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Review Article

The preventive role of Arabic gum in the treatment of Toxicity

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Abstract

Arabic Gum has a wide spectrum of health benefits because of its antioxidant, antidiarrheal, anti-inflammatory, and antimicrobial effects. It was approved as a food additive by the Joint FAO/WHO Expert Committee due to its stabilizing, emulsifying and thickening properties that induce the attractive flavors. Many research demonstrated the Arabic gum as one of the natural antioxidants that have an effective protective and curative role in many intoxicated cases. Recent studies showed that Arabic gum has the ability to prevent or treat the toxic manifestations of some common drugs such as indomethacin, aspirin, acetaminophen, and gentamicin as well as some chemotherapeutic drugs such as cyclophosphamide, doxorubicin, and cisplatin besides its potent prophylactic role in some chemicals toxicity cases such as trichloroacetic acid, paraquat, and mercuric chloride

Keywords: Arabic Gum, Antioxidant, Prevention

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Introduction

Arabic Gum is a natural complex exudate from Acacia senegal and Acacia seyal trees wherein it consists of polysaccharides and glycoproteins mixture. It was approved as a food additive because of its stabilizing, emulsifying and thickening properties that induce the attractive flavors[1]. Arabic Gum is used in pharmaceuticals wherein it exerts many therapeutic effects due to its antioxidant antidiarrheal, anti-inflammatory, and antimicrobial effects besides it improve the dental re-mineralization[2]. Recently, a lot of the published data revealed that Arabic gum has a positive effect in the treatment of renal, gastrointestinal and cardiovascular disorders besides its hypocholesterolemic effect[3]. Thus and based on it's a wide spectrum of health benefits, the Joint FAO/WHO Expert Committee on Food Additives suggested an acceptable daily intake of Arabic gum for human since 1969[4].

The toxic agents' exposure usually causes many biological changes in the body biomarkers as a response to the toxic effects of these agents whether they are environmental chemicals or drugs. Toxic exposure is defined as a stressful status that proceeds to a balance disturbance between the pro-oxidants and antioxidants inducing the deleterious biochemical and physiological changes. Toxic exposure inducing a stressful status is called an oxidative stress which produces excessive free radicals wherein the antioxidant defense system is suppressed due to the increased oxidant burden or insufficient the antioxidant enzymes[5]. So, the changes in the levels of oxidative stress biomarkers are considered the bio-indicators of intoxication. Moreover, the reactive oxygen species (ROS) usually cause a damage in proteins, carbohydrates, lipids, and nucleic acids[6].

Recently and based on the above - mentioned in toxication pathophysiology mechanism, many research used new natural antioxidants as preventive and therapeutic agents in many toxicity cases. Arabic Gum as one of these natural antioxidants has also been demonstrated to be an effective protective and curative agent in many intoxicated cases[7]. So, this article attempts to focus on the preventive and therapeutic role of Arabic gum as an antioxidant in the treatment of toxicity depending on the available published data in recent years.

Arabic Gum and drugs toxicity

In the last years, a number of studies showed that Arabic gum has the ability to prevent or treat the toxic manifestations of some common drugs such as analgesics and chemotherapy. Elshama et al., 2014[8]. proved that Arabic gum can prevent the systemic toxicity of indomethacin overdose wherein it can improve the toxic indicators of indomethacin on the different body organs and systems; the concurrent use of Arabic gum with indomethacin can ameliorate the renal and hepatic toxicity, and modify the toxic morphological changes of retina associated with improving the complete blood picture and coagulation profile that are affected by indomethacin intoxication.

Moreover, Arabic gum has an effective role in protecting the liver against acetaminophen-intoxication via the oxidative stress reduction, nitric oxide scavenging, and the blocking of hepatic macrophage function wherein acetaminophen overdose causes a significant depletion in the hepatocellular glutathione levels associated with the release of nitric oxide and hepatic macrophages activation that are

mediators of acetaminophen-induced hepatotoxicity[9]. In addition, combined administration of Arabic gum and aspirin can protect the intestinal mucosa against the toxicity of aspirin wherein Arabic gum has anti-ulcer activity besides its role in maintaining the balance of the pancreatic, intestinal enzymes and the intestinal content of iron and zinc modulating the biochemical and histopathological changes that are induced by aspirin toxicity[10].

Furthermore, Arabic gum can also play a preventive role in chemotherapy toxicity. It can limit or neutralize the reactive oxygen metabolites of cyclophosphamide and then protect the urinary bladder against cytotoxicity[11]. In the related context, Arabic gum protects the heart against the toxic effect of doxorubicin reversing its histopathological changes such as myocardial damage, myofibrillar degeneration, mitochondrial dilatation, and the cellular vacuolization wherein Arabic gum is considered as a potent superoxide scavenger preventing doxorubicin cardiotoxicity[12,13]. Moreover, Nephrotoxicity of cisplatin and γ-radiation limit their use as chemotherapy and radiotherapy agents in the clinical field of cancer treatment. So, Arabic gum can help the physicians to overcome this problem because of its renoprotective and antioxidant properties wherein pretreatment by Arabic gum prevents the renal cellular damage that is attributed to cisplatin and γ -radiation toxicity[14].

