PHARMACOLOGICAL POTENTIAL OF GREEN TOMATO GLYCOALKALOIDS: AN OVERVIEW

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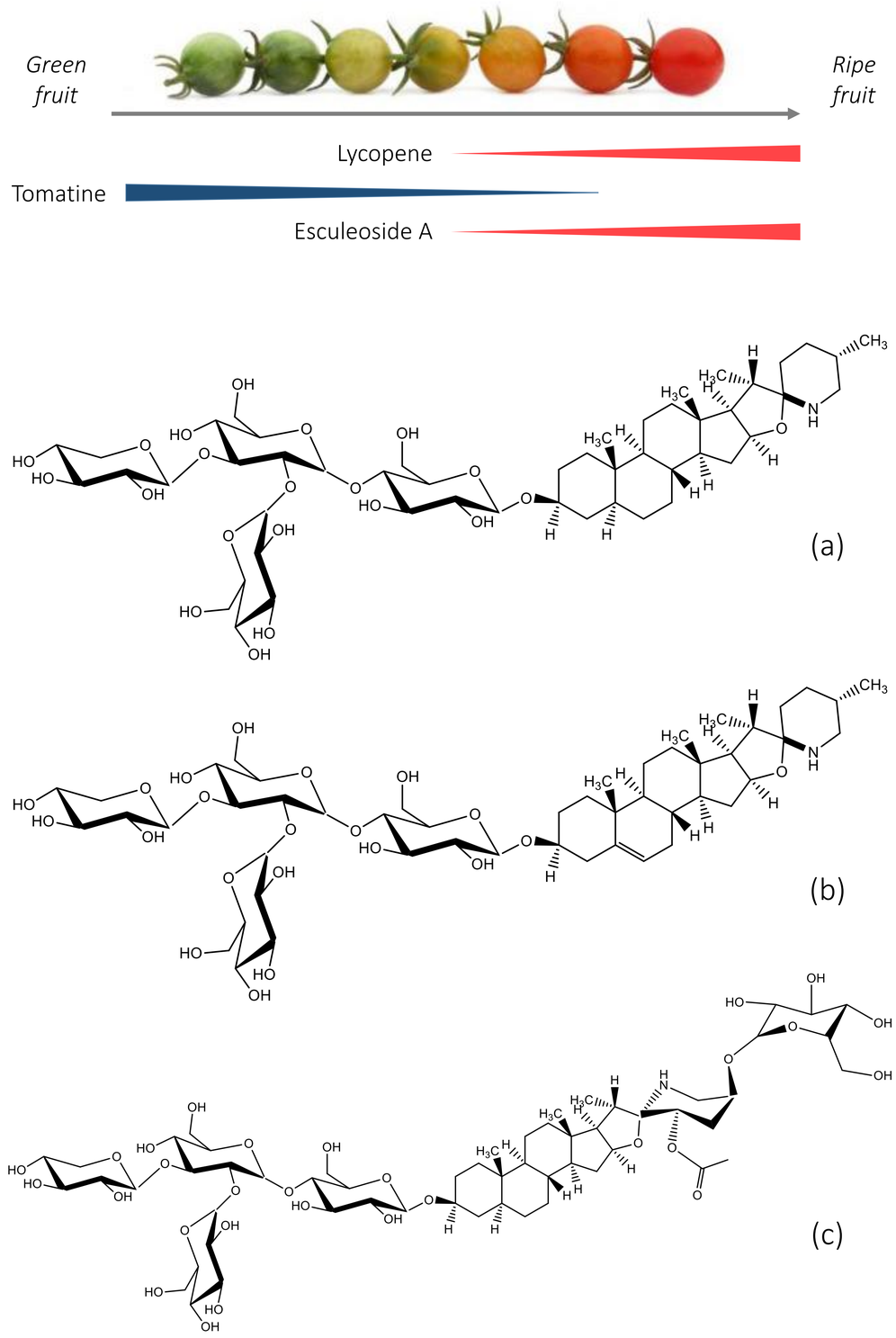
TOMATO GLYCOALKALOIDS

