In-vivo pharmacological evaluation of *quisqualis indica* against atherosclerosis and myocardial infraction

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ABSTRACT

Quisqualis indica is commonly known as Rangoon creeper or madhumalti in Hindi which is an evergreen plant growing as an ornamental plant all over the country has been reported to explore a lot of pharmacological activity. In the present study the effect of methanolic and hydro- alcoholic extract of aerial parts of *Quisqualis indica* on cholesterol diet (coconut, biscuits and milk powder), and triton induced hyperlipidemia and doxorubicin induced myocardial infarction was investigated in rats. Hyperlipidemia caused by disorder of lipid, largely cholesterol and triglycerides in the blood. Results showed that there is increase in concentration of total cholesterol, triglycerides, low density lipoprotein cholesterol and very low density lipoprotein cholesterol comparatively with control group. Co-administration of methanolic and cholesterol diet reduced the level of cholesterol when compared to cholesterol taken groups. The main principal behind this reduction is due to in lipid per- oxidation as the plant contains flavanoids and other compound act as a free radical scavenger which obstruct the formation of free oxygen in the endothelial space. Similarly, doxorubicin induced myocardial necrosis in coronary artery ligation, reperfusion arrhythmia and infracts size in rats. The effects of methanolic and hydro-alcoholic extract of aerial part of *Quisqualis indica* had been compared at different doses with atorvastatin drug and it had been concluded that methanolic extract was more effective than hydro-alcoholic extract.

KEYWORDS: Hyperlipidemia, Quisqualis indica, myocardial infarction, flavanoids, atrovastatin.

DOI Number: 10.14704/nq.2022.20.9.NQ44697 **Neuro Quantology 2022; 20(9):5971-5995**

1.0 INTRODUCTION

1.1 Atherosclerosis

It is a progressive disease with in wall of optimum sized vascular arteries that develop lesion k/a atherosclerotic lipid plaques. Also, the arteries lose their elasticity and develop hardening. Another forms, such as arteriolosclerosis is characterized by general hardening of arterioles but atherosclerosis is a solidifying of an artery particularly because of plaques. Atherosclerotic are dissimilar focal thickening of the intima of vessels, having erythrocyte generating injury and immune cells, smooth muscle tissues, endothelial cells, connective tissue elementsand lipids. Following are the risk factors for development of atherosclerosis (Lusis et al., 2000).

The term atherosclerosis acts to a situation in which an inner artery wall thickens as a result of deposition of cholesterol and structural changes with increased collagen in the wall. Atherosclerosis is a chronic inflammatory process affecting large and medium sized arteries throughout the cardiovascular system (Hennekens et al., 1993).

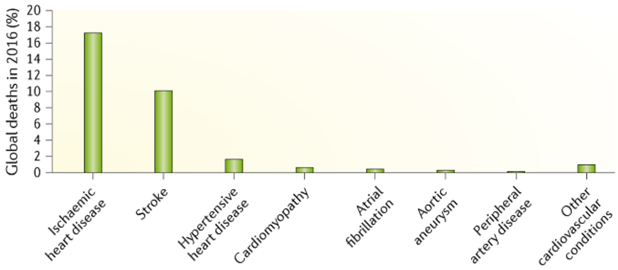


Figure 1.5. atherosclerosis global death case in 2016

Extensive proofs `of atherosclerosis in the aorta and carotid arteries is reported in mummies. Now, it is the leading problems of CAD leading 19 million deaths per year (Venegas-Pino et al., 2018).

Hyperlipidemia defined as increase the blood cholesterol level aong with less density and very less density lipoprotein lipid and are the major risk for the coronary disease (Nelson et al., 2013). Hyperlipidemia based problems cause the plague CVD. Above high fatty deposition low lipid concewntratyion are commonly linked with ischemic coronary disease (Barrett et al., 2019). Hypercholesterolemia is major problems of cardiovascular diseases like atheroscelerosis and its complications, acute infraction of the myocardium or hypertension (Linton et al., 2000). A rich source of lipid diet is a leading contributor for imbalanced lipid protein biometabolism. The concentration of cholesterol in the serum reflects the concentration of different lipoprotein in the serum (Feingold 2019). Major classes of lipoprotein particles are chylomicrons, VLDL, LDL and HDL. Each of these lipid particles contain lipid core and associated proteins, apolipoproteins. The major fractions of lipoproteins have their varying effects on atherosclerosis and ischemic heart disease (Feingold et al/. 2021).

- LDL is the riches in cholesterol and has the maximum association with atherosclerosis.
- VLDL carries much of the triglycerides and has less marked effect than LDL.

