deletion polymorphism of Turkish professional hip-hop and latin dancers

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Abstract

Angiotensin converting enzyme is one of the key components of cardiovascular system, effecting athletic performance. In this study, we aimed to analyze the angiotensin converting enzyme insertion/ deletion (ACE I/D) gene polymorphism in Turkish Hip-hop and Latin dancers. 25 professional dancers were recruited. Genotyping procedure was carried out by conventional PCR methodology. 8 (32%) of the dancers had DD, 13 (52%) had ID and 4 (16%) had II genotypes. Number and the percentages of D and I alleles were 29 (58%) and 21 (42%), respectively. Respective numbers and percentages of male dancers for DD, ID and II genotypes were 5 (33%), 7 (47%), 3 (20%). For females, 3 (30%) had DD, 6 (60%) had ID and 1 (10%) had II genotypes. D allele was found as 17 (57%) in males, and 12 (60%) for females. 13 (43%) male and 8 (40%) female dancers had I allele. This first study analyzing the distribution of ACE I/D alleles in professional dancers suggest that ID genotype and D allele may have a genetic advantage for the physical predisposition for dancers. But to fulfill the role of the ACE on dancing, further studies with extended numbers of subjects should be carried out.

Keywords: Dance, ACE, athletic performance, renin, human physiology

INTRODUCTION

Dance is a specific expression of human motor behaviors, as well as series of movements in which the person moves in space and time according to the rhythm of music, at least in the terms physical performance (Hugel et al., 1999). During the movements, help of a number of unique physical characteristics maintains the coordination. Therefore, dancers are considered to demonstrate better proprioception, have significantly faster long-latency neuromuscular responses, display consistent muscle activation and stronger interlimb coupling when compared to non-dancers (Jola et al., 2011; Simons, 2005; Sofianidis et al., 2012). Besides, the deep and wide movement of arms and legs, and excessive range of motion of the body by advanced movements are some of dancers characteristic movement types. All of these unique movements are controlled by the neuromuscular system, in which genetic factors play important roles.

Athletic performance is the term used for all the necessary mental and physical characteristics of an individual to compete for a given task in a certain exercise. These characteristics are mostly under the control of our genes, and sports genomics covers all the genetic studies related with athletic performance. One of the most studied genetic marker for human physical performance is angiotensin-converting enzyme gene (*ACE*) insertion (I)/ deletion (D) polymorphism (*ACE ID*). Gene product, angiotensin-converting enzyme (ACE), converts angiotensin I to angiotensin II, which causes blood vessels to constrict, and as a result blood pressure in increases. The most studied polymorphism in the gene (rs4646994) is determined by the presence or absence of a 287 bp *Alu* repeat element in intron 16 (Guney et al., 2013). Recent studies reported the higher activity of ACE enzyme in DD homozygotes, when compared to II homozygotes. I allele has been associated with improved endurance performance and the D allele with higher ACE activity and enhanced strength and sprint performance (Ulucan and Gole, 2014).

The ratio between environmental factors and genetic factors to determine the athletic performance or which have more effect on sports exercise metabolism has not been fully identified and is still a point of research. When we consider the fact that genes play crucial roles on athletic performance, many studies including successful athletes and genes should be carried out. Before, in certain populations, effect of ACE gene on athletic performance was evaluated, but to date, there is no study including Latin and Hip-Hop dancers and *ACE*. In this study, we aimed to analyze the distribution of *ACE ID* gene alleles in Latin and Hip-Hop dancers.

METHOD

Participsnts

A total of 25 professional dancers, all with Turkish ancestry were recruited for the study. They perform exercise activity nearly 9 hours/week. The study handled in accordance with ethical protocol. Written informed consent obtained from each dancer indicating that each participant understood and accepted the aim and study protocol of the study.

