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Antioxidative and anti-inflammatory effects of metformin; a new look to an old drug

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Implication for health policy/practice/research/ medical education

Metformin is broadly prescribed to treat high blood glucose in patients with type 2 diabetes mellitus. In addition, metformin has also been shown to have anti-inflammatory and antioxidant effects which it can be administered in the treatment of other medical conditions.

Keywords: Antioxidative, Anti-inflammatory, Metformin

The result of decreased antioxidant defense system and also, increased pro-inflammatory cytokines are detectable in chronic diseases such as diabetes (neuropathy and nephropathy), cardiovascular disorders (hypertension), metabolic syndrome, hepatotoxicity, ototoxicity and infectious disorders. An excess of reactive oxygen species (ROS) cause cellular degradation process that leads to cell damage and induced apoptosis (1-3). Reduction of the ROS with drug treatment and/or diet variation strategy would give a nice objective for suppression of ischemia-reperfusion (I/R) damage in the kidney (4). Recent studies suggest that in the intestinal mucosa of patients with irritable bowel syndrome (IBS), immune cells were activated, and suggest a possible role for low-grade inflammation in the pathogenesis of IBS. Evidence suggests that ROS, pro-inflammatory cytokines and damaged tissue caused hypersensitivity of visceral vessels which is thought to play a main role in the increase of chronic pain and distress in IBS (5).

For most conditions, these diseases can be managed with an appropriate preventive and treatment methods and training for patients. Metformin, a biguanide drug, is broadly prescribed to treat high blood glucose in patients with type 2 diabetes mellitus. This drug improves infarct size and reduces adverse restoration in animals with diabetic or nondiabetic and delays the development of heart failure in nondiabetic animals. In addition to its effect on heart failure, administration of metformin has beneficial effects of diminishing endotoxemia and improves insulin signaling pathway in animals. There is the positive effect of metformin on decreasing oxidative stress activity in the body (6). Acetaminophen (acetyl-para-aminophenol [APAP]) poisoning can cause necrosis of the centrilobular cells, fatty degeneration and increased inflammation. In addition, acetaminophen-induced hepatotoxicity is believed to be mediated by increasing pro-inflammatory cytokines (such as IL-6, TNF-α and CRP levels), tissue enzymes (such as AST, ALT, ALP and malondialdehyde), and also through decreasing glutathione and superoxide dismutase activities. Our recent study suggests, a 21-day treatment with metformin (200 mg/kg/d) protects hepatocytes against acute APAP hepatotoxicity. ROS and pro-inflammatory cytokines play a main effect in toxicity of APAP, resulting in acute hepatotoxicity. However, improved hepatocyte necrosis, attenuated antioxidant defense system, diminish proinflammatory cytokines and prevention of tissue damage were also found with metformin treatment (7). Recent investigations have shown that metformin may have a role to improve nephropathy of diabetes (8). Also, studies have suggested that metformin treatment improved gentamicin-induced renal toxicity in Wistar rats (9). In this study, it has been shown that administration of metformin after the development of tubular damage by gentamicin, can ameliorate tissue injury. Likewise, co-administration of garlic extract and metformin has a role in protection against oxidative stress in renal toxicity (10). The main target of metformin is mitochondrial respiratory chain complex I, which can result in the activation of the adenosine monophosphate-activated protein kinase (AMPK) signaling pathway (11). In general, the stimulation of AMPK signaling pathway with metformin causes antioxidant and anti-inflammation effects. And finally, It has been suggested the attenuation of chronic diseases.

Author's contribution

AH is the single author of the manuscript.

Conflicts of interest

The author declared no competing interests.

Ethical considerations

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References

1. Kalantar M, Shirali S, Hasanvand A, Valizadeh M, Tavakoli R, Asadi M, et al. Ameliorative effects of hydroalcoholic extract

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of *Lavandula officinalis* L. on methotrexate-induced oxidative stress in rats. Pharm Sci. 2017;23:18-26. doi:10.15171/PS.2017.04
2. Darabi S, Hasanvand A, Nourollahi A. Assessment of the effects of anti-inflammatory of garlic; nettle leaves and olives extracts in STZ-induced diabetic rat. Complementary Medicine Journal of Faculty of Nursing and Midwifery. 2016;1:1452-60.
3. Darabi s, Hasanvand A, Nourollahi A. Effects of garlic extract, olive leaf extract, nettle extract on serum inflammatory markers hsCRP and IL-6 and TNF-α in rats with diabetes. Complementary Medicine Journal of faculty of Nursing & Midwifery. 2016;6:1452-60.
4. Hasanvand A, Abbaszadeh A, Darabi S, Nazari A, Gholami M, Kharazmkia A. Evaluation of selenium on kidney function following ischemic injury in rats; protective effects and antioxidant activity. J Renal Inj Prev. 2017;6:93-8. doi: 10.15171/jrip.2017.18.
5. Choghakhori R, Abbasnezhad A, Hasanvand A, Amani R. Inflammatory cytokines and oxidative stress biomarkers in irritable bowel syndrome: association with digestive symptoms and quality of life. Cytokine. 2017;93:34-43.
6. Ghosh P. The stress polarity pathway: AMPK 'GIV'-es protection against metabolic insults. Aging (Albany NY). Aging (Albany NY). 2017;9:303-14. doi: 10.18632/aging.101179.
7. Saeedi Saravi SS, Hasanvand A, Shahkarami K, Dehpour AR. The protective potential of metformin against acetaminophen-induced hepatotoxicity in BALB/C mice. Pharm Biol. 2016;54:2830-7. doi:10.1080/13880209.
8. Beladi Mousavi SS, Nasri H, Rafieian-Kopaei M, Tamadon MR. Metformin improves diabetic kidney disease. J Nephropharmacol. 2012;1:1-2.
9. Amini FG, Rafieian-Kopaei M, Nematbakhsh M, Baradaran A, Nasri H. Ameliorative effects of metformin on renal histologic and biochemical alterations of gentamicin-induced renal toxicity in Wistar rats. J Res Med Sci. 2012;17:621-5.
10. Rafieian-Kopaei M, Baradaran A, Merrikhi A, Nematbakhsh M, Madihi Y, Nasri H. Efficacy of co-administration of garlic extract and metformin for prevention of gentamicin–renal toxicity in Wistar rats: a biochemical study. Int J Prev Med. 2013;4:258-64.
11. Nasri H, Baradaran A, Ardalan MR, Mardani S, Momeni A, Rafieian-Kopaei M. Bright renoprotective properties of metformin: beyond blood glucose regulatory effects. Iran J Kidney Dis. 2013;7:423-8.

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