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Review

Crime and Genetics

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ABSTRACT

Genetics have overwhelming importance in crime phenomenon. Monoamine oxidase A (MAOA) is directly associated with occurrence of criminal behavior. Monoamine oxidase A is a polymorphic gene which divides into two groups as low-activity MAOA and high-activity. Individuals with low-activity MAOA gene are more prone to engage in criminal activity compare other people. Nevertheless, this genetic risk factor indicates differences according to environmental factors. When environmental factors are bad those individuals are more likely to commit crime but on the other hand, when environmental factors are good this genetic risk factor does not display importance on those individuals. Hence, genetics has an influence on criminal behavior but this influence depends on environmental conditions.

Keywords: Crime, environmental factor, gene X environment, genetic, monoamine oxidase A.

As summarized in a recent meta-analysis, it has been shown that genetic factors have critical roles in the emergence of anti-social behavior.[1-7]

According to these studies, almost half of the variables in antisocial behavior are genetically based and the remaining variables are attributed to the non-shared environment. Scientists have begun to investigate the effects of genetic factors on antisociality in more detail and have focused their studies on specific genes.[8-10]

MONOAMINE OXIDASE A (MAOA)

As a result of studies, monoamine oxidase A (MAOA) gene is prominent. MAOA is a polymorphic gene located on chromosome X at position Xp11.23-11.4.[11] Monamine oxidase A is divided into two groups as low MAOA activity group and high MAOA activity group. Low MAOA activity group consists of 2 repeat alleles and 3 repeat alleles, while high MAOA activity group consists of 3.5 repeat alleles, 4 repeat alleles and 5 repeat alleles.[12]

It has been proved by researchers that the low activity alleles of a functional polymorphism in the promoter region of the MAOA gene are at greater risk of developing a series of antisocial phenotypes.[13] In the light of researches that have done up to day, it is approved that low activity MAOA alleles are correlated with inappropriate behavior, dysfunction and criminal behavior.[8] Brunner's syndrome, an X-linked disease characterized by increased aggression, mild mental retardation, arson, and sexual offense due to MAOA deficiency, has also been described by Brunner et al.[14]

One of the assumptions for the pleiotropic effects of MAOA is that it affects the regulation of emotion and cognition in the limbic system.[8]

In addition, a study showed that there was an 8% reduction in gray matter volumes in the cingulate fold, insula, amygdala, and hypothalamus of carriers of low-activity MAOA poliformis.[15]

The researchers conducted a study to test whether the 30-bp repetition of MAOA polymorphism was associated with alcohol dependence and antisocial personality disorder. In their research, they examined a total of 488 German male participants, 59 with both antisocial personality disorder and

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alcohol dependence. The prevalence of low-activity 3-repetitive alleles was compared with the antisocial and alcoholic group of 59 (185%) and the control group (51% vs 31%, P = 0.031) and tested with 244 alcoholics without antisocial personality disorder (51% vs. 32% P=0.0008). Based on these results, it has been concluded that the low-activity 3 repeat allele increases susceptibility to antisocial behavior.[16]

There is no doubt that genetics have significant effect on crime as it is seen in the researches, but it is worth noting that other issues are not ignored.

CRIME AND ENVIRONMENT

Researchers have proved that there is a consistent relationship between the environment and the emergence of criminal behavior. According to a study based on data obtained from individuals living in the city of Chicago and problematic neighborhoods, it was found that the level of the individual's violent crime behavior was strongly related to the problematic environment measurements. The information put forward by scientists is that individuals living in regions with high crime rates will have a higher tendency towards criminal behavior. According to these findings, we can assume that crime rates in a particular region will be predictive of a person's tendency to crime. However to the best of our knowledge, no study has addressed this issue directly. This shows a significant limitation in the present literature.[17-19]

ENVIRONMENTAL PSYCHOLOGY AND CRIME

Environmental psychology, while dealing with the individual's health, experiences and behaviors, investigates the environmental factors in another aspect. It is among the subjects of environmental psychology in terms of the impact of environment on crime behavior. Criminal behavior is an important issue in psychology. Forensic psychology, which is one of the sub-branches of psychology, directly deals with the crime phenomenon and important researches are made on this subject.

