Biochemical hypolipidemic action of some herbs and medical plants

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Summary

This review highlighted the biochemical hypolipidemic action of some herbs and medical plants and could submit a good survery regarding intended plants and herbs as well promote and indicate the biochemical functions and importance of natural plants in medicince as a biochemical alternatives with no reverse or side effects. The present study have highlighted the biochemical hypolipidemic action of some herbs and medical plants: Daudelion *Taraxacum officinale*, Basil *Ocimum sanctum* L., dill *Anethum graveolens* , Celery *Apium gravedense*. , Fenugreek *Trigonella Foenum-graccum* , Grapes *Vitis vinifera* , olive tree *Olea europea* L., Green tea *Comellia sinenis* , Blue berry *Vaccinium angnstifolium* juice and Clove *Eugenia caryophyllus*.

Keywords : medical plants . hyperlipidemia . biochemical action . herbs.

Introduction

Hyperlipidemia is a heterogeneous group of biochemical-clinical discorder related to lipid metabolism , occurs when abnormal high levels of fatty substances (Lipids) found in blood stream (Karma *et al*., 2015; Youseti *et al*., 2017). Practically, the concentration of total cholesterol (TC), triacylglycerol (TG), low density lipoprotein (LDL) and very low density lipoprotein (VLDL) become high and high density lipoprotein become low (Karma *et al*., 2015).

This complex metabolic conditions sometimes called hypercholesterolemia or dyslipidemia or hyperlipoproteinemia (Salam *et al*., 2013; Youseti *et al*., 2017) because cholestrol circulates through blood stream and included in cells structure and function, TG constitutes the energy storage of cells where it is biosynthesized in the liver from exogenous

sources (Food) (Salam *et al*., 2013), cholestrol crystallize as atherosclerotic lesions and lipoproteins (except HDL) deposit in the formation of atherosclerotic plaque which cause endothelial cell ingury and atherogenesis (Salam *et al*., 2013; Argani *et al*., 2015).

Hypercholesterolemia and high level of LDL play a crucial role in the development of cardiovascular diseases because arteries are smooth in normal cases but in hyperlipidemia, a sticky substance (Plaque) is found inside arteries walls causing reduced blood flow, stiffening and narrowing of the arteries while interestingly HDL have a protective effect (Salam *et al*., 2013; Youseti *et al*., 2017). In this regard, hypercholestrolemia increases free radical production and reduces antioxidant defense and free radical scavenging systems (Devi *et al*., 2017). Regarding synthetic drugs ad hyperlipidemia treatment, these chemicals like statin and fibrates lead to complex adverse effects although characterized by high lipid lowering speed, for examples; renal failar, abnormal liver function, myopathy, hyperuricemia, gastric irritathion (Salam *et al*., 2013; Daradka *et al*., 2017; Zaaza *et al*., 2018). Consequently, medical plants/herbs became a crucial part to treat hyperlipidemia due to their effectiveness, safety, low cost in addition to its major hypolipidemic action (Dalam *et al*., 2015; Dianat *et al*., 2015). Remarkably , it has been suggested that herbs increase lipids resistance to lipid oxidation and also induce inhibition of lipid accumulation during adipogenesis particularly through improvement of triacylglycerol-rich lipoprotein catabolism (Rouhi-Boroujeni *et al*., 2015). Therefore, medical plants have been widely known for different biochemical actions (Zaazaa *et al*., 2018). Recently, natural antioxidants contained in plants play a vital role in protection against free radicals because of containing phenolic acids and falvonoids (Aryal *et al*., 2019). Regarding flavonoids, these active biochemical compounds generated by plant protect itself or promote the cellular growth under in favorable condictions (Tungmunnithum *et al*., 2018).

Flavonoids-rich natural diets with antioxidant activity are strongly highlighted in nutrition and food science because natural antioxidants play a vital role in protection against free radical action (Aryal *et al*., 2019). All flavonoids and many phenolic acids have been reported for their not only antioxidants, but also their anti-inflammation, anti-cancer and cardio-vascular (anti-hyperlipidemic) effect. (Tungmunnithum *et al*., 2018).

Oxidative stress occurs when free radicals production overcomes the capacity of the anti-oxidant system. Subsequently, oxidative stress is one of the causative factors that link between dyslipodemia and atherogenic effects (Wang *et al*., 2018). In particular, the exclusive chemical structure of flavonoids is important to excit antioxidant action and free radical scavenging effects (Zeca *et al*., 2017).

