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Mini Review

Plant Extracts as Antihypertensive Agents

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Abstract

The synthesis of medicinal antihypertensive drugs is an expensive endeavor for a developing country. Besides, anti-hypertensive synthetic medicines are not environmentally friendly and have a range of side effects which are usually irreversible. Thus, there is an urgent need to seek alternative, complimentary medicine of herbal nature, which is far cheaper, environmentally safe, commercially available and produces little or no side effects. To this effect, the literature has been surveyed to extract a list of plants used as antihypertensive agents. Various solvent types of plant extracts have been used and will continue to be used. Each synthetic drug or herbal extract has its own mechanism of action on human cells.

Keywords: Synthesis; Medicinal antihypertensive; Complimentary medicine

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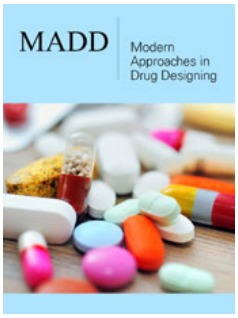

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Introduction

Hypertension (HTN) also known as High Blood Pressure (HBP) is a chronic medical condition in which the human blood pressure is above the threshold range. It can be classified as primary (essential) or secondary [1]. About 90-95% of the cases are primary, whereas 5-10% is secondary. Secondary HTN are caused by conditions that affect the kidneys, arteries, heart or endocrine system. Blood Pressure (BP) can be defined as the pressure exerted by the blood inside the blood vessels. There are two types of BP: systolic blood pressure, SBP<120mmHg) and diastolic blood pressure (DBP<80mmHg). Hypertension (HTN) is one of the risks factors for strokes, heart attacks, heart failure and arterial aneurysm. It is also the leading cause of chronic kidney failure [2]. HTN has several sub classifications such as HTN stage 1, HTN stage II and isolated systolic HTN. Isolated systolic HTN is elevated systolic pressure with normal diastolic pressure. Its common in elderly. Persons older than 50 years are classified as HTN if their BP is higher than 130/80mmHg. HTN is also classified as resistant if medications don't reduce BP to norm [3]. Another classification is exercise HTN during exercise. For exercise HTN, the systolic range accepted is between 200 and 230mmHg [4].

Discussion

There are many factors that are responsible for high blood pressure [5-7]. These are

a. Lifestyle: Sedentary lifestyle increases the risk of hypertension

b. Stress: Increasing stress, elevates blood pressure

c. Visceral obesity

d. Potassium deficiency (hypokalemia)

e. Obesity: A body mass index greater than 25 is responsible for than 85% of the cases

f. Salt (NaCl) sensitivity: A higher salt intake will increase the blood pressure.

g. Alcohol intake

h. Vitamin D deficiency

i. Aging

j. Inherited genetic mutations

k. Family history of HTN

Hypertension is one of the leading cause of death. It's the most common and main contributor to the pathogenesis of myocardial infarction, stroke and renal diseases. WHO reports that over 60million people suffer from hypertension. This is more than 10% of the worldwide population [8]. The hypertension profile varies from one country to another. Secondary HTN results from an identifiable cause and its treated differently from essential HTN. This include Cushing's syndrome, a condition whereby the adrenal gland over produce the hormone cortisol [9]. Several synthetic drugs of various classification have been developed over the years to lower the blood pressure and lower the risk from hypertension. These are shown in Table 1. Each of these drugs has its own mechanism of action. For example, blood pressure lowering by clonidine results from a reduction in the cardiac output due to a decrease in heart rate and relaxation of capacitance vessels. It also results in a reduction in peripheral vascular resistance. This is also accompanied by a decrease in renal vascular resistance and maintenance of renal blood flow [10]. Vasodilators work by relaxing smooth muscles of the arterioles and thus decreasing systemic vascular resistance which decreases blood pressure. Figure 1 shows the structure of some selected anti-hypertensive drugs. The side effects and the cost of synthesizing synthetic antihypertensive agents have resulted over the years in the use of herbal medicines which is far cheaper, commercially available and having little or no side effects. Besides, synthetic anti-hypertensive agents, when expired have to be dumped and this creates an environmental problem.

