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Physiological and biochemical effect of α-Amyrin: A review

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Abstract

Background: Alexander has identified α-Amyrin as a triterpene molecule synthesized from the leaves of this medicinal plant: Celastrus hindsii. A few nations in Southeast Asia as well as Vietnam, and some nations of South America are in require of this specific plant. Both qualitative and quantitative methods have been used in the analysis to give a conclusive affirmance of the existence of α-Amyrin. The included techniques include Gas chromatography-mass spectrometry (GC-MS), Electrospray ionization mass spectrometry (ESI-MS), and Nuclear magnetic resonance (NMR) spectroscopy. It showcases notable inhibition of antioxidants, anti-xanthine oxidase, and anti-tyrosinase, making it an agent that could be employed to treat different illnesses. As far as the biological aspect is concerned, α-amyrin has a multitasking role, primarily it plays the role of an antioxidant, xanthine oxidase inhibitor, and also an agent that could suppress the activity of tyrosinase. Because of all these attributes, it is an exceptionally useful molecule that can be used in developing new drugs targeting various diseases and conditions. Based on the findings it is evident that the relative abundance of a considerable amount of α-amyrin in the leaves of C. hindsii suggests the feasibility of using the plant as a source or extracting and purifying this particular component.

keywords: α-Amyrin, anti-inflammatory, mitochondrial.

Introduction

An anti-inflammatory triterpene with the name α-Amyrin has been identified in the leaves of the medicinal tree Celastrus hindsii. This chemical has been widely recognized as being medicinal or having medical uses[1]. The demand for this plant is high in several countries in the South American region together with some countries in Southeast Asia and Vietnam. To purify and quantify α-Amyrin, numerous analytical techniques have been used in the process for purposes of evaluating and establishing the concentration of α-Amyrin, a number of analytical procedures have been used. Some of the techniques that come under this category are Gas chromatography-mass spectrometry (GC-MS), electrospray ionization-mass spectrometry (ESI-MS)[2], and Nuclear Magnetic Resonance (NMR) spectroscopy. This is because the specific molecule has antioxidant properties, anti-xanthine oxidase activity, and anti-tyrosinase action and therefore possesses the potential for the treatment of various ailments [2].

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The main code figured out for the biological relevance of α-amyrin is the antioxidant/anti-xanthine oxidase/antis-tyrosinase properties it might have. Due to these characteristics, it is a very versatile molecule that can be used for the synthesis of new drugs for several diseases and therapeutic applications. It is also possible to use it in therapy or during such practices and sessions. To be specific, the analyzed parts of C. hindsii provide the abovementioned benefit due to the presence of a rather essential amount of α-amyrin in the leaves of the plant, indicating that the plant may contribute to the advantageous extraction and purification of this particular compound [3].

Review:

Chemical composition

α-Amyrin is a pentacyclic triterpene compound with the chemical formula C30H50O. It belongs to the ursane series of triterpenes and is an isomer of α-amyrin, which belongs to the oleanane series. The structure of α-amyrin consists of five fused rings, with four six-membered rings and one five-membered ring[4]. The compound has a hydroxyl group (-OH) attached to the C-3 position of the A ring. α-Amyrin is widely distributed in nature and has been isolated from various plant sources, such as epicuticular wax. It serves as a precursor for the biosynthesis of ursolic acid in plants. The structural similarities between α-amyrin and beta-amyrin, along with their shared pentacyclic triterpene skeleton, contribute to their closely related properties and functions[5].