HDL is protective against atherosclerosis.

1.1.1 Development of Atherosclerotic plaque:

Atherosclerotic plaque accumulation by conyinuous changes of arterial inner wall lesions, middle the deposition of lipids on arteries and the resulting of inflammatory immunological respose (Badimon et al., 2012).

- LDL concentration elevated due to lipid depositions.
- Adjusted by enzymes, suddenly oxidized to proinflammatory mediators, to cause inflammation and intima.
- Narrowing of arteries due to deposition of lipids, leads stress conditios of arteries.
- Inflammation starts with endothelial cells chemoattractants, which together draw lymphocytes, mast cells, monocytes, and neutrophils of the arteries.

For early-stage prevention of atherosclerotic, the percentage of lipid buildup is crucial. Atherosclerosis would not include separate foam cells, numerous layer upon layer of foam cells, or isolated extracellular reservoirs of lipid. These would be microscopic aberrations that may develop to gross transparency (Johnston et al., 2019). It is possible to alter these cholesterol alterations. Atherosclerosis is thought to begin when lipid buildup causes cell necrosis by forming confluent extracellular lipid puddles and exracellular lipid cores with diminished lining epithelium. The natural architecture of the intima is gradually altered until it is completely disrupted. These growing pools of lipid-rich necrotic cores that dominate the centre region of the intima eventually take up 30 to 50 percent of the vascular endothelial area (Schwartz et al., 1975).

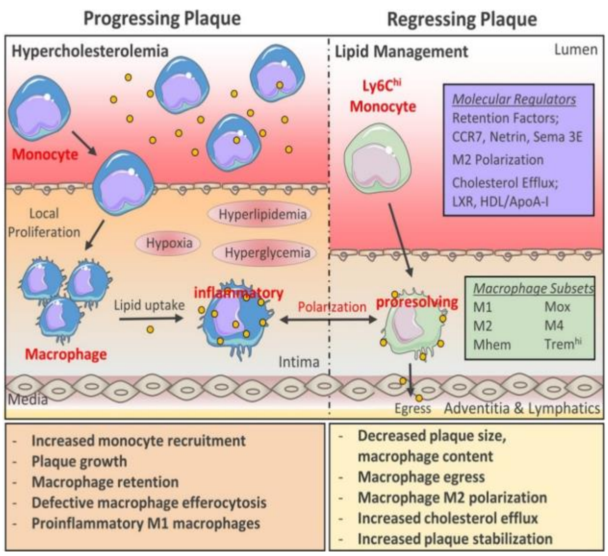


Fig.1.1 A roles of oxidized phospholipids for the formation of atherosclerosis.

1.1.2 Lipoprotein metabolism

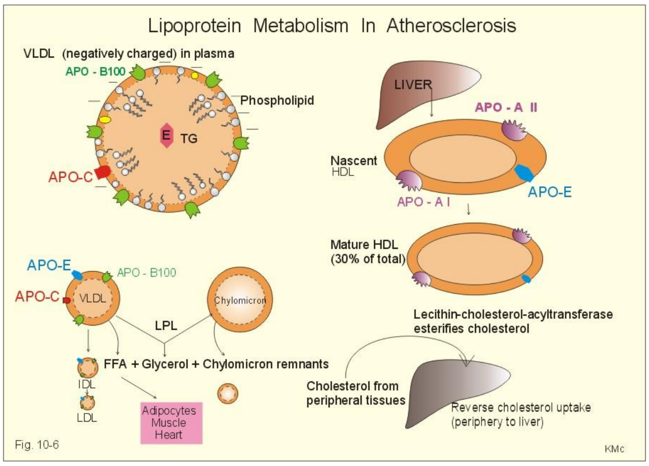


Fig 1.2 Lipoprotein metabolism in atherosclerosis

1.1.3 Risk factors in Atherosclerosis (Vinereanu et al., 2006)

The major risk factor of atherosclerosis is discussed in detailed in figure 1.3.