Materials and procedures

Genomic DNAs were isolated from 2 ml peripheral blood using the High Pure PCR Template Preparation kit (Roche, Mannheim, Germany) following the instructions of the manufacturer. Primers were as follows: sense 5'-CTGGAGACCACTCCCATCCTTTCT-3' and antisense 5'-GATGTGGCCATCACATTCGTCAGT-3'. Genotyping process was maintained by single polymerase chain reaction (PCR), in a total volume of 50 ul PCR mixture, containing 80-100 ng of genomic DNA,

1.25 mM of each primer, 25 mM KCl, 1 mM dNTP mixture, 1.5 mM MgCl2, 10 mM Tris-HCl, and 1U Taq DNA polymerase. Conditions for PCR was as 94°C for 5 min, annealing at 58°C for 1 min, and extension at 72°C for 2 min, a total of 30 cycles. Ending extension was 72°C for 7 min.

Analysis

After amplification, amplicons were separated by 1.8% agarose gel electrophoresis (with ethidium bromide), and genotyped under ultraviolet light. D allele gave rise to 190 bp fragments, I allele 490, and heterozygous genotypes displayed both DNA fragments (Figure 1).

RESULTS

We analyzed 25 Turkish professional dancers, 15 (60%) of them were males and 10 (%40) were females. 8 (32%) had DD genotype, 13 (52%) had ID and the rest had II genotypes. When we count the allele numbers, number and the percentages of D and I alleles were 29 (58%) and 21 (42%), respectively. For male dancers, respective numbers and percentages for DD, ID and II genotypes were 5 (33%), 7 (47%), and 3 (20%). For female dancers, 3 (30%) had DD, 6 (60%) had ID and only one (10%) had II genotypes. When we consider the alleles, D was found as 17 (57%) in males, and 12 (60%) for female dancers. The respective numbers and percentages for I allele were 13 (43%) and 8 (40%) for male and female dancers. These results were summarized in Table 1. In our cohort, *ACE* ID genotype and D allele was higher in number and percentage when compared to other genotypes and I allele.

Table 1: Numbers and the percentages of the *ACE* genotypes and alleles in dancer cohort

Dancers	ACE Genotypes and Percentages			Alleles	
	DD	ID	II	D	I
Male (n=15)	5 (33%)	7 (47%)	3 (20%)	17 (57%)	13 (43%)
Female (n=10)	3 (30%)	6 (60%)	1 (10%)	12 (60%)	8 (40%)
Total (n=25)	8 (32%)	13 (65%)	4 (16%)	29 (58%)	21 (42%)

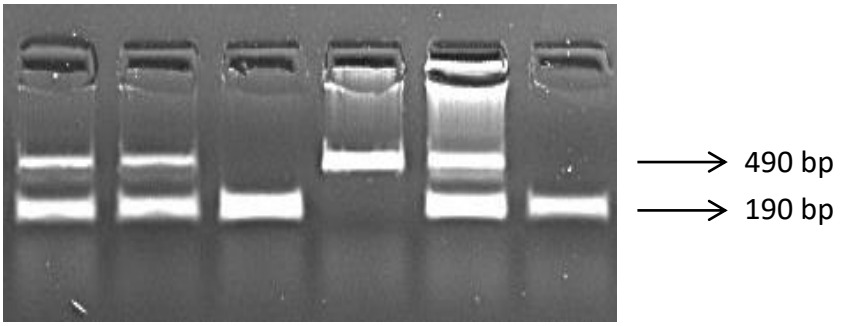

Figure 1. Agarose gel electrophoresis of *ACE* amplicons, black arrows indicate the length, and also the genotypes of the *ACE*. 490 bp indicates the I allele, 190 indicates D allele. Lanes 1,2 and 5 are the heterozygous, ID genotypes, lane 3 and 6 are DD, whereas lane 4 has II genotype.

DISCUSSION

Recent studies have shown that several genes are involved in determining the athletic performance, both physiologically and psychologically (Ulucan et al., 2014). Having information about the athletes, or dancers like in our case, genetic endowment will guide trainers to set up the optimal training modules. In this regard, genetic parameters will help trainers, and therefore, creation of genomic databases will be very useful for sport scientists.