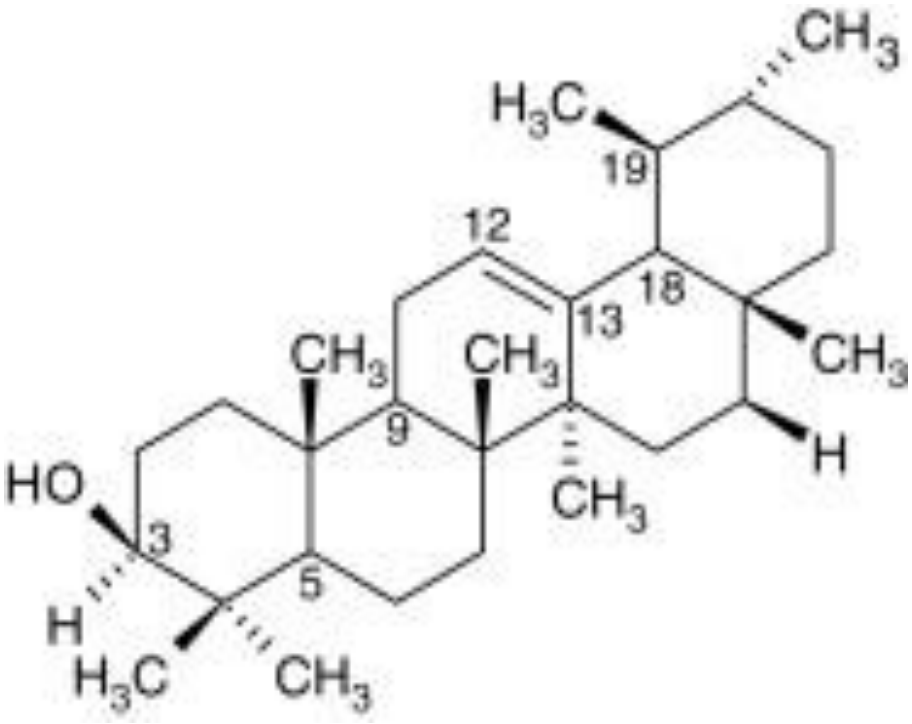

Figure 1: Structure of α-Amyrin

Interconnectedness

α-Amyrin has been quantified and determined by so many methods such as high-performance thin-layer chromatography, high-performance liquid chromatography with diagonal densitometry, and high-performance liquid chromatography with diode array detection (HPLC-DAD). They have been proven specific, constructive, exact, distinct, and sensitive:

1. High-Performance Thin Layer Chromatography (HPTLC) is a method used to study the characteristics of products through the separation of chemical compounds in a thin layer of material.

- A method involved normal phase HPTLC to quantitate α-amyrin in medicinal plant samples to determine the presence of this compound [4].
They used a LiChrospher 100 C18 reversed-phase column and the mobile phase that contained the acetonitrile [2].

2. High-Performance Liquid Chromatography (HPLC) coupled with Spectrophotometric Detection (HPLC-DAD): High-Performance Liquid Chromatography (HPLC) coupled with Spectrophotometric Detection (HPLC-DAD):

HPLC-DAD was used as the technique to quantify α-amyrin in some varieties of Humulus lupulus [3].

The technique employed a LiChrospher 100 C18 reverse phase column, had a mobile phase in acetonitrile, and used detection at 200nm [2].

3. Gas Chromatography-Mass Spectrometry (GC-MS):

- Qualitatively, the authors used GC-MS to determine the quantity of α-amyrin within the therapeutically relevant plant, Centranthus longiflorus. Both the electron impact mode and selected ion monitoring (SIM) method were used to achieve quantitative measurement [3].
It used an exposure-response calibration curve to evaluate the features such as linearity, precision, accuracy, and the LOD and LOQ [3].

These approaches have been applied and shown to have effectiveness in the detection as well as quantification of α-amyrin and provided positive information regarding its presence and quantity in the various resources of plant origin.

Pharmacological effects of alpha-amyrins:

Researchers have discovered that both alpha and beta-amyrins can defend against various ailments, including inflammation, microbial/fungal/viral infections, pathogenic organisms, and cancer cells, in both in-vitro and in vivo systems[6].

Antimicrobial and antifungal

The electronic supplements for this paper illustrate Biotin was investigated to identify how n-hexane and methanol extracts from the flower of B. malabaricum affected different types of bacteria, fungi, and yeast. The results of this study on methanol extract reveal that it falls under moderate activity against Gramme-positive bacteria including *S. aureus*, *B. subtilis*, and *S. faecalis*, as well as Gramme-negative bacteria including Neisseria [7].
Some of the bugs that were exterminated by these chemicals included Gonorrhoea, Pseudomonas aeruginosa, and Candida albicans. From the antibacterial test, it can be concluded that moderate activity can be observed for n-hexane extracts of active compounds from the plant on the microbes that were used for the experiment. As we have mentioned before, charged solvents such as cyclohexan, n-hexane, and the rest as noted by El-Hagrassi et al in 2011 were used to remove the sterols which included α-amyrin. The n-hexane extracts of Bursera simaruba (L) Sarg, commonly known as the ‘Paraiso’ tree or ‘Palos de resina’, grown in the Taita hills of Kenya were investigated. Chromatographic fractionation of leaves in a bioassay-directed fashion allowed the isolation of five sterols and α-amyrin. Also, the anti-inflammatory properties of n-hexane extracts have been investigated on adjuvant-carrageenan-induced inflammation in rats [8]. In this regard, chemicals such as α-Amyrin, among other compounds, have

been advised to be used in identifying instances of fungal resistance in grapevine leaves particularly those of the Vitis vinifera [9].