Glycoalkaloids are characteristic secondary metabolites in plants of the Solanaceae family. Although perceived as potentially toxic, these compounds display different bioactivities and pharmacological effects. The glycoalkaloids esculeoside A and tomatine (which comprises a junction of α-tomatine and dehydrotomatine) can be found in tomato plants. Structurally, dehydrotomatine differs from α-tomatine by having a double bond in the steroidal B ring of the aglycone; but both glycoalkaloids have the same tetrasaccharide (lycotetraose) side chain. Therefore, while α-tomatine has lycotetraose bonded to the aglycone tomatidine, dehydrotomatine has the side chain attached to the aglycone tomatidenol. Up to 500 mg/kg FW of tomatine can be found in unripe (green) tomatoes, levels that decrease with ripening (approximately 5 mg/kg FW in ripe red tomatoes) [1]. On the other hand, the content of esculeoside A, which is stored in ripe red tomatoes, is comparable to or higher than that of lycopene [2]. Thus, the levels of esculeoside A increase as the fruit matures, contrary to that observed for tomatine [3].

AIMS **THIS STUDY WAS CARRIED OUT TO REVIEW THE MECHANISMS OF ACTION OF GREEN TOMATO GLYCOALKALOIDS AND THEIR INVOLVEMENT IN HUMAN HEALTH**

MECHANISMS OF ACTION OF TOMATO GLYCOALKALOIDS

The bioactivity of green tomato glycoalkaloids derives mainly from the capacity to inhibit acetylcholinesterase (AChE) and butyrylcholinesterase (BuChE) enzymes, and to complex with membrane 3β-hydroxy sterols. The aglycone alone is practically inactive against cholinesterase enzymes; the sugar unit is required for activity, but it is the structure of the aglycone that determines the extent of inhibition. The existence of heterocyclic nitrogen is also a necessary condition for activity [4]. Regarding a second mechanism of action, and with respect to the aglycone subunit, an intact E ring and an unshared pair of electrons on the F-ring nitrogen, as well as solanidane and spirosalane rings are necessary for the membrane lytic activity [5]. In general, the glycoalkaloids bioactivity increases when they are administered as mixtures (depending on the relative proportion used) [6]; but the synergistic effect of α-tomatine and dehydrotomatine remains unknown. In inflammatory processes, the aglycone tomatidine is able to reduce inducible nitric oxide synthase (iNOS) and cyclooxygenase-2 (COX-2) expression through blocking nuclear factor kappa B (NF-κB) and c-Jun N-terminal kinase (JNK) signalling in lipopolysaccharide-stimulated macrophages [7]. In turn, α-tomatine has the ability to decrease the cholesterol and triglyceride levels, enhance the immune system, induce apoptosis, and inhibit the growth and proliferation of different type of cancer cells [8-10].



Chemical structures of (a) α-tomatine, (b) dehydrotomatine and (c) esculeoside A.

CONCLUSIONS

This review study highlights the pharmacological potential of green tomato glycoalkaloids (such as tomatine) that has been demonstrated by several *in vitro* and *in vivo* studies and clinical trials, which recognize these compounds (either isolated or in combined extracts) as potential anticancer, anti-inflammatory, anticholesterolemic and anti-obesity drugs that can be used in the development of new pharmaceutical formulations.

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Bioactive Compounds of Tomatoes as Health Promoters - *Pp. 48-91 (44)*

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Abstract

Tomato (Lycopersicon esculentum Mill.) is one of the most consumed vegetables i
garden crop. It is a key component of the Mediterranean diet, commonly associate
diseases. Currently there are a large number of tomato cultivars with different m
tomato-based products, being major sources of nourishment for the world's popu
linked with its high levels of bioactive ingredients. The main compounds are caroteno
and mostly lycopene, which is responsible for the red colour, vitamins in partic
compounds including hydroxycinnamic acid derivatives and flavonoids, and lectins
dependent. Besides, unlike unripe tomatoes, which contain a high content of toma
tomatoes contain high amounts of lycopene and a lower quantity of glycoalkaloids. C
of these bioactive compounds, either isolated or in combined extracts, na
hepatoprotective effects among other health benefits, mainly due to its antioxidant a
bioavailability and bioactivity of these bioactive compounds will be discussed, as w
cancer and other bioactivities including antioxidant, antiinflammatory, cardiovasc
Possible applications of tomato bioactive compounds in the industry will also be propo