UNIVERSITI TEKNOLOGI MARA

AN ASSOCIATION STUDY BETWEEN SPORTS-RELATED GENETIC POLYMORPHISMS AND PERFORMANCE CHARACTERISTICS AMONG THE ELITE ATHLETES

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ABSTRACT

Human physical performance is a multigenic trait. Variations in athletic performance may be attributed to a polygenic profile instead of a single genetic variant. This research aims to determine the frequencies of the allele and genotype of ten (10) sports-related genetic polymorphisms (*ACE*, *ACTN3*, *PPARA*, *PPARGC1A*, *ADRB2*, *IL6*, *AGT*, *NOS3*, *MTHFR* and *PPARG*) in Malaysian elite athletes. Cross-sectional study was incorporated to investigate the associations between physical performance and sports-related genetic polymorphisms which are represented by power and endurance TGS. A total of 184 elite athletes comprised of 26 power athletes, 28 endurance athletes, 84 adolescent football players, as well as 46 U19 and U21 football players were genotyped for the polymorphisms. The athletes' genotype data and physical performance data that were collected in prior by professional fitness coaches involving the football players were analysed using Student's t-test, ANOVA, and standard multiple regression (which includes Pearson Correlation) analyses using SPSS software. The study on U19 football players found that players who had better postural stability, power and muscle strength performances had higher power TGS. Significant positive correlations were discovered between muscle strength performance and power TGS. Significant positive correlation was also revealed between the power performance and TGS of power. Standard multiple regression analysis indicated that the power performances parameters are significant in explaining the variation in power TGS. Significant negative correlations between postural stability and TGS of power were also discovered. Standard multiple regression analysis indicated that postural stability parameters are significant in explaining the variation in endurance power TGS. The study on adolescent football players found that players who had significantly better speed and acceleration, as well as muscle strength and endurance performances were revealed to have significantly higher mean of power TGS. Significant positive correlation between 20 m sprint and endurance TGS, as well as negative correlation between handgrip and endurance TGS were also found. Standard multiple regression analysis indicated that muscle strength and endurance parameters are significant in explaining the variation in endurance TGS among the players. Therefore, the research suggested that genetic factors are useful in personalizing athletes' regular training programs to improve sports performances.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

In recent years, correlations between genetic factors and human physical performance are widely studied. These findings have led to the emergence of a new scientific discipline that focuses on the genomic architecture of elite athletes known as sports genomic. Therefore, numerous association studies have been conducted in the past few years to unravel the genetic endowments that might explain the differences in the levels of athletic performance among individuals, particularly elite athletes, by profiling naturally occurring genetic polymorphisms in their genomes (Maciejewska et al., 2012; Ahmetov & Fedotovskaya, 2015; Jacob et al., 2021). The components of the athletic performance include endurance, strength, power, cardiovascular capacity, and neuromuscular coordination (Dror et al., 2015).

Sport-related genetic polymorphisms are heritable influence over components of the athletic performance (Williams & Folland, 2008). Given that the human physical performance is a multigenic trait (Lucía et al., 2010; Guilherme et al., 2014), the variation in athletic performance may be attributed to a polygenic profile instead of a single genetic variant. Variants in genes that are involved in many biological systems of the body may be potentially associated with the elite athletes' phenotypes. To date, there are over 120 sport-related genetic polymorphisms associated with elite athlete status. These include endurance-related genetic markers (Ruiz et al., 2009; Ahmetov & Fedotovskaya, 2015) and power/strength-related genetic markers (Ruiz et al., 2010; Ahmetov & Fedotovskaya, 2015; Maciejewska-Skrendo et al., 2019). Among those sport-related genetic markers, positive associations with elite athlete status have been replicated in a number of those sport-related genetic markers (Ahmetov & Fedotovskaya, 2015). As of now, positive associations with athlete status have been shown in at least ten of these polymorphisms (*ACE*, *ACTN3*, *PPARA*, *PPARGC1A*, *ADRB2*, *IL6*, *AGT*, *MTHFR*, *NOS3*, and *PPARG*) in several studies.

Football is considered as the world's number one sport. A large number of people in the world are actively involved in the game of football (Kunz, 2007). According to the latest statistics based on the findings of a large-scale FIFA survey