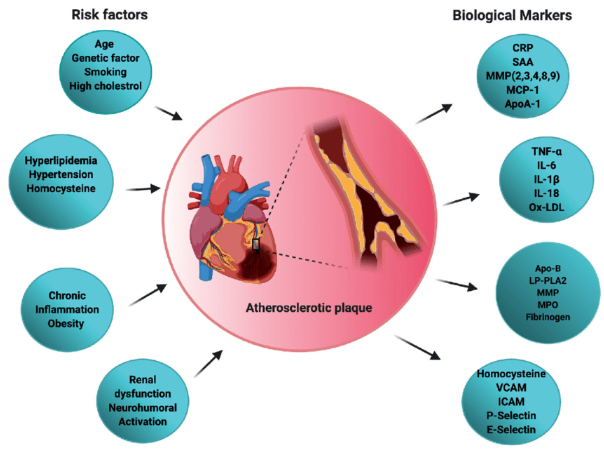


Fig 1.3 Risk of Atherosclerosis

Genetic factors **(**Tamminen et al. 1999**)**

- LDL as well as VLDL
- HDL
- lipoprotein
- elevated tension
- Insulin resistance
- Diabetes
- Gender
- Homocysteine
- Fibrinogen
- Syndrome

Environmental related factors **(**Ross et al., 1993**)**

- Cigarette smoke
- Less Physical exercise
- Excess fatty diet
- Communicable m/o

Elevated titre of blood lipids is commonly different to drive the formation of plague and hence, qualifies as the third important factor besides environmental and genetic factors. A prefentive response in Inflammation to damage tissue and plays a vital role in the deposition of plaques (Guo et al., 2010). The formation of a plaque start by elevated LDLs in serum guttered in the inner wall of artery, for the oxidation LDL present in lipids or lipoproteins (Rafieian-Kopaei et al., 2014). In response, Endothelial cells display adhesion molecules (VCAM-1, ICAM, P-Selectin and ESelectin) on their luminal (inner) surface that attract and entangle inflammatory cells (monocytes).4 Smooth muscle cells of the intima secrete chemokines; monocyte chemoattractant proteins (MCP-1), which attract monocytes and convert them into macrophages. The macrophages then ingest oxidised LDL and foam tissues. Lymphocytes, monocytes with in inner wall of artery & seceates inflammatory cytokines & focusing the inflammatory chemical reactions (Ericson et al., 2000). The foam, macrophages and lymphocytes that marks the deposition of plaque. Several times of injury lead to deposition of macrophages or death of some cells, formation the socalled core necrotic, stimulate smooth muscle cell division and migrationin the to form thick fibrous cap in the case of chronic, lesions of atheroschlerosis (Agen et al., 1993). Expansion of a plaque in coronary artery obstructs the blood flow but most heart attack results due to plaque rupture. Lymphocytes stimulates foam cells to form tissue factors that is k/a primitive cofactor of biological source participate in the stimulation of the coagulation route. The novel stage of tissue factors is expressed in components of coronary artery and conjugation with tissue cholesterol zones, smooth muscle cells, and macrophages, that participate a vital application in analysis of plaque lipid thrombogenicity (Kalogeris et al., 2012).

1.1.4 Diagnosis

Chronic cholesterol deposition donot gives any external symptoms till chronically narrows or blocks an artery passage hence, an emergency trauma occurs like chest pain, angina pectoris, stroke is often a heart attack consequence. Increased plasma concentration of lipids as wlell as sugar are the prime symptoms for the diagnosis of major cause of plague during atherosclerosis (Barker et al., 1995).

1.1.5 Prevention of atherosclerosis

Lifestyle disturbances due to irregular physical work, excessive obesity, hypewrtension and diabetes are the major cause of atherosclerosis. Many lipid lowering drugs such as statins, fibrates and bile sequestrants are available in the market that decreases the onset and progression of atheromatous plaque formation when detected in its early phase (Chandra et al., 2014). Statins: Statins are HMG-CoA reductase inhibitors that limit cholesterol synthesis hence, are most popularly used for treating atherosclerotic condition in patients. Statins (Lovastatin, Pravastatin, Simvastatin, Fluvastatin, Atorvastatin, and Rosuvastatin) block HMG-CoA reductase by competitive inhibition due to a higher affinity for the enzyme than its HMG-CoA substrate that further trigger proliferation of LDL receptors and their action. It elevates removal of LDL matter. As a result, serum level of LDL-C as well as reducing LDL particles in the blood stream with fewer LDL-C particles interacting with the intimal layer of blood vessels. Statins are popular because they are effective group of drugs that manifest fewer side effects (tiredness, diarrhoea, sleeplessness and headache (Sharma et al 1908).