Natural flavonoids (which are plant secondary metabolities) featured by an aromatic ring bearing at least are hysroxyl group, this exclusive feature made flavonoids good eletron donors, their hydroxyl groups can directly contribute to antioxidant system. Additionally, some of these hydroxyl groups stimulate the biosynthesis of endogenous antioxidants molecules in the living cells (Aryal *et al*., 2019). In this paper, we have highlighted the biochemical hypolipidemic action of some herbs and medical plants: Daudelion *Taraxacum officinale*, Basil *Ocimum sanctum* L., dill *Anethum graveolens* , Celery *Apium gravedense*. , Fenugreek *Trigonella Foenum-graccum* , Grapes *Vitis vinifera* , olive tree *Olea europea* L., Green tea *Comellia sinenis* , Blue berry *Vaccinium angnstifolium* juice and Clove *Eugenia caryophyllus*.

1-Hypolipidemic action of Dandelion *Taraxacum afficinole*

Dandelion *Taraxacum afficinale*, on orential herbal medicine, widely used in medicine. In particular, it has been used in Asia, Europe, and America (Xarnell *et al*., 2009 and Choi *et al*., 2010). It belongs to the Asteraceae or Compositae family (Garcia-Cairasco *et al*., 2015). In accordance with lipid metabolism, both roots and leaves of dandelion positively change plasma antioxidant enzyme activities and lipid profile in cholesterol-feed rabbits, theretore it may has hypolipidemic and antioxidant effects, at this point, dandelion roots and leaves could protect against oxidative stress coupled with artherosclerosis, depress the atherogenic index (Choi *et al*., 2010) and hypoglycemic properties (Yarnell *et al*., 2009).

The exclusive activity of dandelion due to containing reactive antioxidants and anti-hyperlipidemic compounds which are found in both leaves and roots. Several polyphenols and coumarin are present in dendelion leaves, in particular, flavonoids have been isolated from leaves and flowers while lactones are found in dandelion root (Garcia-Carrasco *et al*., 2015). It have been reported that three selected dandelion extracts from leaves and roots polyphenols/ flavonoid rich, play a crucial role in adipogenesis and lipid metabolism. Dandelion increases bile production in animal studies and also improves liver ability to detoxify. Moreover , the polysaccharides in dandelion are considered a key intermediates in immune response (Xarnell *et al*., 2009). In this regard, the thickness of the vascular wall and infiltration of macrophages and lymphocytes are significant features of atheroscterosis, according to histopathological tests, the formation of athermatous plaque aorticmeaia were remarkanly decreased in experimental groups treated by dandelion leaves and roots compared with control group. Interestingly , dendelion prevents the oxygen radical induced endothelial cell injury

associated with hypercholestrolemic atherosderosis, also reduces the extent of atherosclerosis due to its lipid bwering activity (Choi *et al*., 2010).

In particuler, leaves extract has the highest total phenolic content, it has the best antioxidant activity (Garcia-Cairasco *et al*., 2015). Dandelion leaves supplemented-diet increase HDL-cholesterol levels in serum compared with cholesterol-rich diet humans.

The dandelion leaves prevent a cholesterol-rich diet which induce MDA elevation, the result is depressing MDA content in liver (Choi *et al*., 2010). On the other hand, dandelion root extract exerts higher antioxidant activity compared with the crude powdered extract, this remarkable difference may be caused by different in phenolic composition which might be responsible this effect. The root extract contains hesperidin while the powdered crude root has myricetin. In particular, myricetin a component of the crude powdered root has both hypolipidemic and anti-iflammatory properties (Garcia-Carrasco *et al*., 2015). Dandelion roots and leaves have a key effect on antioxidant enzymes activities, hypercholestrolemia diminshed the antioxidant defense system and elevate the lipid peroxide level . Glutationnne S transferase (GST) , the important detoxificated enzyme, its activity was increased in patients with any disease related to defect in lipid peroxidation, but is was decreased under treatment with dandelion root extract. Furthermore, glutatione peroxidase (GPx) is more important than catalase for hydrogen peroxide detoxification in brain because the brain contains little amounts of catalase and GPx can also directly contact with lipid peroxides. The activities of these two enzymes are increased under treatment with dandelion leaves and roots compared with control group. Interestingly, the dandelion root group have the higher antioxidant enzyme activity compared with dandelion leaves.

Remarkably, dandelion leaves extract reduces TG content but cholesterol changes were modest (Garcia-Corrasco *et al*., 2015).

In this regard, higher levels of TG in serum are key biochemical markers of atherosclerosis, heart disease and stroke, TG levels were significantly decreased under treatment with the extract of dandelion (leaves and roots) compared with control group (Choi *et al*., 2018).

