Abstract

Genetic and environmental factors are important determinants of the athletic performance. Sports genetic determines certain the alleles for the identification of the genes that affect athletic performance. Comprehensive researches, including the biology of mental properties are accumulating due to the improvement of the information of molecular biology. Dopamine is an important neurotransmitter of the dopaminergic system that affects the athlete mentally and psychologically. In this study, our goal is to determine the genotype and allele distributions of the DRD2 rs1800497 polymorphism in the cyclists. 19 cyclists and 52 sedentary individuals (controls) participated in our study. Genotyping was carried out by real time PCR (rt-PCR) after DNA was isolated from buccal epithelial cells. In our cohort, AG and GG genotypes were detected as 6 (32%) and 13 (68%), respectively. In the control group, the respective AA, AG and GG genotypes were detected as 9 (17%), 18 (35%) and 25 (48%). No statistically significant difference was detected in terms of genotype distribution between the two groups (p=0.1107). When allelic distributions were examined, in athlete cohort. A and G allele numbers were counted as 6 (16%) and 32 (84%), respectively. In the control group, same alleles were count as 36 (35%) and 68 (65%). There was no significant difference in the terms of alleles in our study cohort (p=0.0295). In our cohort, GG genotype and the G allele of the DRD2 rs1800497 polymorphism were dominant. Recent studies showed the association of the A allele with addiction. Therefore we hypothesized the association of the related allele and success in cyclists. Although we were unable to find statistically significant difference, we suggest to analyse the same polymorphism in athletes with different sport branches to fulfill the role of the given polymorphism.

Keywords: sports, genetics, polymorphism, DRD2, cyclist
1. Introduction

The need for research in athletic performance is increasing due to the development of technology and science in sports. There are many factors determining success in sports. Training types and diversity, genetic factors, epigenetics, diet patterns, motivation, equipment and other environmental factors are some of them. Mental and physical factors make up the overall athletic performance and increases with the progress in environmental factors such as training and nutrition. Having information about the genetic structure in athletes is important to have certain functions and personal training programs in both individual and team sports.

Cycling activities that require long-term endurance and strength. Muscle volume and muscle fiber types affect many biomechanical variables like pedal force in cyclists. Therefore, it affects the cycling performance. There are also many different types of cycling and the performance in these types varies accordingly.

Dopamine is an important neurotransmitter that significantly affects the dopaminergic system and physical activities that we face in daily routine. Apart from these activities, it affects exercise and athletic performance to a great extent. It provides regulation of neurological functions and communication between neurons, that are crucial in motor activities. Factors affecting the central nervous system are directly related to psychology. Therefore, dopamine affects mentally athletic performance (Ulucan et al., 2014).

There are five different types of dopamine receptors; DRD1, DRD2, DRD3, DRD4 and DRD5 (Girnghc et al., 1993). DRD2 gene that encoding dopamine metabolism is localized at 11q22–q23. Some polymorphisms have been identified in the gene, one of which is rs1800497 (G/A transition). The G allele in the DRD2 rs1800497 polymorphism is considered wild type and related with the high numbers of the receptor molecules on the cell membrane. The A allele is considered to be polymorphic allele and studies to date have linked the A allele with lower receptor numbers and lower dopamine levels (Turner et al., 1992). Dopaminergic neurons and regions in the brain also appear to play a role in addiction and with some neuropsychiatric disorders (Pohjalainen et al., 1998).

In the present study, we aimed to examine the distribution of receptor 2 (DRD2) rs1800497 in cyclists, and comparee the results with the sedentary individuals. This report, according to the best of our knowledge, is the first which is carried out in cyclists.

2. Materials and Methods

The protocol used in the present study was approved by the Üsküdar University Ethics Committee and was performed in accordance with the principles of the Declaration of Helsinki II. The study protocol was approved by Üsküdar University Ethical Committee and was in line with the principles of the Declaration of Helsinki II. Before the study, all participants signed consent forms containing all the information such as the study protocol, results and evaluation of the results.

