Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(1): 727-729
Received: 08-11-2017
Accepted: 09-12-2017

Aarti Sharma
Amity Institute of Biotechnology, Amity University Uttar Pradesh, Noida, Uttar Pradesh, India

Anit Kumar
Amity Institute of Biotechnology, Amity University Uttar Pradesh, Noida, Uttar Pradesh, India

Vineet Kaswan
Department of Biotechnology, College of basic science and humanities, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujrat, India

Naveen Kaushik
Amity Institute of Virology and Immunology, Amity University Uttar Pradesh, Noida, India

Amit Kaushik
Amity Institute of Biotechnology, Amity University Uttar Pradesh, Noida, Uttar Pradesh, India

Correspondence
Amit Kaushik
Amity Institute of Biotechnology, Amity University Uttar Pradesh, Noida, Uttar Pradesh, India

Role of monoamine Oxidase A (MAOA) in drug addiction

Aarti Sharma, Anit Kumar, Vineet Kaswan, Naveen Kaushik and Amit Kaushik

Abstract
Monoamine oxidase A (MAOA), an enzyme that affects dopamine, norepinephrine, and serotonin. Monoamine oxidase (MAO) is expressed in brain and with regional variation. It helps in metabolizing neurotransmitter molecules and dietary amines. It is is a candidate gene for studying anti-social and other behavioural disorders like Brunner syndrome in humans. Monoamine oxidase A degrades different types of monoamines and has been associated with greater degrees of aggression and impulsivity in the general population. MAOA promoter polymorphism confers increased susceptibility to anti-social behavior rather than alcohol dependence *per se* in alcohol-dependent males and quantitative behavioural traits. The monoamine oxidase-A have been hypothesized to have a relationship with alcoholism and personality traits. These discrepancies imply that the MAOA-uVNTR functional polymorphism might not play a crucial role in behavioral or physiological variability in humans. MAOA had a vital role in regulating personality traits by altering serotonin levels which regulated behaviour and can be act as a biomarker to predict the risk to being a drug addicted. Drug addiction is a very poweful demon that can put your life in danger before a person has live his life. Goverment should take actions for this cause will destroy families and will lead to a life full of sorrow.

Keywords: monoamine Oxidase, drug addiction, dietary amines

Introduction
MAOA is monoamine oxidase A (MAOA). It is also called warrior gene. It compromises particular varations in the X chromosome gene that produce monoamine oxidase A. It is an enzyme that affects dopamine, norepinephrine, and serotonin (González-Tapia & Obsuth, 2015) [8]. The variants, known collectively as MAOA-L, produce human MAOA "knockouts" with a low level of enzyme. In humans it is encoded by the MAOA gene. The mutuation of this gene results in Burnner Syndrome. This gene is associated with a variety of other psychiatric disorders, including anti social behavior (Kim-Cohen *et al*., 2006) [11].
This gene encodes a monometric protein which shares a 70% amino acid sequence identify, as well as conserved chain folds and flavin adenine dinucleotide (FAD) binding site structures, with MAO-B. MAO-A produces an amine oxidase, which affect carcinogenesis (Hassan-Abdallah, Bruckner, Zhao, & Jorns, 2005) [9]. Other disorders associated with MAOA are Alzheimer's disease, aggression, panic disorder, bipolar affective disorder, major depressive disorder, and attention deficit hyperactivity disorder (Ni *et al*., 2007) [14].
Monoamine oxidase (MAO) is expressed in brain and with regional variation. It helps in metabolizing neurotransmitter molecules and dietary amines (Westlund, Denney, Kochersperger, Rose, & Abell, 1985) [21]. MAO is of 2 types, *MAO-A* and *MAO-B*, which are encoded by separate, but highly homologous genes. The genes ncoding MAO-A and MAO-B are mapped to X chromosome Xp11.23~11.4 (Sabol, Hu, & Hamer, 1998) [19] oriented in an adjacent, tail-to-tail fashion. Two different iso-forms of MAO have distinct substrate specificities. MAO-A deaminates serotonin and norepinephrine, while MAO-B acts on phenylethylamines and benzylamine (Bach *et al*., 1988) [1]. In general, MAO-B is considered to have wider role in metabolism of dietary amines. Interestingly, MAO-B transcripts appear at highly elevated levels in the amygdala, prefrontal cortex and hypothalamus (http://expression.gnf.org).
Notwithstanding the existence of two forms of the enzyme and perhaps short-sightedly, most behavioral studies have concentrated on the A form. MAO-A activity has been repeatedly shown to affect changes in neurotransmitter levels, especially that of serotonin and norepinephrine.
The main role of MAO-A is in degrading serotonin following its re-uptake by serotonin transporter from synaptic cleft. Genetic variation and altered pharmacological intervention are