2-Hypolipidemic action of Basil *Ocimum sanctum* L.

Traditionally, basil leaves have been recognized as a food additive but recently it have been shown that these leaves can overcome some chromic diseases because it contains some bioactive antioxidant compounds like polyphenols, (Rachnawati *et al*., 2019) and phenyl propanoid compounds (Suanarunsawat *et al*., 2009), chemical analysis have reported that

essential oil derived from basil leaves is particularly rich in monoterpenes, sesquiterpenes and phenylpropane derivatives (Rachmawati *et al*., 2019). For this reason, basil leaves have been reported as a potential factor in lipid lowering action (Suanarunsawat *et al*., 2009). Flavonoids and tannins contained in basil leaves can reduce cholesterol levels by conversion the pathway of cholesterol metabolism into bile acids and cholestrol excretion through feces (Rachmawati *et al*., 2019). The essential oil extracted from basil leaves can decrease total cholesterol in serum, triacylglycerol, LDL-c and the atherogenic index while no significant effect on HDL-c was reported (Suanaransawat *et al*., 2009). Basil flavonoids able to inhibit 3-hydroxy 3-methylglutarly coenzyme A (HMG-CoA) reductase which mainly responsible for the biosynthesis of cholesterol. The inhibition of HMG-CoA reductase results in decreased levels of not only cholesterol but also triacylglycerol, LDLc and VLDLc (Rachmawati *et al*., 2019). The fact that essntial oil in basil leaves depress high liver cholesterol and triacylglycerol levels without significant effect on faecal excretion of both lipids due to the lipid-lowering action of the essential oil is majorly reflected by the suppression of liver lipid biosynthesis (Suanawunsawat *et al*., 2009). On the other hand, flavoinds can support the activity of lecinthin cholestrol acyl transferase (LCAT), the last enzyme can convert free cholesterol to a more hydrophobic cholestrol ester, subsequenty cholestrol esters can bind to lipoprotien nucleus particles to from new HDL, the result is increased HDL levels.

Also, other compounds found in basil extract like tannins can reduce cholestrol and LDL levels through change the direction of cholestrol metbolism into bile acids and increase excretion of bile acids through feces (Rachmawati *et al*., 2019). Ultimately, eugenol and methyl engenol and also the phenylpropanoids, have antioxidant property leading to inhibition of the oxidative stress and decreased blood cholesterol (Suanarunsawat *et al*., 2009; Rachmawati *et al*., 2019) Eugenol has been reported to lower a high serum lipid profile in hyperlipidemic mice (Suanarunsawat *et al*., 2009).

3-Hypolipodemic action of dill *Anethum graveolens*

Dill *Anethtum graveolens* is an annual herb related to Apiaceae family , (Yousof *et al*., 2015; Danesi *et al*., 2016) it is growing in Asia, Europe and Mediterranea region (Oshaghi *et al*., 2005). Dill tablet are used as lipid lowering agents due to the presence of high precent of tannins, dillanoside, coumarin, vicenin, kaempferol, myristicin and other flavonoids and phenolic acids (Oshaghi *et al*., 2015; Yousof *et al*., 2015).

Hence, moderate amounts of polyphends are detected in both dill tablet and dill extract, those bioactive chemical compounds have a potential therapentic influence as anti-hyperlipidemia agents (Oshaghi *et al*., 2015).

Remarkably, aqueous extract of dill seed is effective on lipids of serum or plasma by reducing levels of both cholesterol and LDL (Yousof *et al*., 2015). Dill has been reported to decrease blood cholesterol levels in hypercholesterolemic animals (Danesi *et al*., 2016).

Regarding cholesterol, dill tablet and dill extract have a major effect on cholesterol metabolism via inhibition the activity of HMG-CoA reductase which known as the rate limiting enzyme in cholesterol biosynthesis pathway, this therapentic action made dill involved in hypercholesterlemic treatment, animals treated with dill tablets have shown more reduction in HMG-CoA reductase activity compared with no treated groups (Oshaghi *et al*., 2015).

Interstingly, SREBFs are transeriptional factors activity as master regulators to intracellular cholesterol homeostasis, the expression of SREBF1 is upregulated by dill. On the other hand, liver X receptors is activated by guercetin (one of the bioactive compounds found in dill), (Danesi *et al*., 2016).

Regarding LDL, dill increase LDL receptors in liver, the result is stimulation of cholesterol clearence from blood circulation (Oshaghi *et al*., 2015). Moreover, hyperchlolesterolemic patients treated with dill flvonoids were reported to decrease LDL and increase HDL because those flavonoids could increase the number of receptors on the surface of liver cells while affecting on LDL receptor gene (Yousof *et al*., 2015).