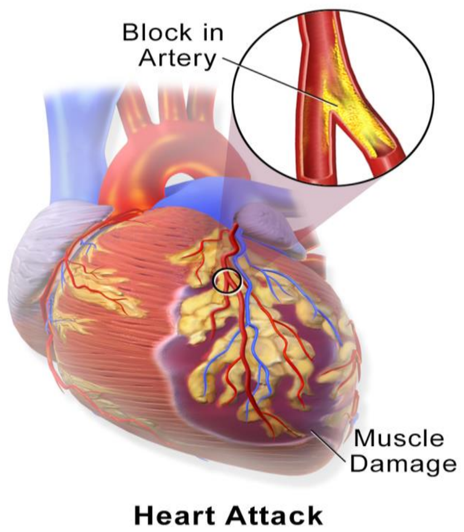


Figure 1.4 Deposition of Cholesterol and plague formation

Fibrates: Fibrate is a popularly used term for Fibric acid or Phenoxyisobutyric acid (parent compound) that is used in several drugs that lower plasma cholesterol and triglyceride concentrations. Gemfibrozil, fenofibrate, and clofibrate are collectively known as fibrates or fibric acid derivatives (Shepherd 1993). With respect to statins, related drugs cannot control lipid biosynthesis. So above agents trigger β-peroxidation of higher fatty acids commonly in peroxisomes &mitochondria thus lowering plasma fatty acid and triacylglycerol. However, nausea, diarrhoea and indigestion along with occasional skin rashes, impotency and weight gain may be the resultant side effects associated with these drugs (Villaret-Cazadamont et al., 2020).

1.1.6 Drug used for the treatment of Atherosclerosis (Nakamura et al., 1993)

HMG-CoA Reductase inhibitors: statins-simvastatin, lovastatin, pravastatin, atorvastatin and rosuvastatin.

Fibrates-benzafibrate, ciprofibrate, gemfibrozil, fenofibrate and clofibrate.

Drugs that inhibit cholesterol absorption- ezetimibe,

Bile acid-binding resins- colestyramine, colestipol.

Nicotinic acid derivatives- nicotinic acid.

Natural Resins

By-products of lipid (Bile acids) metabolism in liver that are excreted via bile. Approximately 90% of it is reabsorbed from the intestine and reused for cholesterol biosynthesis in the liver. Bile Acid Sequestrants (Resins) (Cholestyramine, colestipol, and colestaol level react with this gut re-absorption, by conjugating to the bile product of GIT & inducing the elimination along with faeces. Above molcules have negligible effects and prevent LDL high cholesterol conc. Up to 10-30% based on their daily dose. Side effects include nausea, bloating, cramping and abnormal liver function (Chiang 2013).

1.2 Myocardial Infraction

Coronary diseases and there, myocardial infarction (MI) contribute majorly to the overall statistics of mortality and morbidity in the western world. In UK alone, there are more than one million people who have suffered a heart attack. As per the updated statistics released by WHO, MI is leading cause of people death globally in 2020 (Sanchis-Gomar et al., 2016). Myocardial infarction has witnessed a significant rise in India with a high frequency of occurrence amongst male patients (Laatikainen et al., 1982). Since 50 years, Acute MI can be described based upon different perspectives such as clinical, electrocardiographic (ECG), biochemical and pathological characteristics (Leischik et al., 2016). In MI, the first few hours witness ventricular tachyarrhythmia that results in considerable mortality because of their occurrence before a patient reaches the hospital. Ironically, these are easily preventable in an intensive care set. Myocardial Ischemic chest pain is diffusive, left upper arms, radiating to left shoulder, right upper limb and is often. Associated symptoms include dyspnea, fatigue, sweating, nausea and/or vomiting. MI can be classified as (Go AS et al., 2016).

Type 1: Continuous MI

Type 2: MI to an ischemic imbalance

Type 3: MI causing death due to unavailability of biomarker importance

Type 4: MI based to coronary intervention

Type 5: MI and coronary artery bypass surgery

Type 1: it related to

- atherosclerotic plaque rupture,
- ulceration,
- fissuring,
- erosion,
- thrombus
- non-obstructive or no coronary artery disease.

Type 2:

- endothelial dysfunction,
- artery spasm,
- coronary embolism,
- tachyarrhythmias
- bradyarrhythmias,
- anemia,
- respiratory failure,

Type 3:

- Cardiac sacrifice
- branch block,
- occurring blood samples

Type 4:

- rise of cardiac troponin values >20%
- symptoms suggestive of myocardial ischemia,
- new ischemic electrocardiographic changes
- new left bundle branch block

Type 5:

- Electrocardiogram for angiopgraphy
- abnormality in ECG patterns
- lipid profile are elevated in plasma during cardiac damage.
- The measurement of Ck and Ck-MB levels has long been used for the diagnosis of MI. Ck, an enzyme present in many tissues, including the myocardium and skeletal muscle, has 3 isoenzymes: MM, MB, and BB (Blanke et al., 1984). Ck-MB is present in a relatively high concentration in the myocardium (roughly 20% of the total myocardial Ck), whereas the concentration of Ck- MM is highest in skeletal muscle (98% of total muscle Ck).