likely to have profound effects on human behaviour, as MAO-A inhibitors are used in treatment of different behavioral disorders. Evidence indicates that MAO-A plays an important role in human behavior, physiology and psychiatric disorders (Balciuniene, Syvänen, McLeod, Pettersson, & Jazin, 2001) [2]. Therefore, MAO-A is a candidate gene for studying anti-social and other behavioural disorders like Brunner syndrome in humans (Deckert *et al*., 1999) [6].

Monoamine oxidase A degrades different types of monoamines; e.g. serotonin, dopamine, and norepinephrine. The gene encoding MAOA maps on X chromosome, i.e. Xp11.23~11.4 (Sabol *et al*., 1998) [19]. MAOA activity has been repeatedly shown to affect changes in neurotransmitter levels, particularly serotonin and norepinephrine. A VNTR in upstream of the promoter region has been characterized (Deckert *et al*., 1999) [6], (Sabol *et al*., 1998) [19] and which affect activity of MAOA by affecting transcriptional efficiency. The promoter polymorphism consists of a 30 basepair (bp) repeat sequences that can include 2, 3, 3.5, 4 or 5 copies. Genetic association studies have reported association between MAOA-VNTR polymorphism in the pathogenesis of aggression and impulse control disorders. The three VNTR-repeat, low activity allele has been associated with greater degrees of aggression and impulsivity in the general population (Manuck, Flory, Ferrell, Mann, & Muldoon, 2000) [12].

Association of a regulatory polymorphism in the promoter region of monoamine oxidase A gene with anti-social alcoholism was reported by (Craig, 2007) [4]. A novel functional 30-bp repeat polymorphism in promoter region of X-chromosomal monoamine oxidase A gene was analyzed to test whether length variation of the repeat polymorphism contributes to variation in vulnerability of individual to anti-social behavior and its liability to alcohol dependence. His findings suggest that the low activity of 3-repeat allele of MAOA promoter polymorphism confers increased susceptibility to anti-social behavior rather than alcohol dependence *per se* in alcohol-dependent males.

(Rosenberg *et al*. 2006) [17] studied the association of MAOA genetic variation with a large set of quantitative behavioural traits in normal individuals. It appears that common genetic variation at the VNTR contributes to the behavioural attribute of "straightforwardness", while rare haplotypes defined by SNPs downstream of the transcription start site may contribute to "conscientiousness". Their study is used to address the validation, interpretation and limitation of genetic association studies of quantitative behavioural traits.

(Pai *et al*., 2007) [16] assessed the role of a functional VNTR polymorphism in MAOA promoter. The monoamine oxidase-A is involved in the degradation of various biogenic amines which have been hypothesized to have a relationship with personality traits. These discrepancies imply that the MAOA-uVNTR functional polymorphism might not play a crucial role in behavioral or physiological variability in humans.

Alcoholism in both males and females has been associated with polymorphisms in genes encoding for proteins important for central serotonergic function. (Gokturk *et al*., 2008) [7] genotyped two functional polymorphisms in promoter region of serotonin transporter and monoamine oxidase-A in a group of women with severe alcohol addiction. The pattern of associations between genotypes of 5-HTT and MAOA in women with severe alcoholism differs from most corresponding studies on males. Using data from the National Longitudinal Study of Adolescent Health, (De Neve & Fowler, 2009) [5] showed that individuals with a polymorphism of the MAOA gene with lower transcriptional efficiency are significantly more likely to report having credit card debt.