It is known that the nephrotoxicity of aminoglycosides antibiotics is well established as one of the most serious drugs intoxication signs. According to Al Majed et al., 2002[15], Arabic gum may ameliorate the biochemical and histopathological manifestations of gentamicin nephrotoxicity via inhibition the oxygen free radicals production that causes lipid peroxidation in the renal tissues. In addition, Alla and Sadeek, 2018[16] confirmed the renoprotective effect of Arabic gum wherein its oral administration can alleviate the renal toxicity of adenine preventing the oxidative stress, so it is considered a promising treatment in the patients of chronic renal diseases. On the other hand, Alubaidy, 2013[17] suggested that Arabic gum can exert a hepatic protection through the free radical scavenging properties in the cases of hepatic toxicity that is induced by gentamicin exposure restoring the normal biochemical parameters and increasing the regenerative capacity of the liver. In the related context, Arabic gum can also counter the hepatotoxicity of sodium valproate based on its antioxidant effect[18].

Arabic Gum and chemicals toxicity

In a similar context, Arabic gum can play a preventive and curative role in other chemicals intoxications. Trichloroacetic acid is one of these chemical compounds wherein it is used in many medicinal products; it is also found in the drinking water after a high concentrated chlorination. Trichloroacetic acid exposure causes a severe toxicological impact on the vital organs inducing hepatotoxicity and renal toxicity in a response to the oxidative stress mechanism[19]. Najla et al., 2017[20] reported that Arabic gum supplementation has an effective hepatoprotective role whether biochemically or histologically in trichloroacetate-induced toxicity wherein antioxidant and antilipoperoxidative activities of Arabic gum can inhibit and scavenge the free radicals that are generated via trichloroacetate and then Arabic gum can prevent and treat hepatic disorders. On the other hand, Alnahdi, 2016[21] referred to the use of Arabic gum as a prophylactic agent against the toxic renal deterioration that is caused by trichloroacetic acid intoxication improving renal performance.

Furthermore, Gamal el Din et al., 2005[22] proved that Arabic gum can alleviate the lung toxicity which is induced by the toxic effect of one of the most herbicidal agents (paraquat). This study showed the ability of Arabic gum to counter the free radicals generation that produces the oxidative stress in lung tissues leading to the toxicity induction.

Every day and with the research development, the protective effect of Arabic gum proves its efficacy in preventing the hazards of many chemicals toxicity. Mercury and its different forms are considered hazardous environmental and industrial toxicants that cause severe changes in the human body tissues wherein it accumulates predominantly in the kidneys leading to acute renal failure based on the reduced glutathione levels and an increase in the reactive oxygen species levels such as superoxide radicals and hydrogen peroxide. In this context, Gado and Aldahmash, 2013[23] indicated to an effective cytoprotective role of Arabic gum in modulating the nephrotoxicity of mercuric chloride via its competence to maintain the activity of antioxidant enzymes in the renal tissues associated with a reduction in the oxidative stress that is produced by the toxic effect of mercuric chloride.

Conclusion

Arabic Gum is considered one of the natural antioxidants that have an effective protective and therapeutic roles in many toxicity cases. A lot of studies showed that Arabic gum has the ability to prevent or treat the toxic manifestations of some common drugs such as indomethacin, aspirin, acetaminophen, gentamicin, cyclophosphamide, doxorubicin, and cisplatin besides its potency to modulate the toxicity of some common chemicals such as trichloroacetic acid, paraquat, and mercuric chloride.

Recommendation

Further human studies should be carried out in the future to verify the efficacy of Arabic Gum as a curative and protective agent in the different drugs and chemicals toxicities.

Conflict of Interest Statement

There are no conflicts of interest.

References

1.S. Patel, A. Goyal, "Applications of Natural Polymer Gum Arabic: A Review, International Journal of Food Properties," vol. 18, no. 5, pp. 986-998, 2015. DOI:10.1080/10942912.2013.809541

2.B.H. Ali, A. Ziada, G. Blunden, "Biological effects of gum arabic: A review of some recent research, Food and Chemical Toxicology, vol. 47, no.1, pp. 1-8, 2009.

3.S. Al-Assaf, G.O. Phillips, P.A. Williams, "Studies on acacia exudate gums. Part I : the molecular weight of Acacia senegal gum exudate," Food Hydrocolloids, Vol. 19, No.4, pp. 647-660, 2005.

4.H.A. Badreldin, A. Ziada, G. Blunden, "Biological effects of gum arabic: A review of some recent research," Food and Chemical Toxicology, vol. 47, no. 1, pp. 1-8, 2009.

5.C. Faggio, F. Fazio, S. Marafiot, F. Arfuso, G. Piccione, "Oral administration of Gum Arabic: effects on haematological parameters and oxidative stress markers in Mugil cephalus," Iranian Journal of Fisheries Sciences, vol. 14, no.1, pp. 60-72, 2015.

6.J. Lykkesfeldt, O. Svendsen, "Oxidants and oxidants in disease: oxidative stress in farm animals," Veterinary Journal, vol.173, no.1, pp. 502-511, 2007.