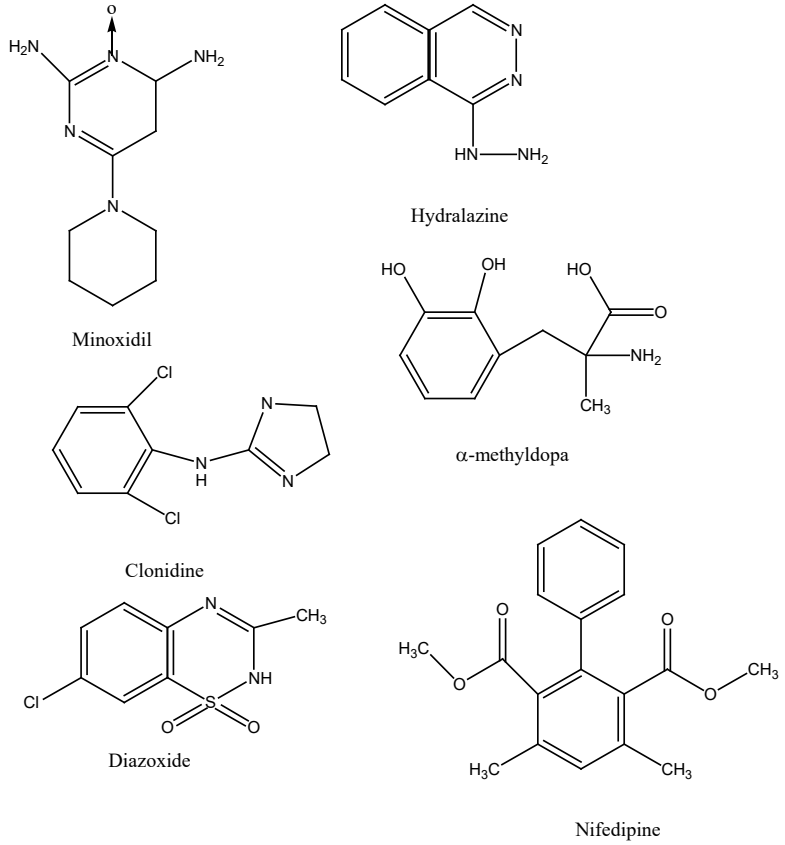

Figure 1: The structure of some selected anti-hypertensive drugs.

Table 1: Conventional synthetic medicines used in the treatment of hypertension.

Number	Classification of Drugs	Examples of Drugs
Diuretics		
1	Loop diuretics	Bumetanide, Ethacrynic acid, Furosemide, Torsemide
2	Thiazide diuretics	Epitizide, Hydrochlorothiazide, Chlorothiazide, Bendroflumethiazide
3	Thiazide diuretics	Indapamide, Chlorthalidone, Metolazone
4	Potassium sparing diuretics	Amiloride, Triamterene, Spironolactone
Adrenergic Receptor Molecules		
5	Alpha-2 agonists: Clonidine, Methyldopa, Guanfacine	
Calcium Channel Blockers		
6	Dihydropyridines	Amlodipine, Felodipine, Israddipine, Lercanidipine, Nicarddipine, Nimodipine, Nitrendipine, Non-dihydropyridines: Diltiazem, Verapamil

7	ACE Inhibitors	Captopril, Enalapril, Fosinopril, Lisinopril, Perindopril, Quinapril, Ramipril, Trandolapril, Benazepril
8	Angiotensin II receptor antagonists:	Valsartan, Candesartan, Eprosartan, Irbesartan, Losartan, Olmesartan, Telmisartan
	Aldosterone antagonists	Eplerenone, Spironolactone
9	Vasodilators	Sodium nitroprusside, hydralazine
10	Centrally acting adrenergic drugs	Clonidine, Guanabenz, Methyldopa, Moxonidine

Thus, research has intensified over the years in finding plants or plant extracts that can be used as antihypertensive agents. Thus, a literature review was done and results summarized. Table 2 shows a List of plants used as antihypertensive agents. Each of the above plants, like synthetic medicines, has its own mode or mechanism of action. For example, *Tribulus terrestris* herb is used habitually for the treatment of coronary heart disease, cerebral arteriosclerosis, myocardial infarction, thrombosis and hypertension [11-13]. Its suggested that the anti-hypertensive effects of the plant is due to its capability to boost up the discharge of Nitric Oxide (NO) from the nitrergic nerve endings and endothelium. Also, the anti-hypertensive effects may be associated with its Angiotensin Converting Enzyme (ACE) inhibitory action[14]. *Crocus sativus* (saffron), main chemical constituents are crocin, safranal, picrocrocin and crocetin. These compounds act as anti-hypertensive agents via a vasorelaxant action [15].