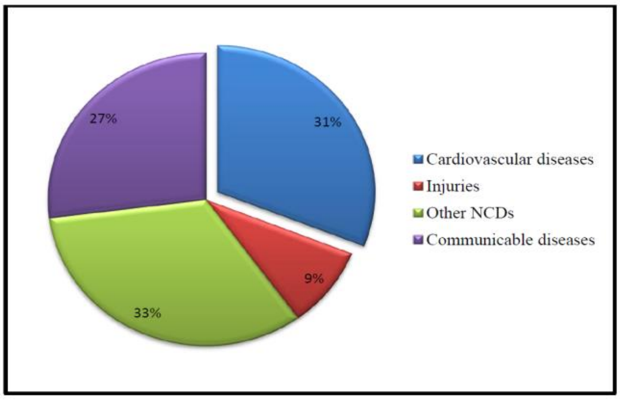


Figure 1.5 Distribution of major causes of death including CVDs

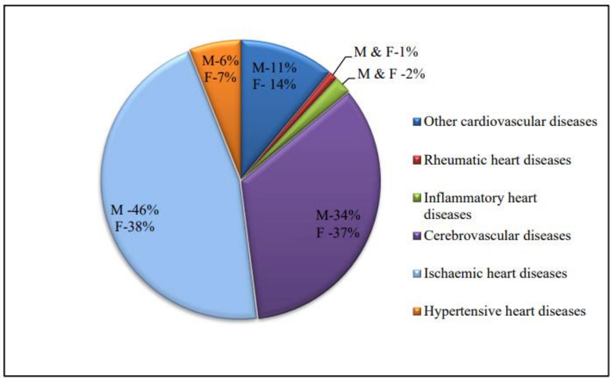


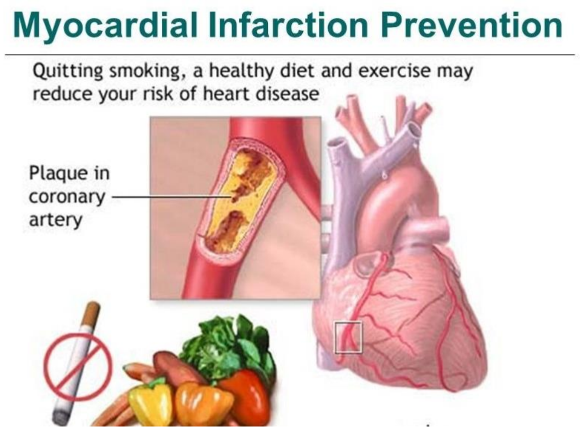
Figure 1.6 Distribution of CVD deaths in male and Females

1.2.1 Prevention

By the defending the major risk MI is avoided by increase the utilization of (Grande et al., 1980)

- rich source of antioxidants from plants and vegetables,
- biomarkers,
- herbal medicinal agents,
- reduce consumption of alcohol.
- By physical exercise,
- utilization of nutraceuticals etc.
- Diatery supplements
- Prebiotics and probiotics

A



B

Figure 1.7 Preventive agents to avoid MI.

CVD regularly one of the leading problems for mortality and morbidity, and is leading at highest rate globally (Sreeniwas et al, 2020; WHO 2016). Last few decades, it is an expression of innovative and clinical developments, related to CVD and in similar areas like major risk factors, like high lipid, obesity, metabolic problems, diabetes, angiogenesis, and Immuno disordes. A new option of major interdisciplinary advanced methods led for the complete identification and validation of novel drug discovery Along with investigations of new lead entity & therapeutic active agents are the major agents for the treatment of CVD and related disorders (WHO 2016).

1.3 Cardioprotective

CVD noticed that it is a leading problems of death cases globally in developed and developing populations, about more than 20% of all global death are recorded every year (Gaziano, et al., 2010). Along with, arrhythmia, hypertension, coronary heart disease, MI and cardiac arrest are the prime problems in males with age of >45 & fewmales age of >65 in the USA and counted for approximately 750,000 deaths yearly (WHO, 2002). Cardioprotection includes "all mechanisms and means that contribute to the preservation of the heart by reducing or even preventing myocardial damage" (Olshansky 1986).