Dancing activity can extend from several minutes to hours, depending on the style, and this activity is known to have an aerobic nature. A dancer's aerobic capacity is commonly considered to be related with the style of dance that they involve, gender and the level of technical ability. Although physical requirements of a dancer in dance classes (essentially designed for the development of technical skills) and during dance performance differs, choreography of dance needs high-intensity movement like quick moving, jump, rotation and leap (Wanke et al., 2012). All these physical parameters are under the control of environmental and genetic factors, and also related with cardiorespiratory status of the dancers (De Moor et al., 2007). In this study we analyzed *ACE* ID genotype, one of the most important regulatory gene in cardiovascular and muscle metabolic processes (Thompson et al., 2006), for the first time in Latin and Hip-hop dancers.

In our cohort, 65% of the dancers had ID genotype, and the percentage of the D allele was found to be as 58%. D allele, and DD genotype, is known to be responsible for high ACE concentration and is considered to be associated with success in speed-strength disciplines (Ulucan et al., 2014). But ID genotype is considered to be associated with sports like football, or basketball, which have mixed aerobic and anaerobic nature (Sercan et al., 2016). There are not enough studies, including dancers, with which we can compare our results. In a study with 97 Korean ballerinas and 203 non-dancers, like our findings, ID genotype was reported to be higher, but unlike our findings, I allele was higher in their cohort (Kim et al., 2014). Results of our and the latter study may help us to debate about the effect of genotype is much more important on phenotype, rather than the effects of alleles.

Ulucan et al. (2016) analyzed another important gene, alpha- actinin- 3 (ACTN3), R577X polymorphism in the same dancer cohort, and reported that RX genotype and X allele is dominant in dancers. RX genotype, like ACE ID genotype, is an intermediate genotype and is mostly related with aerobic and anaerobic sports, together. This study is metabolically in agreement with our study. But unlike our findings, they reported that X allele, which is related with endurance capacity, is higher in dancers.

There are also another studies associating the different kinds of sports and *ACE*. Gineviciene et al. (2016) indicated that ID genotype was the highest genotype with 43.9% and the percentage of the players having at least one D allele was 46.3% on 161 Russian athletes. In another study including Lithuanian football players, ID genotype was found to be the highest genotype with 46.7%, and the percentage of the players having at least one D allele was 76.3% (Gineviciene et al., 2014). Like the previous study, in Turkish football players, ID genotype was higher, and unlike our study, D allele was higher in Turkish football players (Ulucan, 2015). Magi et al. (2016) reported the significantly higher prevalence of the *ACE* ID in Estonian young male skiers in comparison with controls (Magi et al., 2016), stating the important effect of the related genotype in sport predisposition. For instance, there are some studies which cannot find any significantly difference sport and *ACE* gene. Grealy et al. (2016) compared Ironman Championships Triathletes and controls; whereas Heffernan et al. (2016) compared Elite Rugby Union Players and controls, and could not find any significant association between the *ACE* genotypes in the given sports and controls.

To understand the relationship between genes and dancing activity, we need more results including the different kinds of genes and their effect on dance metabolism. By the help of further studies, sports genomics will encourage coaches in developing strategies to improve physical fitness of dancers, and optimizing their artistic and technical skills. In addition, by the help of the genetic data, we will have a chance to understand the cardiorespiratory and neuromuscular systems of dancers, and we can enhance results in movement efficiency, fatigue delaying, and reduced susceptibility to injuries. Therefore, more studies with extended numbers of individuals are needed to understand the effect of genes on dancing activity.

The main limitation of this study is the numbers of the dancers and the style of the dance; only 25 Hip-hop and Latin dancers were examined in the terms of *ACE* genotype. But we hope that this preliminary study that we have conducted for the first time dancers will guide scientist to set up more studies.

CONCLUSION

According to our results that we have from our cohort, *ACE* ID genotype and D allele is more prevalent in Turkish professional Hip-hop and Latin dancers. These polymorphisms, alone or in combination with the additional genetic polymorphisms, should be taken into account when deciding a genomic score profile for success in dance.

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