Research has it that α-Amyrin offers enough antifungal and antibacterial action against some microorganisms. This study is an attempt to determine the antifungal efficacy of the extract of Melia azedarach L. leaves against Ascochyta rabiei (Pass) Lab. Chickpea is devastated by a disease known as blight which is caused by a pathogen of a certain genus.

Arietinum L. involves the identification of the scientific name of the plant which is called also arietinum. Finally, the potency of the fractions as demonstrated by the bioassay and the purification and identification procedures brought out a very high efficacy of the chloroform fraction and methanolic extract of the leaves of M. azedarach against A. rabiei. The expected yield of the fraction that contains these compounds is as follows: β-sitosterol: 3829. 0 µg, α-amyrin: The increasing capital requirements and staggering global event expenditures mean that 248 more publicly traded companies would cease to exist if they adopted such financial reporting tactics. 2 µg, ursolic acid: 213. 8 µg, benzoic acid: For the distance and the city's future, a total of two hundred and forty additional years. 8 µg, 3,5-dimethoxy benzoic acid: 70 declining or negligible, while 71 percent indicated that it continued to rise, suggesting that it remained a significant problem [10]. Evaluating the results in terms of the efficiency of the synthesized compounds against the fiAu, it is possible to state that all the compounds demonstrated anti-fiAu activity, except for the compound with emeric acid-α -amyrin; moreover, its MIC was the smallest one, equal to 0. day) Jabeen, S. M, et al. Other: dose of 0. 00415031 to 0. 015625 mg/mL per day [11].

The study that was conducted recently focused on the leaves of the plant *Siraitia grosvenorii* and from the extract the isolated α-amyrin and other bioactive compounds. The mentioned compounds were then studied in a controlled laboratory environment for their capability to inhibit the growth of oral bacterial species *S. mutans*, Aggregatibacter actinomycetemcomitans, *F. nucleatum*, and the yeast – C. The study carried out by Zheng et al. (2011) also reveals that only a small amount of the sample including α -amyrin had the potential of exerting inhibition against Streptococcus mutans and Fusobacterium nucleatum. Besides, the methanol extract was obtained from the stem bark of Klainedoxa gabonensis Pierre ex Engl. The crude extract of Carwith`] Irvingia gabonensis fam: Irvingiaceae was also tested for its efficacy and effectiveness through bioassay-guided fractionation where 12 fractions were isolated. Some of these compounds include four flavonoids and eight triterpenes with α-amyrin being among them. Regarding the antimicrobial activity, the triterpenoids are showing modest to negligible activity [12]. The purpose of this research was to investigate the effectiveness of the methanolic extract and compounds of the bark of Byrsonima Crassifolia against twelve bacterial strains and the yeast C. albicans that are found in a clinical lab. The active compounds namely α-amyrin, betulin, betulinic acid, oleanolic acid, quercetin, epicatechin, gallic acid, and β-sitoster were isolated and tested for antibacterial activity. It was indicated that α-amyrin, olenolic, and gallic acid at a concentration of 64-1088 µg/ml inhibited bacterial growth as established by Rivero-Cruz and his team in 2008 [13].

Activity:

Hexane extracts from the leaves of Bursera simaruba (L.) Sarg is known as the tropical palo de valle. has demonstrated the presence of an anti-inflammatory activity associated with the effect of carrageenan adjuvant on rats. Before proceeding to separate and further characterize the active components of the hexane extract, a finite phytochemical investigation was completed.

Furthermore, the fractionation guided by the bioassay was done using the carrageenan-induced paw edema test in mice. Among nine fractionations (A-I), the highest inhibition percent was observed in

fractions A and E, which revealed a comparable anti-inflammatory effect as that of phenylbutazone. The fractions have been characterized and it has been found that sterols and α-amyrin combined are present in it. Co-ordinate data show that these bioactive ingredients could influence the anti-inflammatory potential of B. Simaruba extracts substantially [14].