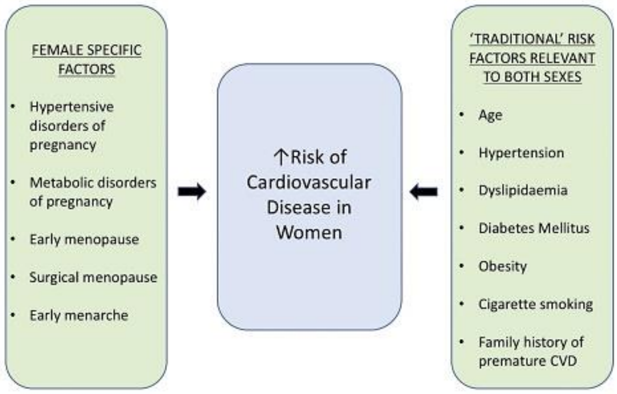


Figure 1.8 Major Risk Factors of CVD

IHD can be defined as cardiac diasability (acute or chronic) generated from disturbances between the anoxia, (a types of coronary disease) is utilized regularly along with IHD. It is caused by disease affecting the coronary arteries (Abbott, et al., 1991). They are coronary blockage, sudden alteration in coronary artries formation of atheromatous plaque, thrombosis,platelet aggregation andartery spasm).

There are two types of ischemic manifestations:

- Myocardial infraction
- Non-infract effects of myocardial ischemia (angina pectoris, chronic ischaemic heart disease, sudden cardiac death)

1.3.1 Metabolic effects of Cardiac ischaemia

Due to lack of oxygen, generation of phosphates basd on anaerobic respiration. Acute intestinal ischemia is a rare disorder defined as the sudden disruption of the blood supply to the intestine. If left untreated, it will lead to complications and irreversible consequences such as necrosis of the intestinal wall and death (Stanley et al., 2004). The occlusive and nonocclusive types of acute ischemia of the bowel is assessed based on their cause. Occlusive causes of acute mesenteric ischemia include mesenteric artery embolism (50% of cases), mesenteric artery thrombosis (15-25%), and celiac vein thrombosis (5-15%). Diverse causes and nonspecific clinical symptoms of patients with acute mesenteric ischemia hinder the diagnostic process, often resulting in delayed diagnosis and late therapeutic intervention (Wolff et al., 2002).

1.3.2 Inflammation & ischaemic dysrhythmias

Acute insufficiency of intestinal blood flow accounts for 60-70% of cases of intestinal ischemia, with the remainder related to chronic mesenteric ischemia, which is not a focus of this review (Lazzerini et al., 2017). The major causes of AMI include mesenteric arterial occlusion (embolism or thrombosis), non-occlusive mesenteric ischemia due to intestinal hypoperfusion, and mesenteric venous occlusion (thrombosis) (Lazzerini et al., 2014). Vasculitis is a rare risk factor for AMI, but this review will focus on the aforementioned etiologies (Suresh et al., 2006).

CK-MB

Ck is involved in energy storage in tissue, primarily muscle. Major classes of lipoprotein particles are chylomicrons, VLDL, LDL and HDL. Each of these lipid particles contain lipid core and associated proteins, apolipoproteins (Cox, 1990). The major fractions of lipoproteins have their varying effects on atherosclerosis and ischemic heart disease. In the normal heart, 15-20% of the CK is CK-MB (Nordestgaard, et al., 2016).

1.3.3 Drugs acting rennin angiotensin aldosterone

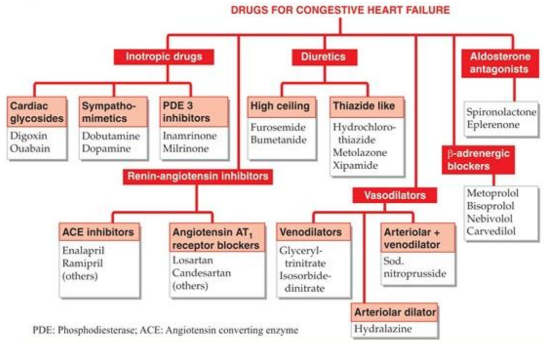


Figure 1.9 Classificicatio of drugs against CHF

2 PLANT PROFILE

2.1 Scientific name: *Quisqualis indica*

2..2 Local Names: English (Rangoon Creeper), Hindi (Madhumalti), Bengali (Modhumalati), Telgu (Radha Manoharam), Filipino (Niyog-niyogan), Spanish (Quiscual), China (Shih-chun-tzu), Manipuri (Parijat), Marathi (Vilayati chambeli) (Ub Wijerathne et al., 2017).