Drug

Drug is a substance that alters normal function resulting in any physically or behavioural change in an individual. If a person is in habit of taking drugs and if he/she suddenly stops takin git, then they experience physical or psychological reaction is known as withdrawl (Seligman, 2011) [20]. It is because of the habit an individual is adapted to and when it is not taken body wants the same amount of drig and when it is not given a person reacts in other ways. It is very difficult for an individual to leave and for family also it's very hard to see that phase.

Drug abuse

This problem is faced by whole world these days. The youths are prone to become the victims of drug abuse. When a drug is taken by an individual it becomes his habit and to come out of that habit is very difficult. Drug is generally prepared by opium or other substances. People first taste drugs just for pleasure, under peer pressure and after that many of them get addicted towards it. Addiction of anything is very bad because one's a person is addicted towards anything can't get rid of that easily. Drugs are generally used to forget pain, sorrow, insult, & to escape from reality (Olley, 2008) [15]. It has become a serious issue thses in whole world specially in India. Punjab state of India where the youths are badly effected by drugs abuse. In Punjab one person from each house is in habit of taking drugs (Rosenblatt, 2000) [18]. It is been told that soon Punjab will become like Mexico if it will not be stopped soon. Almost 90% of Punjab's youth is addicted towards drug and it is very alarming situation because drug in take reduces the body capability and it effects the mental state of an individual. Drugs are taken in the form of injection, smoked and few of them chewed also (Mendelson, Sholar, Goletiani, Siegel, & Mello, 2005) [13].

Causes of drug addiction

Youths are generally addicted towards drug. They start taking drugs under peer pressure. When one of friend is taking in his/her group that individual forces their whole circle and in pressure they take it for taste and gradually it becomes their habit (Järvinen & Østergaard, 2011) [10]. Enviroment around an individual also matters a lot if in a family a person in taking drug then in curiosity a person taste that and can become addicted towards it (Becker, 2014) [3]. Although it is aillegal but from the borders specially from Pakistan border it is easily available and that is the main reason Punjabi s badly affected by drug and countries 60% drug addicts are from Punjab and that too youths. The rehabilitation centres are been opened to improve the condition of youths are to remove their bad habit.

Conclusion

MAOA had a vital role in regulating personality traits. Variation in MAOA level weill lead to altered serotonin levels which regulated behaviour. MAOA can be act as a biomarker to predict the risk to being a drug addicted. Drug addiction is a very poweful demon that can put your life in danger before a person has live his life. Before it destroys a person's life one should stop taking drugs because it not only destoy an individual lifes but their family also gets ruined. Teens take money from parents and when they don't get they

steal their mom's jewellary or in some cases they killed their own parent's just for the sake of drugs. Goverment should take actions for this cause will destroy families and will lead to a life full of sorrow.