Quercetin and limonene contained in dill extract have a specific activity on lipids acuumuation, quercetin can reduce triacyglycerol and LDL in hyperlipidemic mice in addition to its effect on cholesterol, limonene, has antioxidant activity which increase LDL tendency normal and oxidized to the receiver LDL on adrenal cells levels (Yousof *et al*., 2015).

4-Hypolipidemic action of Celery *Apium gravedense*

Celery *Apium gavedense* is a medical herb used as not only food but also traditional medical plant, it has amazing antifungal, antibacterial, antioxidant and antidiabetic properties (Dianat *et al*., 2015) caused by leaves and stalks of celery contain a number of biochemical compounds like phenol, furanocoumarin, psoralen, bergaptene, xanthotoxin (Kooti *et al*., 2014; Asmaa *et al*., 2018) essential oils and reactive flavonoids.

Hepatoprotective effects are also highlightes, regarding hyperlipidemia, celery can depress blood cholesterol level in hypercholesteroleic rats (Dianat *et al*., 2015).

Celery is fitting to the family of Apiaccae (Zaazaa *et al*., 2018). Interestingly, both leaves and roots of celery is efficient on biochemical parameters like glutathione, glutathione peroxidase , catalase, xanthine oxidase and peroxidase activities and lipid peroxidation in homogenate liver and hemolyzed blood (Zaazaa *et al*., 2018). Apigenin, the reactive flavonoids, constitute a major component of celery leaves, expresses strong antioxidant enzymes and consequently decreasing the oxidative damage of tissues (Dianat *et al*., 2015).

Moreover, celery leaves juice decrease the intensity of lipid peroxidation and increase reduced glutathione (Dianat *et al*., 2015). On the other hand, the examination of hydroalcholic extract of celery leaves on serum lipids in rats has revealed that cholesterol and serum LDL levels in the test group animals were decreased (Kooti *et al*., 2014).

Celery ethanolic extract is a hopefull treatment for atherosclerosis, the anti atherosclerotic effect of celery may be attributed to its hypolipidemic, antioxidant and anti-inflammatory characteristics (Zaazaa *et al*., 2018).

5-Hypolipidemic action of Fenugreek *Trigonella Foenum-graccum*

Fenugreek (*Trigonella foenum-gracum*) is a reactive medical plant belongs to Fabaceae family, it has a high antioxidant activity caused by containing flavonoids such as kaempferol-3-O-glycoside, anigenin-7-O-rutinoside and naringenin (Yousef *et al*., 2017). Obesity is a chronic disorder strongly linked with metabolism and characterized by high level of fat deposition not only in adipose tissue, but also in other internal organs, in this regard, fenougreek seeds are used as a potential ingredient in weight loss and as anticholesterol agent. Moreover, it is used in different countries to treat diabetes mellitus which is the main complicant for obesity (Kumar *et al*., 2014). Indeed, fenugreek seeds may improve lipid profile and reduce risk factors due to the high levels of polyphenols. Definetly, 4-hydroxy isoleucine, one of the reactive biochemical compound in fenugreek, plays a crucial role in TG reduction, other polyphenolic compounds like apigening caffeic acid, gallic acid, luteolin and naringenin have also reported in this fielsd, but 4-hydroxy isoleucin is the most active (Yousefi *et al*., 2017). On the other hand , dietary fibers (Galactomannan) in fenugreek seeds are polysaccharids consisting of a mannose backbone with galactose side chains attached at position C_6. Galactomannan consist of linear chains of (1-4) diequatorially linked D-mannose residues, it may contains single sugar side chains of D-galactose attached by (1-6) glycosidic

bonds. Fenureek galactomannan can from a viscous gel in the intestine and inhibit absorption of glucose and lipids (Kumal *et al*., 2014).

6-Hypolipidemic action of Grapes *Vitis vinifera*

Both seeds and fruit of the grape are commonly used as functional medical plant caused by anti dyslipidemic effect and antioxidant activities via free radical scavenging (Devi *et al*., 2017). Red grape seed extract involves oligomeric proanthocynaidins and procyanidins as a major class of polyphenols (Argani *et al*., 2015).

Similarely , the antioxidant and antihypercholesterolemic effect of grape largely due to the presence of fundional ingredients of active antioxidants and phyto constituents definetly flavonoids, such as monomeric flavanols, dimeric, trimeric and polymeric procyanidins in addition to phenolic acids (Devi *et al*., 2017).

