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 that the Arabic gum acts 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. 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. 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. 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.

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. 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. Recently and based on the above - mentioned in toxication pathophysiolog 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. 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 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. 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. 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. 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. 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.

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, 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 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 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.

**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. Najla et al., 2017 reported that Arabic gum supplementation has an effective hepatoprotective role whether biochemically or histologically in trichloroacetic-acid-induced toxicity wherein antioxidant and antilipoperoxidative activities of Arabic gum can inhibit and scavenge the free radicals that are generated via trichloroaceticate and then Arabic gum can prevent and treat hepatic disorders. On the other hand, Alnahdi, 2016 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 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.