2.3 Taxonomical classification

Kingdom:	Plantae	**Vernacular name**
Division:	Magnoliophyta	Bengali: Basantilatas
Class:	Magnoliopsida	Spanish: Madhabilata, Modhumalati
Order:	Myrtales	English name: Rangoon-creeper, Chinese honey-suckle
Family:	Combretaceae	Hindi: Modhumalati
Genus:	*Quisqualis*	Telugu: Radha Manoharam
Species:	*Q. indica*	

2.4 Cultivation and Collection

Commonly needs a land with

- sunlight,
- watering
- water,
- fertilizer etc.

Figure 1.10Floral parts of*Quisqualis indica*

2.5 Description

Quisqualis indica Linn is an exceptionally notable tropical vine, discernible by its leaf size and color of the flower. Its height can reach 210 cm and its length in between 20-90 cm. *Quisqualis indica* Linn is seen with green and on cascading branches with abundant axillary and terminal drooping racemose inflorescences. Its leaves are oblong to elliptic, 8-14 cm length, with acuminate tip and rounded base.

The length of the flowers is 3.0 to 3.5 cm long, tubular and their color changes from white to pink and pink to red. Fruit shows five prominent wings with a specific ellipsoidal shape. One plant will carry 3 different colors of flowers. Flowers flinches into white, pink and then red they gives out a distinct perfume[12, 13]. The fruit tastes like almonds when mature.

2.6 Parts used

Commonly leaves, seeds, flower, fruits and roots are used for the treatementg of several types of ailments 63,65

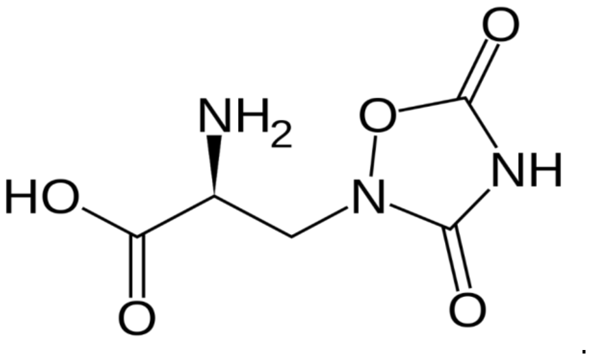
2.7 Chemical constituents

The seeds of *Quisqualis indica* Linn contain amino acids and their salts: quisqualic acid, potassium quisqualate,[14] arginine, γ-aminobutyric acid,[15, 16] fatty acids: myristic acid, palmitic acid[17], triterpenoids, betulinic acid, steroids, cholesterol and 3-O-[6'-O-(8Z-octadecenoyl)-β-D-glucopyranosyl]-cholesterol[18].

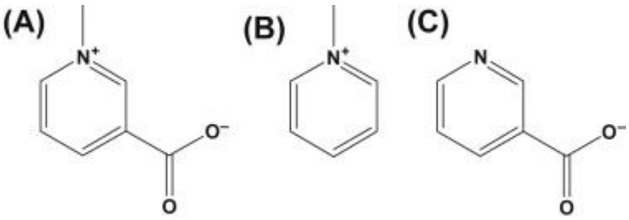
The fruit contains fatty acids: linoleic acid, palmitic acid, oleic acid, stearic acid and arachidonic acid[18]; hydrolysable tannins: quisqualins A, B, V, hydrolysable tannin, pedunculagin[19]; pyrolidine alkaloid trigonelline[20]. Leaves and flowers encompasses flavonoids: pelargonidin-3-glucoside and rutin[21], alkaloids, tartaric acid, tannins[22], terpenoids, ellagitannin, gallic acid, rutin, trigonelline, L-proline, L-aspargine and quisqualic acid. Flowers also contain pelargonidin-3-glucoside & linalool oxide[23]. The stem bark contains diphenylpropenoid, terpenoids and flavonoids[24].