Environmental psychology is related, albeit indirectly, to the phenomenon of crime. The goal of environmental psychology is to eliminate or limit criminal behavior. Studies have been conducted on this subject and significant findings have been obtained. To illustrate, it has been proved by different studies that the violation of the socially accepted norm in a given environment increases the possibility of knowing about the chewing in other norms. In this behavior, which is called the cross norm blocking effect, the individual has difficulty in adhering to social norms in the incompatible movements of other people against the norm. For example; an individual throwing garbage out the window of the car while driving on the road can cause other people who see this behavior to throw garbage out in the same way. The fact that the behavior which is incompatible with the social norm is seen by the environment causes the behavior similar to this behavior to increase.

According to a study by the researchers, they put envelopes containing five euro banknotes in their mailboxes in a visible manner and observed how many individuals who noticed these banknotes would like to buy them. The result showed that these envelopes were taken as 13%. It has been observed that the crime rate increases twice when mail boxes are spray painted or painted.[20,21]

There is no doubt that environmental factors have an important place in committing crime, but as it is understood from the studies, it would be difficult to ask for a complete answer alone.

GENE-ENVIRONMENTAL INTERACTION (GXE) AND CRIME

Behavioral genetic research typically divides the variance in phenotype into three; heredity, shared environment and non-shared environment. As mentioned earlier, behavior geneticists have suggested that criminal behavior may be hereditary at 50%. Researchers have begun to pitch the screen of heredity to identify the links between measured genes and phenotypic outcomes with mapping of the human genome. Molecular genetics has put forward many ideas in this direction.[22]

For example, some genetic polymorphisms, attention deficit and hyperactivity disorder,[23] behavioral disorder in children,[24] adult violence behavior.[10,24,25] Molecular genetic studies have identified the importance of the environment in the emergence of genetic effects called GxE.[26] Findings from gene and GxE studies indicate that certain hereditary effects are more likely to occur when environmental factors are combined.[25,27-30]

The aim of the study of gene and GxE is to investigate whether the effects of a genetic risk factor on the development of a fernotype will differ between individuals based on their exposure to environmental risk factors. For example; genetic risk in an individual with low environmental risk

factor. In addition as environmental risk increases, the likelihood of the effects of genetic risk increases. [9] There is a lot of research on gene and environment interaction in antisocial behavior.

According to a study on this subject, the first group of children with severe genetic conditions (low activity MAOA allele) and poor environmental conditions in childhood without a genetic risk factor (high activity MAOA allele) male individuals were compared it is more likely to be tried for a crime. Although only 12% of the participants were exposed to both risk factors (ie., environmental risk and low MAOA activity allele), they accounted for approximately 44% of all violent criminal convictions in the sample. According to this study, MAOA genotype supported the interaction between gene and environment in the prediction of antisocial behaviors.[31,32]

Researchers found that individuals with low activity MAOA allele showed higher antisocial behavior when maltreatment was high, but showed less antisocial behavior when not exposed to maltreatment when compared to individuals with high activity MAOA allele.[13]

Gene-environmental interaction hypothesis, MAOA different genetic polymorphisms were examined. In these studies, the relationship between certain dopaminergic genes and antisocial behaviors was discussed. Dopamine is a neurotransmitter that is part of the body's pleasure and reward center.[24] Therefore researchers assumed that a connection with antisocial behavior could be established through the ways of pleasure and reward in the brain.[33]

Three dopamine genes (DAT1, DRD2 and DRD4) related to antisocial behavior have come to the fore as a result of research.[9,34-37] The researchers studied the effect of violent offenses on two dopamine genes (DRD2 and DRD4) with two separate groups of participants. In group A, participants living in a low crime rate group and in group B were living in a high crime rate environment. The researchers concluded that the risky alleles in the two dopamine genes have a significant impact on violent criminal behavior, but only when they live in a bad environment. Dopamine genes did not pose a risk for participants living in a suitable environment.[38]

Another study found that children with poor parental care and at the same time DRD4 risk allele showed higher levels of emotional seeking. Parental quality did not affect the emotional search of children without risk allele.[39]

These findings show that genes have an effect on antisocial behavior but these effects play a role in environmental experience.

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