Practically, 28 days of grape seeds powder administration reduced TC, TG and LDL-c levels and also prevent fatty liver occurrences among rats (Argani *et al*., 2015).

The pivotal biochemical action of grape seeds refleted by not only the rich content of polyphenols but also the replacement of saturated fatty acids by polyunsaturated fatty acids whereby all grape seeds has high percent of linoleic acid (60%-75%) and it is recognized for shifting lipid profile towards balance (Kaseb *et al*., 2016).

7-Hypolipidemic action of olive oil related to olive tree *Olea europea* L.

Olive oil is the supernant of the natural juice obtained exclusively from olive fruit *Olea europea* L. (Akrida-Demertzi *et al*., 2016). The biochemical role of olive oil consumption is high widely recognized nowadays (Tsavtsou *et al*., 2019). Remarkably, the superior reactivity of olive oil is reflected by the chemical composition of olive oil caused by the replacement of saturated and trans fats by mono unsaturated fatty acids. Olive oil contains high level (70-80)% of oleic acid that may lead to altering in lipid homeostasis, reducing TG and elevation of HDL. Moreover, phenolic compounds of olive oil also contribute to biochemical benetits (Kaseb *et al*., 2016).

8-Hypolipidemic action of Green tea *Comellia sinenis*

Green tea has been reported to improve cardiovascular risk factors involving circulatory lipid profiles (Samavant *et al*., 2016). Furthermore, Green tea extract was suggusted to counter insulin resistance and remarkably alter fat metabolism (Huang *et al*.,

2018). Green tea with its bioactive constituent epigallocotechin gallate (EGCG) have shown hypocholesterolemic effects particularly on lowering the concentrations of total cholesterol and LDL cholesterol in blood (Samavant *et al*., 2016). Interestingly , green tea extract play a suprior role in weight loss, a significant increase in leptin level and decrease in LDL cholesterol level was reported with green tea extract (Huang *et al*., 2018). Regarding the effect on cholesterol level, green tea was studied in accordance with serum and hepatic oxidative abnormalities in hyper cholesterolemic rats, the result is lowering cholesterol in serum and liver, lowering levels of TG and LDL, and increased HDL levels (Alshatwi *at al*., 2011).

9-Hypolipidemic action of Blue berry *Vaccinium angnstifolium* juice

Blue berry induce the inhibition of lipid accumulation via activation of lipid catabolism, it deftinitely decreases the levels of TG and LDL (Rouhi-Boroujeni *et al*., 2015).

A recent study has suggeested that consumption of 240 ml/day of wild blue berry juice may support cardiprotective effect by improving adults with type 2 diabeles mellitus (Stote *et al*., 2017). Another recent study highlighted improvements in isulin resistance (increase in insulin sensitivity) in insulin resistant rodents or humans consumed blue beeries , this boactive action may be caused bay the fact that this medical plant is a high source of bioactive polyphenols including anthocyanin compounds. Moreover, incroporation blue berries in diet may lower the risk factor of type 2 diabetes (Stull, 2016).

10-Hypolipidemic action of Clove *Eugenia caryophyllus*

Essential oil of clove *Eugenia caryphyllus* contains a reactive hypolipidemic compounds Eugenol. This role of eugenol in lipid metabolism has been demonstrated in several laboratories (Harb *et al*., 2009). Aspirin eugenol ester (AEE) is a novel biochemical compound acts a vital influence on hyperlipidemia by lowering cholesterol, triacylglycerol, LDL levels in serum, increased HDL index but no significant increase in HDL levels (Karam *et al*., 2015). Besides the hypolipidemic effect, eugenol protects liver, reduce inflammation and improve the antioxidant status (Harb *et al*., 2019).

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كلية التربية للعلوم الصرفة إبن الهيثم / جامعة بغداد

الخلاصة (عربي):

إن هذه الدراسة النظرية سلطت الضوء على التأثير الكيموحيوي المضاد للدهون لبعض الأعشاب و النباتات الطبية و تقدم تغطية جيدة بما يخص النباتات المعنية و الأعشاب كما أنها تعزز و تؤكد الدور الكيموحيوي و أهمية النباتات في المجال الطبي كبدائل بايوكيميائية طبيعية المنشأ بدون تأثيرات جانبية . في الدراسة الحالية تم تناول التأثير الكيموحيوي لعشبة الهندباء ، الريحان ، الشبت ، الكرفس ، الحلبة ، العنب ، زيت الزيتون ، الشاي الأخضر ، التوت الأزرق و القرنفل .