References

1. Bach AW, Lan NC, Johnson DL, Abell CW, Bembenek ME, Kwan SW, *et al*. cDNA cloning of human liver monoamine oxidase A and B: molecular basis of differences in enzymatic properties. Proceedings of the National Academy of Sciences of the United States of America. 1988; 85(13):4934-8. http://doi.org/10.1073/pnas.85.13.4934
2. Balciuniene J, Syvänen AC, McLeod HL, Pettersson U, Jazin EE. The geographic distribution of monoamine oxidase haplotypes supports a bottleneck during the dispersion of modern humans from Africa. Journal of Molecular Evolution. 2001; 52(2):157-163. http://doi.org/10.1007/s002390010144
3. Becker. Outsiders. Igarss. 2014; 1:1-5. http://doi.org/10.1007/s13398-014-0173-7.2
4. Craig IW. The importance of stress and genetic variation in human aggression. Bio Essays: News and Reviews in Molecular, Cellular and Developmental Biology. 2007; 29(3):227-36. http://doi.org/10.1002/bies.20538
5. De Neve JE, Fowler JH. The MAOA Gene Predicts Credit Card Debt. Social Science Research Network Working Paper Series, 2009. http://doi.org/10.2139/ssrn.1457224
6. Deckert J, Catalano M, Syagailo YV, Bosi M, Okladnova O, Di Bella D, *et al*. Excess of High Activity Monoamine Oxidase A Gene Promoter Alleles in Female Patients with Panic Disorder. Human Molecular Genetics. 1999; 8(4):621-624. http://doi.org/10.1093/hmg/8.4.621
7. Gokturk C, Schultze S, Nilsson KW, von Knorring L, Oreland L, Hallman J. Serotonin transporter (5-HTTLPR) and monoamine oxidase (MAOA) promoter polymorphisms in women with severe alcoholism. Archives of Women's Mental Health. 2008; 11(5-6):347-355. http://doi.org/10.1007/s00737-008-0033-6
8. González-Tapia MI, Obsuth I. Bad genes & criminal responsibility. International Journal of Law and Psychiatry. 2015; 39:60-71. http://doi.org/10.1016/j.ijlp.2015.01.022
9. Hassan-Abdallah A, Bruckner RC, Zhao G, Jorns MS. Biosynthesis of covalently bound flavin: Isolation and in vitro flavinylation of the monomeric sarcosine oxidase apoprotein. *Biochemistry.* 2005; 44(17):6452-6462. http://doi.org/10.1021/bi047271x
10. Järvinen M, Østergaard J. Dangers and pleasures: Drug attitudes and experiences among young people. Acta Sociologica. 2011; 54(4):333-350. http://doi.org/10.1177/0001699311422018
11. Kim-Cohen J, Caspi A, Taylor A, Williams B, Newcombe R, Craig IW, *et al*. MAOA, maltreatment, and gene-environment interaction predicting children's mental health: New evidence and a meta-analysis. Molecular Psychiatry. 2006; 11(10):903913. http://doi.org/10.1038/sj.mp.4001851
12. Manuck SB, Flory JD, Ferrell RE, Mann JJ, Muldoon MF. A regulatory polymorphism of the monoamine oxidase-A gene may be associated with variability in aggression, impulsivity, and central nervous system serotonergic responsivity. Psychiatry Research. 2000; 95(1):9-23. http://doi.org/10.1016/S0165-1781(00)00162-1
13. Mendelson JH, Sholar MB, Goletiani N, Siegel AJ, Mello NK. Effects of low- and high-nicotine cigarette smoking on mood states and the HPA axis in men. Neuropsychopharmacology. 2005; 30(9):1751-1763. http://doi.org/10.1038/sj.npp.1300753
14. Ni X, Sicard T, Bulgin N, Bismil R, Chan K, McMain S, *et al*. Monoamine oxidase A gene is associated with borderline personality disorder. *Psychiatric Genetics*. 2007; 17(3):153-157. http://doi.org/10.1097/YPG.0b013e328016831c
15. Olley N. Drugs and Popular Culture: Drugs, Media and Identity in Contemporary Society. British Journal of Criminology. 2008; 48(3):415-418. http://doi.org/10.1093/bjc/azn022
16. Pai CY, Chou SL, Fu F, Huang Yuan. Assessment of the role of a functional VNTR polymorphism in MAOA gene promoter: a preliminary Study. Forensic Science Journal. 2007; 6(2):37-43. Retrieved from http://fsjournal.cpu.edu.tw/content/vol6.no.2/960202.pdf
17. Rosenberg S, Templeton AR, Feigin PD, Lancet D, Beckmann JS, Selig S, *et al*. The association of DNA sequence variation at the MAOA genetic locus with quantitative behavioural traits in normal males. Human Genetics. 2006; 120(4):447-459. http://doi.org/10.1007/s00439-006-0198-x
18. Rosenblatt R. Consuming desires : consumption, culture, and the pursuit of happiness. Journal of American and Comparative Cultures. 2000; 23(4):114-115.
19. Sabol SZ, Hu S, Hamer D. A functional polymorphism in the monoamine oxidase A gene promoter. Human Genetics. 1998; 103(3):273-279. http://doi.org/10.1007/s004390050816
20. Seligman MEP. Authentic Happiness Using the New Positive Psychology to Realise Your Potential for Lasting Fulfilment. Ebl, 2011. http://doi.org/10.1176/appi.ajp.161.5.936
21. Westlund KN, Denney RM, Kochersperger LM, Rose RM, Abell CW. Distinct monoamine oxidase A and B populations in primate brain. Science. 1985; 230(4722):181-183. http://doi.org/10.1126/science.3875898