Chinese medics employ Ligustrum (privet) as [15] plants for the Pulmonary hepatitis and chronic bronchitis preventive and curing purposes. Three species out of the multiple Ligustrum plants are widely distributed such as Ligustrum lucidum Ait. Lonicera japonica Thunb. (LL), Lonicera praesens S. F. Yu & L. H. Zhou (LP), and Lonicera sinensis Lour. Some of these are; lipopolysaccharides (LPS), tumor necrosis factor-α (TNF-α) Interleukin-1β(IL-1β), Interleukin-6 (IL-6), and lipocalin-type prostaglandin D synthase (LPXD) collectively referred to as Lethal Dose (LD), 50% mortality at different times, and carriage Methanolic extracts of the Ligustrum leaves effectively prevented the pain sensations induced by 1% acetic acid and 1% formalin solutions in this experimentation. LP and LL reduced the inflammation arising from 1% carrageenan edema. As for the ligustrum plant, the most powerful one is named LP and it also could reduce the leakage of Evan's blue dye from the abdomen in the case of lipopolysaccharide, lipoteichoic acid, autocrines, and sodium nitroprusside. Herein, the concentration of triterpenoids in the three samples is presented [16].

The choice of Ligustrum spp with high levels of α-amyrin, betulinic acid, and lupeol. was determined using HPLC. Of all the assessed forms, the highest concentrations of these compounds were detected in LP. Finally, as pointed out by Wu et al. (2011) in this study, this demonstrated that the three triterpenoids were responsible for the anti-inflammatory benefits of LP [17].

The latest report reveals that the following and the seeds of Indian milkweed, Calotropis gigantea (Linn.) R. Br, which has been used for the treatment of asthma, has an inhibitory effect against lipoxygenase. The report also presented evidence that even though intraperitoneal administration of indomethacin did not reduce the development of edema, edema formation was reduced when montelukast and methanolic extracts of C. gigantea roots were used. This indicates that the extract derived from C. gigantea was the one that could inhibit the lipoxygenase pathway of arachidonate metabolism. From this one can deduce that like dexamethasone C. gigatea may work through a similar mechanism and in addition has antioxidant and anti-lipoxygenase which could be attributed to the presence of α-amyrin [18].

Research looks at the effects of aqueous and organic extracts from Acacia visco Lor. ZEA 92025 derived from Ap Griseb (Fabaceae) was tested in rats in an experimental paradigm. The extracts alleviated the inflammatory response as evidenced by carrageenan-induced edema, phospholipase A-induced edema, and cotton pellet-induced granuloma—none of which exhibited any toxic effect within the first 24 hours. The concentrated triterpenoids lupeol, α - amyrin as well as beta - amyrin which have been reported in A. visco leaves may be considered primary chemicals accountable for the inflammation-inhibiting effects depicted [19]. This research aimed at assessing the implications of α-Amyrin in managing acute pancreatitis occurred through L-arginine administration in rats. Studies have shown that the crude resin of Protium heptaphyllum has an alpha- and beta-amyrin ratio of 63: Acpth 37 The present results of substance administration and methylprednisolone treatments were in a way potent enough to successfully prevent the rise in the pancreatic wet weight/body weight ratio that was brought about by L-arginine intervention. Moreover, it led to significant down-regulation of amylase, lipase, TNF-alpha, and IL-6 levels in blood samples of the experimental animal as compared to the control group which received only the vehicle. Also, the MPO activity, lipid peroxides by TBARS, and

nitrate/nitrite in the pancreas were significantly lowered in the experimented group. The results of subsequent research show that the application of α-amyrin indeed possesses the potential for treatment of acute pancreatitis through its anti-inflammatory and antioxidant properties [19].

A recent study has shown the preventative or therapeutic anti-inflammatory action of the triterpenes α- and β-amyrin through the prevention or the treatment of mice with TNBS-induced colitis. Here α-amyrin has an efficacy similar to that of dexamethasone in reversing the macroscopic and histological signs of TNBS-induced colitis and the restoration of cytokines balance.

Furthermore, the study also implies that it is mainly through the NF-κB and CREB activation that the triterpenes possess an anti-inflammatory activity [19].The study conducted in 2010 revealed that α, β-amyrin from Protium heptaphyllum possesses a role in modulating acute periodontal inflammation in rats. It accomplishes this by diminishing the penetration of the neutrophils, lowering the concentrations of free radicals, and inhibiting the synthesis of the inflammatory agent TNF-a. Research made based on this study proposes that these triterpenes may be effective as anti-gingivitic therapy and retard the progression of periodontitis [20].