Table 2: List of plants with antihypertensive activities.

Number	List of Plants	Common Name
1	*Allium sativum*	Garlic
2	*Andrographis paniculata*	Creat or green chiretta
3	*Apium graveolens*	Celery
4	*Camella sinensis*	Tea plant, tea shrub or tea tree
5	*Copis chinensis*	Chinese goldthread
6	*Coriandrum sativum*	cilantro
7	*Crataegus spp*	hawthorn, quickthorn, [3] thornapple, May-tree
8	*Crocus sativus*	saffron crocus or autumn crocus
9	*Hibiscus sabdariffa*	Roselle
10	*Panax quinquefolius*	ginseng
11	*Salviae miltiorrhizae*	Red stage, redroot sage, Chinese sage
12	*Zingiber officinale*	Ginger
13	*Bidens Pilosa L*	Cape beggar's tick, Baja tickseed
14	*Mammea africana*	African mammee apple
15	*Cymbopogon citratus*	West Indian lemon grass
16	*Nigella sativa*	black cumin, nigella, kalonji, charnushka
17	*Agastache Mexicana*	Mexican giant hyssop
18	*Cocus nucifera*	Coconut tree
19	*Lepidium sativum*	garden cress
20	*Laelia autumnalis*	
21	*Carum copticum*	
22	*Olea europaea*	The olive
23	*Hsian-tsao*	
24	*Eucommia ulmoides*	gutta-percha tree" or "Chinese rubber tree
25	*Phyllanthus urinaria*	chamber bitter,[2] gripeweed, shatterstone, stonebreaker
26	*Tropaeolum majus*	garden nasturtium, nasturtium, Indian cress or monk's cress
27	*Fritillaria Ussuriensis*	
28	*Laelia anceps*	Orchid
29	*Guazuma ulmifolia*	West Indian elm or bay cedar,
30	*Lepechinia caulescens*	
31	*Elettaria cardamomum*	green cardamom or true cardamom
32	*Aronia mitchurinii*	Black choke berry, red choke berry

33	*Momordica charantia*	
34	*Clerodendron trichotomum*	harlequin glorybower, glorytree or peanut butter tree,
35	*Tanacetum vulgare*	Tansy
36	*Cecropia pachystachya*	Ambay pumpwood
37	*Eugenia uniflora*	Suriname cherry, Brazilian cherry, Cayenne cherry, cerisier carré
38	*Geum japonicum*	Asian herb bennet
39	*Cirsium japonicum*	
40	*Astragalus complanatus*	
41	*Citrus limetta*	Citrus limon,
42	*Achillea millefolium*	yarrow
43	*Averrhoa carambola*	carambola, star fruit and five-corner
44	*Valeriana wallichi*	
45	*Erythroxylum gonocladum*	catuaba
46	*Cudrania tricuspidata*	cudrang, kujibbong, storehousebush, mandarin melon berry, silkworm thorn
47	*Antrodia camphorata*	stout camphor fungus
48	*Melothria moderaspatana*	
49	*Solanum torvum*	pendejera, turkey berry, devil's fig, pea eggplant, platebrush or susumber
50	*Echinodorus grandiflorus*	
51	*Polyalthia longifolia*	false ashoka
52	*Jatropha gossypiifolia*	bellyache bush, black physicnut or cotton-leaf physicnut
53	*Salvia cinnabarina*	

Conclusion

Plants have been mankind first medicine and still will have to be resorted to, considering that synthetic medicines produce side effects which are usually irreversible. In addition, synthetic drugs are environmentally unsafe and the cost of synthesizing a drug is an expensive endeavour. A wide range of synthetic drugs have been used over the years to treat hypertension. The mechanism of action of these drugs are variable. Plant herbal antihypertensive agents will be a good remedy to offset the disadvantages of synthetic anti-hypertensive agents, both from a medicinal and economic perspective.

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