7.Y. Dror, Y. Cohen, R. Yerushalmi – Rozen, "Structure of gum arabic in aqueous solution," Journal of Polymer Science: Part B: Polymer Physics, vol. 44, no.1, pp. 3265-3271, 2006.

8.S.S. Elshama, A.E. El-Kenawy, H.E.H. Osman, H.M. Youseef, "Amelioration of indomethacin systemic toxicity by arabic gum administration in the adult albino rats," International Journal of Medicinal Plants and Alternative Medicine, vol. 2, no. 3, pp. 32- 46, 2014.

9.A.M. Gamal eldin, A.M. Mostafa, O.A. Al Shabanah, A.M. Al Bekairi, M.N. Nagi, "Protective effect of arabic gum against acetaminophen-induced hepatotoxicity in mice," Pharmacol. Res., vol. 48, no. 1, pp.

631-635, 2003.
10.W.A. Nasif, M. Lotfy, M.R. Mahmoud, "Protective effect of gum acacia against the aspirin induced intestinal and pancreatic alterations," Eur Rev Med Pharmacol Sci., vol. 15, no. 3, pp. 285-92, 2011.
11.A.A. Al-Yahya, A.A. Al-Majed, A.M. Gado, M.H. Daba, O.A. Al-Shabanah, A.R. Abd-Allah, "Acacia Senegal gum exudate offers protection against cyclophosphamide-induced urinary bladder cytotoxicity," Oxid Med Cell Longev., vol. 2, no. 4, pp. 207-13, 2009.
12.A.R. AbdAllah, A.A. Al Majed, A.M. Mostafa, O.A. Al Shabanah, A.G. Din, M.N. Nagi, "Protective effect of arabic gum against cardiotoxicity induced by doxorubicin in mice: a possible mechanism of protection," J. Biochem. Mol. Toxicol., vol. 16, no. 4, pp. 254-259, 2002.
13.M.A. Elderbi, A.W.H. Mohamed, A.H.A. Hadi, M.D. Dabobash, "Potential protective effect of gum Arabic against Doxorubicin-induced cardiotoxicity in Wistar albino rats," Int J Pharm Sci Res; vol. 5, no. 3, pp. 1023-27, 2014. doi: 10.13040/IJPSR.0975-8232.5(3).1023-27.
14.A.M. Heba, S.N. Ahmed, H. Neamat, F.Z. Hala, A.K. Sanaa, "The renoprotective effect of gum arabic in gamma-irradiated and cisplatin treated rats," International Journal of Scientific and Research Publications, vol. 5, no. 6, pp. 1-11, 2015.
15.A.A. Al-Majed, A.M. Mostafa, A.C. Al Rikabi, O.A. Al Shabanah, "Protective effects of oral arabic gum administration on gentamicin-induced nephrotoxicity in rats," Pharmacol. Res., vol. 46, no. 5, pp. 445-451, 2002.
16.F. Alla, E.A. Sadeek, "Effect of Arabic Gum as Prebiotics and Lactobacillus casei Shirota (LcS) as Probiotic on Oxidative Stress and Renal Function in Adenine-Induced Chronic Renal Failure in Rats," European Journal of Nutrition & Food Safety, vol. 8, no. 1, pp. 29-46, 2018.
17.G.F. Alubaidy, "Study the biochemical effect of gum Arabic in liver injury and blood serum of mice induce by gentamicin," Bas. J. Vet. Res., Vol. 12, No. 1, pp. 243-252, 2013.
18.S.S.M. Ahmed, "The effect of gum Arabic supplements on sodium valproate-induced hepatotoxicity in rats," Master Thesis of Science in Biochemistry, University of Khartoum, Khartoum, Sudan, 2010. https://core.ac.uk/download/pdf/71671401.pd
19.I. Celik, "Determination of Toxicity of Trichloroacetic Acid in Rats: 50 Days Drinking Water Study," Pestic. Biochem. Phys., vol. 89, no. 1, pp. 39-45, 2007.
20.O.A. Najla, S.R. Kholoud, E.A.F. Hoda, S.A. Hanan, "Protective role and antioxidant activity of arabic gum against trichloroacetate-induced toxicity in liver of male rats," Indian Journal of Animal Research, vol. 51, no. 2, pp. 303-309, 2017.
21.H.S. Alnahdi, "Prophylactic impact of Arabic gum extract against nephrotoxicity induced by chronic exposure to trichloroacetic acid in rat," Advances in Environmental Biology, vol. 10, no. 12, pp. 250-258, 2016.
22.A.M. Gamal el Din, A.A. Al-Yahya, A.A. Al-Majed, A.M Al-Bekairi, A.M. Mostafa, "Antioxidant effect of Arabic gum against paraquat-induced lung oxidative stress in mice," J. Med. Sci., vol. 5, no. 2, pp. 95-100, 2005.
23.A.M. Gado, B.A. Aldahmash, "Antioxidant effect of Arabic gum against mercuric chloride-induced nephrotoxicity," Drug Design, Development and Therapy, vol. 7, no. 1, pp. 1245-1252, 2013.