Pharmacological actions

α-Amyrin as well as Palustrine Lactone have also been explored for several other biological functions. Cytocarpa procera and Amphipterygium adstringens were tested on a group of rats that were inflicted with injury to their stomach under controlled experimental settings. The cytological analysis also proved the presence of α -amyrin in phytochemical testing and this as [21].

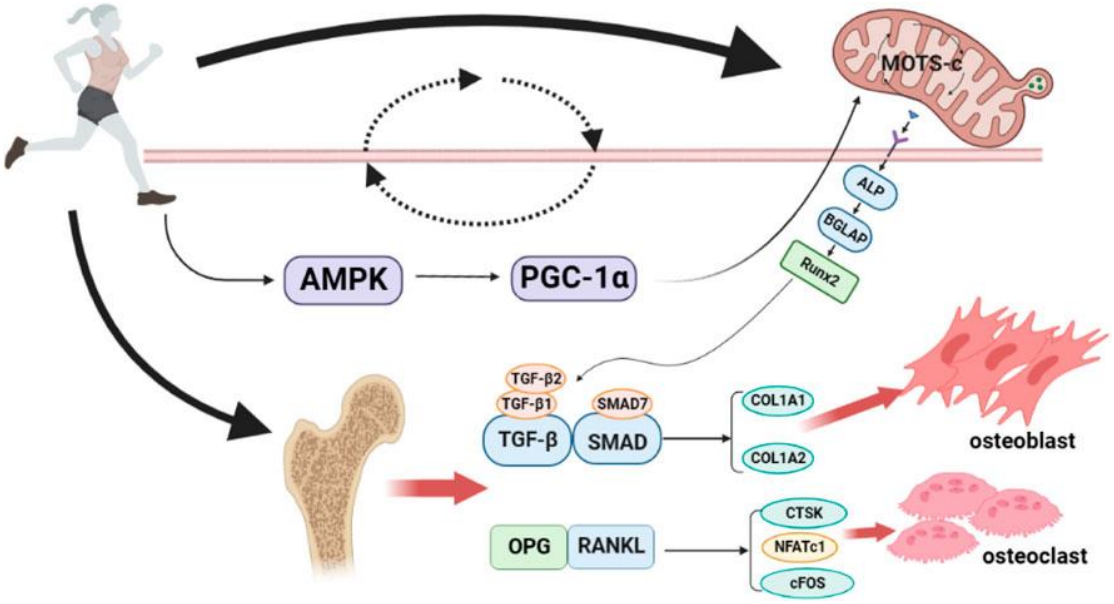

Figure 2: Effect of α-Amyrin MOTS-c is one of the potential ways that could be enhanced by exercising to improve bone metabolism. Exercise promotes endogenous AMPK activation to increase MOTS-c, which increases PGC-1α and also osteoblast/osteoclast-associated gene expression while promoting the optimum balance between the two. AMPK PGC-1α ALP BGLAP Runx2 TGF-β1 TGF-β2 SMAD7 Collagen type I alpha 1 [COL1A1], Collagen type I alpha 2 [COL1A2], Collagen type I alpha 2 [COL1A2]