2.2. Genotyping:

DNA isolations from buccal epithelial cells of the athletes were carried by the commercially obtained PureLink DNA isolation kit (Invitrogen, Van Allen Way, Carlsbad, CA, USA). Genotyping of the DRD2 rs1800497 polymorphism was performed using quantitative real-time PCR (StepOnePlus, Thermo Fisher Scientific, Inc.), using a TaqMan Genotyping assay (cat. no. 4362691; Thermo Fisher Scientific, Inc.). Manufacturer’s protocols were followed for the genotyping processes. PCR conditions were 60 °C for 30 s and 95 °C for 10 min, followed by 40 cycles of 15 s at 95 °C for and 1 min at 60 °C. Finally, 60 °C for 30 s was applied for post PCR reading. The fluorescent signal was detected at the prePCR, amplification at the end of each cycle, and postPCR reading steps. G and A alleles were determined using VIC and FAM primers, respectively (Fig. 1). The sequences of the TaqMan Probe used for genotyping are listed in Table 1.

2.3. Statistical analysis

Genotype distribution and allele frequencies between groups of athletes and controls were compared by χ² test, using the SPSS (version 18.0 for Windows, SPSS, Chicago, IL, USA) program. p<0.05 value was accepted as statistically significant.

2.1. Study subjects

19 cyclist were participated in our study. 52 sedentary individuals also participated as a control group. All the volunteers had no transmitted genetic anomalies. The
3. Results

In our cohort, 13 (68%) of 19 players had GG and 6 (32%) of them had AG genotypes. No AA genotype was detected. When allele distributions were examined, it was observed that the percentage of A allele was 16% and the G allele was 84%. In the control group (n = 52), 9 individuals had AA, 18 individuals had AG and 25 individuals had GG genotype. A allele was counted as 36 (35%) and G allele as 68 (35%). The genotype and allele number distributions of the athletes are summarized in Table 1.

Table 1. Genotypic and allelic distribution of the DRD2 rs1800497 polymorphism in the study cohort.

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Cyclist (19)</th>
<th>Control (52)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>p Value</td>
<td>p Value</td>
</tr>
<tr>
<td>AA</td>
<td>0.1107</td>
<td>0.0295</td>
</tr>
<tr>
<td>AG</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>GG</td>
<td>13</td>
<td>25</td>
</tr>
<tr>
<td>Percentage</td>
<td>0%</td>
<td>17%</td>
</tr>
<tr>
<td>Allelic Frequency</td>
<td>6%</td>
<td>32%</td>
</tr>
<tr>
<td>A</td>
<td>36</td>
<td>35%</td>
</tr>
<tr>
<td>G</td>
<td>68</td>
<td>65%</td>
</tr>
</tbody>
</table>

Significance was assessed at the p <0.05 level. Comparison with the control group was made using the x² test.

4. Discussion and Conclusion

Variations in the DRD2 gene can affect athletic performance. Low dopamine level due to DRD2 polymorphisms may be a parameter that prevents success in sports. Low dopamine levels are associated with neurological diseases and hyperactivity as well as sports performance. Apart from that, high dopamine levels are also associated with abnormal brain function (Ndamanisha et al., 2009). There are studies in which polymorphism is associated with sports addiction (Munafo et al., 2007).

Dopamine shows its biological effects by binding to its receptors (DRDs). DRD1, DRD2, DRD3, DRD4 and DRD5 are the known five different dopamine receptors. Studies shows that DRD2 receptors in neuronal membranes are higher in numbers who have the GG genotypes than in the AA genotypes (Grandy et al. 1989).

In our study with 19 cyclists, the GG genotype was found higher than the AG genotype. There were no athletes with the AA genotype. At the same time, when we compare the G allele with the A allele, G allele is higher than the A allele. The results of our study were in agreement with the previous studies. Our results are similar to the findings of previous studies. The DRD2 A Allele has been found to be associated with addiction. Studies have shown that the same allele is associated with sports addiction and athletic performance. Our study will contribute to the literature and support other studies in this field. It can help prevent early psychological disorders encountered in athletes.

Patient informed consent: Informed consent was obtained.

Ethics committee approval: The protocol used in the present study was approved by the Üsküdar University Ethics Committee and was performed in accordance with the principles of the Declaration of Helsinki II. All participants signed consent forms containing all the information such as the study protocol, results and evaluation of the results.

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Çisem Şılar (20%): data collection, formation of the article
Esra Karagöz (20%): data collection, formation of the article
Toğra Polat (10%): data collection, statistics 10%
Özlem Özge Yılmaz (10%): laboratory assistance
Beğüm Su Baltacıoğlu(10%): laboratory assistance
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Tuğba Kaman(5%): data collection

References: