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Culinary Argan oil: Its chemical composition and associated health benefits

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Abstract

Argan oil is produced from nuts of *Argania Spinosa. L* tree. It contains several active molecular species such as tocopherols, carotenoïds, sterols, polyphenols and essential fatty acids. In vitro and in vivo studies in animals have shown that Argan oil has anti-oxidant, anti-tumor and anti-inflammatory properties. However, clinical evidence for such activities and interventional studies with argan oil are scarce. In the present review, I summarize some recent clinical and biochemistry results on the effects of Argan oil consumption; in particular, those studied in end stage renal failure patients under hemodialysis and knee osteoarthritis patients. The main outcomes of Argan oil consumption are a significant improvement of blood lipids status and lipid atherogenic ratios, a better blood oxidative status, and an improvement of some metabolic syndrome components and pain scores in osteoarthritis patients. In light of the above biological and clinical effects of Argan oil consumption, some potential therapeutic properties of Argan oil will be discussed.

Keywords: Argan Oil, hemodialysis, knee osteoarthritis, metabolic syndrome, cholesterol, blood lipids, joint pain, oxidative stress.

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Introduction

Argan oil "AO" is extracted from nuts of an endemic tree in south-west of Morocco, called *Argania Spinoa L*. For many centuries, the amazigh/berber population have used AO for culinary purposes, and also as traditional cosmetic to moisturizing and softening of skin. Most importantly, AO has always been used as a traditional medicine for joint pain and many other health issues. Chemical composition of AO has been studied thoroughly [1-5]. AO is composed mainly of triglycerides (99%) that contains most of the fatty acids of AO, of whom, 80 % belong to the unsaturated category of fatty acids, such as oleic acid (omega-9, cis) (45%) and linoleic acid (34%) (Photo 1). The most abundant saturated fatty acid in AO is palmitic acid (12%). The above chemical composition of argan oil is one of the best balanced oil compositions, because it has the advantage to contain a important level of oleic acid and linoleic acid, which are key fatty acids for cell structure and physiology. Linoleic acid is the substrate for the synthesis of arachidonic acid in the cells. The latter has an important role in blood hemostasis, inflammation and immune reactions, kidney function and many other roles in cell physiology.

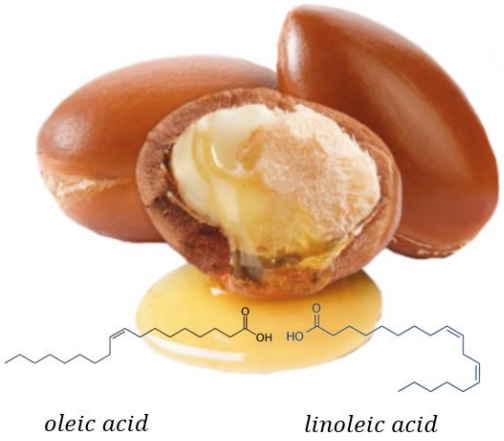

Photo 1: Argan seeds and argan oil

The role of oleic acid as an important fatty acid in health and immunity was highlighted through epidemiology and interventional studies [6]. Olive oil is the edible oil where oleic acid is the most abundant. Consumption of olive oil [7-9] was shown to be associated with a low incidence of cardiovascular events, hypertension and stroke in man.

Antioxidant properties

Argan oil is mainly (99%) composed of triglycerides, however, the remaining 1% of the chemical composition of AO is made of several molecular species of active molecules. The main categories of

those molecules are tocopherols, carotenoïds, sterols and polyphenols. Gamma-tocopherol (vitamine E) is the most abundant species of tocopherols found in AO [1-5]. AO contains much more gamma-tocopherol (around 600 mg/Kg) than other oil species such as olive oil. Thanks to its vitamin E properties, gamma-tocopherol, along with carotenoïds, and polyphenol molecules, make AO a good antioxidant edible oil. Its consumption provides an important level of antioxidant molecules that may play a key role against oxygen free radicals-associated pathologies. They prevent molecular damage in many inflammatory, cardiovascular and neurodegenerative diseases.

Anti-proliferative properties

The effect of polyphenol molecules on cell growth of healthy and tumor cells in cell tissue cultures experiments, have shown that some of these molecules are endowed with anti-proliferative and anti-tumor properties [10]. Argania spinosa seed extracts were shown to exert anti-proliferative effect on cells in culture [11,12], which is in favor of a possible antitumor property of AO in man.

Improvement of blood lipid status

Sterols in AO are represented by two major molecules, namely, schottenol (46%) and spinasterol (38%) [1-4]. There is no clinical data on AO regarding these molecules; however, some phytosterols were reported as lipid - and cholesterol lowering molecules [13]. Most of the clinical studies that were carried out on AO have focused on its effect on blood lipids and oxidative status. Several studies have shown that consumption of AO for several weeks can improve plasma lipid status in humans [14-22]. It is known that most end-stage renal failure patients who undergo hemodialysis have abnormal lipid levels (high LDLc, low HDLc, high triglyceride). Argan oil consumption study was carried out in these hemodialysis patients. In a controlled randomized clinical study [18,19], it was found that patients who have consumed argan oil during 5 weeks (30 ml per day) have had an improvement of their plasma lipid status and their atherogenic ratios (Cholestérol/HDL, TG/HDL, LDL/HDL et ApoB/ApoA**)** were ameliorated. The above data are very relevant for cardiovascular protection in hemodialysis patients, because in this category of patients, dyslipidemia is a risk factor for cardiovascular mortality [23,24]. These patients also suffer from oxidative stress-associated harmful biochemical events, such as lipid peroxidation and protein- and nucleic acid-oxygen free radicals attacks, upon hemodialysis sessions [25,26]. Targeting dyslipidemia and oxidative stress in these populations with AO should be a therapeutic tool along with other molecules such as other "lipid lowering drugs" such as statins [27]. The latters were a subject of hot debates among the scientific community these last years [28]. In a controlled

and cross-over clinical study on Moroccan hemodialysis patients, AO consumption has proved to be efficient in improving both oxidative stress status, vitamin E levels and HDLc in a significant manner [20].

Argan oil on pain and metabolic syndrome in osteoarthritis patients

A clinical study was carried out in order to check the effect of AO consumption on patients suffering from knee osteoarthritis. Most of the patients enrolled in the study were diagnosed with metabolic syndrome [21-22]. Metabolic syndrome is declared in a given patient when at least three of the five following events are found: high waist circumference, high blood pressure, high triglyceride levels, high glycemia, low HDLc [29]. Some of the metabolic components were described to be associated with knee pain [30]. Pain, stiffness and walking difficulties were assessed by several tests (WOMAC, Lesquennes index and visual analogic scale [30]. AO consumption has alleviated pain in knee osteoarthritis patients [21]. Scores of walking difficulties were also ameliorated in a significant manner [21]. Interestingly, upon AO consumption, plasma lipid status and lipid atherogenic indices were ameliorated as well [21,22]. A small but significant amelioration of blood pressure and glycemia were found in AO consumers, though, this effect should be confirmed in a large scale study.

Future and perspectives for Argan Oil.

Thanks to its special chemical composition, AO seems to be a perfect "cocktail" of bioactive compounds that are rarely found all together in the same plant extract. The above mentioned biologic effects in laboratory experiments, a well as those that were reported in clinical studies, should encourage other clinical studies on various clinical events where cholesterol, abnormal lipid status, metabolic syndrome, as well as oxidative stress are key factors as suggested here below (Figure 1).

Retina protection

AO contains a fair concentration of β-carotene (around 20 mg/Kg) [1]. The presence of carotenoïds in AO was reported in a paper published in 1974 [31], to whom most recent papers have referred to, regarding carotenoïds content of AO, however, the presence of other carotenoïds in AO other than β-carotene, such as xanthophylls (lutein and zeaxanthin) have never been documented in AO. These pigment molecules are known to be present in olive oil [32] and in other yellowish plants, vegetables and fruits. The hazelnut color of AO is supposed to be due to these carotenoïd pigments, although, in the process of culinary AO production, nuts roasting also darkens the original hazelnut color of AO, as

compared to cosmetic AO whose production process does not involve nuts roasting. Xanthophylls are concentrated in the retina, and are relevant for eye protection against UV light and cell damage caused by oxygen free radicals [33,34].

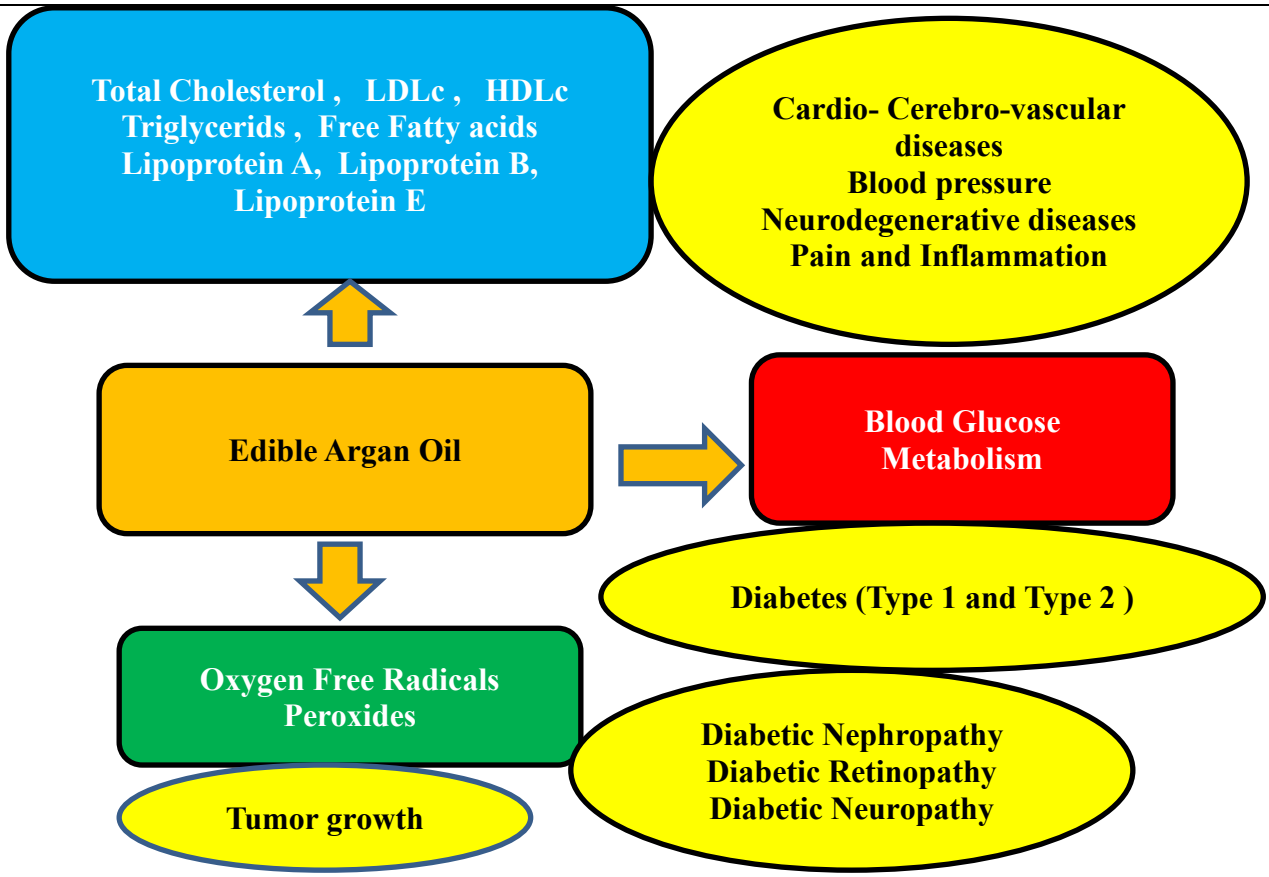

Figure 1 : Possible biological and health effects upon argan oil consumption

Carotenoïds, gamma tocopherol and other antioxidants molecules of AO should be of special interest to investigating diabetes - and metabolic syndrome-associated retinopathies [33,34].

Memory loss and cognitive issues in Neurodegenerative diseases

It is known that cholesterol metabolism as well as oxygen free radical-associated neuronal damage are associated with mild cognitive impairment in early phases of Alzheimer disease [35-39]. Plant sterols and antioxidant Vitamin E were suggested as possible treatments of mild cognitive impairment [40,41]. Because AO has a special chemical composition, many of its lipophilic and antioxidant molecules (vitamine E, sterols, polyphenols, carotenoïds) can reach the brain cells, and should provide a real synergistic molecular and cell protection properties against oxygen free radicals. Sterol molecules and

the other antioxidant components of AO could potentially interfere with cholesterol-associated plaque formation and its subsequent clinical consequences [39,40].

Oxidative stress-associated male subfertility

Sperm and spermatozoids are thought to be very sensitive to aggressive environments, mainly the oxidative one. Although there is a lot of research work supporting antioxidant therapy against oxidative stress-associated spermatozoid cells damage [42], a meta-analysis on this issue supports partially possible treatment of oxidative stress-associated subfertility [43]. In this regard, AO chemical composition, as a rich source of many species of antioxidants, should be suitable and worth investigating on spermatozoids protection and as protective molecules against harmful oxidative stress-associated spermatozoids damage.

Ionizing radiation-associated cell oxidative stress damages

It is known that exposure to ionizing radiation has potential oxidative effects on organisms. Examples of such events are exposures to low dose of ionizing radiations, or leak of radiations upon a nuclear facility accident. Many research works support the protective effects of antioxidants against radiation-associated oxidative stress [44]. Interestingly, Vitamine A, Vitamin C and vitamin E were shown to prevent chronic gamma radiation-associated inhibition of intestinal nutriments absorption in mice [45]. Another study has shown that the phenolic compound, quercetin, has preventive and therapeutic effects on experimental radiation induced lung injury in mice [46]. From the above references, AO could be a good candidate for investigating its potential therapeutic effect against radiation-associated cell damage.

Burn wound healing capacity

Recently, laboratory experiments have shown that topical AO can significantly improve burn wound healing in rat [47]. In this regard, olive oil efficacy on burn wounds was demonstrated both in clinical and experimental studies [48-50]. The above studies encourage clinical investigations on the potential of oral and topical use of AO on skin wounds healing.

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