In the cross-sectional study by Rosas-Acevedo et al. in 2011, the researchers identified that α -sitosterol is contained in A. adstringens. Three triterpenoids named α−amyrin, cohulupone, and garcinielliptone were extracted from the pericarp, heartwood, and seed part of Garcinia subelliptica respectively. Therefore, it has been demonstrated that these chemicals can block the function of xanthine oxidase. O mismatch: Human bladder cancer cell NTUB1 was treated with α-amyrin or α-amyrin and cisplatin for 24 hours. This made the cells less viable to full function due to the mechanical disruption they experienced when being placed in the Petri dish. This research demonstrated that α -amyrin could not cause potent cytotoxicity to NTUB1 cells. This study also focused on the effects of n-hexane [22], chloroform, and aqueous methanol extract from the whole plant of Centaurea Arenaria M. B. ex Willd, the plant may exhibit the ability to suppress the growth of cervix adenocarcinoma (HeLa), breast adenocarcinoma (MCF7), skin epidermoid cancer (A431) cells. That is why it was decided to use the MTT test. According to Csapi et al. (2010), the current study indicates that only flavonoids and lignans had some impact on these cell lines. While there was no impact of α-amyrin on the expression of genes involved in the oxidative stress pathway, the treatment with chloroform extract of E [23], turcomanica significantly upregulated the expression of superoxide dismutase, catalase, and glutathione peroxidase-1 at both 24 h and 48 h time points. The ethyl acetate part of the stem bark of Camellia japonica was used to get three new triterpenoids: Three structures identified as 3-β-O-acetyl-16β-hydroxy-12-oxoolean, 3β-O-acetyl-16β-hydroxy-11-oxoolean-12-ene, and 3-β-O-acetyl-16β-hydroxyolean-12-ene. Seven known chemicals were also identified It shows that there are several unknown chemicals present in the collected samples as well as seven known chemicals were also identified. They include 3-α-hydroxy-1-oxofriedelan, friedelin, 3-β-friedelanol, canophyllol, 3-oxofriedelan-1(2)-ene, 3-α-amyrin, camellenodiol, and camelledionol. Staking great reliance on spectroscopic analyses and chemical information, their structures were ascertained. Every material was subjected to controlled and separately examined in the lab to assess the effectiveness of its ability to kill cancer cells of A549, LLC, HL-60, and MCF-7 types. The authors were also able to identify that α-amyrin was only relatively toxic to the A549 and HL-60 cancer cellular strains, with the conventional fixation of 46. 2, and 38. This concentration is far lower than the IC {50} value determined by Thao et al., where the investigated flavonoids exhibited their most potent action against the MCF-7 cell line with the calculated IC {50} = 6 μM, respectively.

The essential oil obtained in this study was compared to the methanol extract of the Soxhlet extracted Ardisia elliptica Thunberg (Myrsinaceae) leaves where α- and β-amyrin were identified in a previous study by GSMS.

From the BC50 value point of view, it has a value of 167/μg/mL, and it was found that the leaf extract did inhibit the clumping of platelets as revealed in S3 bioassay-guided fractionation. Some selected phytochemicals were evaluated for their ability to inhibit human cancer cell proliferation and the IC50 value for α-amyrin was determined to be 4. Before upgrading and extracting it, the concentration of ssDNA was increased to 5 μg/mL. On the other hand, in the same context was Aspirin with an IC50 value of 11μg/mL. Therefore, alphnumeric amyrin is more effective than this aspirin in inhibiting platelets

from coagulating because of collagen [24]. Two triterpenes were combined: It is used in the synthesis of α-amyrin and 12-oleanene 3β, 21²-diol. Both were obtained from the stem of Duranta repens (Verbanaceae) employing chloroform. The mixture was very good at getting rid of the larvae of Culex quinquefasciatus Say (Diptera: Lemongrass is a special pest repellent particularly against the mosquito species *Aedes aegypti* (2S: Culicidae), making it a potent mosquito killer. The eosinophils and *Wuchereria bancrofti* are involved in the development and progression of human lymphatic filariasis [25]. The following vector was likely to be carrying this parasite Culex quinquefasciatus.

The research focused on whether the various kinds of plants that grow in the Brazilian Cerrado could effectively trypanosome-killing plants [26]. This was done through a process referred to as in vitro screening that involved the use of twenty extracts of ten different plants. It has been observed that the phytochemical constituents of the hexane extracts were α-amyrin, lupeol, other triterpenes, and sterols [27]. The findings of the study were that pure amyrins have no effect as indicated by the lack of activity;[15] however, an n-hexane leaf extract from Tibouchina stenocarpa cogn. Melastomataceae did. This conforms with other researchers' findings suggesting that even other chemicals present in the extract can have a trypanocidal effect [19].

Conclusion

α-Amyrin are a series of chemical compounds that exert pharmacological activity, which can be isolated from the barks, leaves, and resins of various plants. This particular type of botanical material itself is a very interesting reservoir of these triterpenoids because of its rather easy extractability. Research has revealed the general occurrence of α-amyrin in studies of the last four years with a significant amount of findings. Many plants contain pure chemicals that have been proven to be capable of eliminating microorganisms, reducing inflammation, and executing many other stunning biological manifestations. Moreover, the organisms that produce amyrins synthesize other bioactive compounds including avenacine, centellosides, glycyrrhizin, and ginsenosides. Thereby, the construction of biotransformation systems that would allow for the transformation of amyrins into these or other compounds may open new uses for α- and β-amyrins as natural precursors of rare plant secondary bioactive metabolites.

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Conflict of interest:

the authors declare no conflict of interest

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