Table- Major Phytochemicals

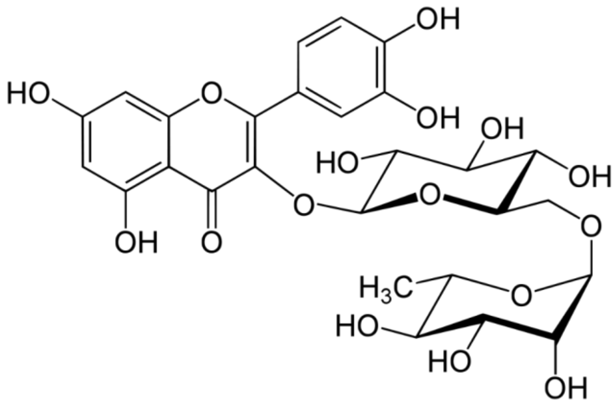
Parts of the plant	Secondary metabolite or phytochemicals
Flower	Alkaloids, Phenols, Flavonoids, Saponins, Tannins
Leaf	Torpenoids, Flavonoids, Saponins, Tannins, Alkaloids
Root	Cardiac glycosides, Reducing Sugars, Torpenoids, Flavonoids, Saponins, Tannins, Alkaloids
Stem	Cardiac glycosides, Reducing Sugars, Torpenoids, Flavonoids, Saponins, Tannins, Alkaloids



Trigoneline



Quisqualic acid



Rutin

Figure - Major chemical constituents of *Quisqualis indica*

2.7 Traditional Uses

Decoction of the plants helpful for antihelmintic to kill thre parasitic and prevent infecxtionm. Atees has been used from centuries to cure various diseases externally and internally as well. Externally the crushed leaves and seeds are used to be applied on the throat to treat tonsillitis. For Internal uses the juice of Atees roots along with milk is considered as an expectorant. The root powder of this plant is taken orally to cure cervical lymphadenitis.

The seeds and roots of Atees help in making digestive system strong. Seeds are also thought to have diuretic properties which help in alleviating the burning sensation (Singh, et al., 2017).

2.8Pharmacological Activity

Evaluation of immunomodulatory activity of hydroalcoholic extract of *Quisqualis indica* flowers in wistar rats for antioxidant (Shah et al., 2019).

- Quisqualis acid induced neuronal necrosis in stratum and hippocampus in 7 days old rat 38
- Total phenolic content shows antioxidant activity (Shah et al., 2019).
- Quisqualic acid acted as anthelmintic for driving roundworms and threadworms especially Ascaris.
- Flower extracts shows inhibition of acetylcholinesterase (Shah et al., 2019).
- Fruit extract shows nematocidal42 and larvicidal activities (Shah et al., 2019).
- Hydroalcoholic extract of flower shows immunomodulatory effect in wistar rat
- Quisqualis acid obtained from seeds shows the effects on the neuromuscular junction of Crayfish induce desensitization of receptor to l-glutamic acid (Shah et al., 2019).
- 25-O-acetyl, 23-24 dihyro cucurbitacin isolated from *Quisqualis indica* Linn showed significant cytotoxic activity (Singh, et al., 2017).
- Leaves extract shows antioxidant activity (Singh, et al., 2017).

Table- Parts of *Quisqualis indica* Linn used for Medicinal Purpose

Usable parts	Ailment diseases
Fruit	Dysentry, diarrhoea, gastric
All parts	Male nutrition, Leocoderma, constipation, insomnia, tissue-building, nervous breakdown, fever, painful swelling and opthalmitis
Rhizome	Asthma, gastric, cough and cold
Bark	Hypertension, stress rheumatism
Leaf, root	Cough and cold, Hypertension, stress rheumatism
Rhizome	Indigestion, diarrhoea, dysentery, dyspepsia, vomiting, cholera, and fever
Fruit	Dysentry, diarrhoea, hypertension, stress rheumatism, gastric
Fruit	Dysentry, diarrhoea
Leaves, flower	Fermentation of all Ayurvedic products
Whole plant	Dysentry, diarrhoea
Bark, fruit	Digestive, tonic and chronic dysentery
All parts	Cough and colds, bronchitis and other respiratory disorders
All parts	Cough and cold, relieving toothache
Stem	Anti-malarial, stomachic, laxative, anthelmentic and antidiarrhoeal
Seed	Diabetes
All parts	Stimulant and antiseptic. Laxative and used in sherbet drinks
Leaves	Facial fitness and skin diseases
Leaves	Anthelmintic, constipation, colic, dysentery and dyspepsia, strangulation of intestine, in spleen complaints and debility.
Whole plant	Fish bait, aromatic; reported to be sex stimulant
Root, bark, leaf	Dysmenorrhoea, ammenorrhoea, sterility and other menstrual disorders

1.4.8 Toxicity

Quisqualis indica Linn is mildly toxic, the symptom of toxicity is bleaching, nausea, vomiting, (toasting the herb decreases its toxicity), and allergic reaction with skin, rashes with or without itching, painful swelling of ankle, increasing body temperature.

3.0 MATERIAL AND METHODS

3.1 Identification, collection and authentication of plant material

The Aerial part of *Qisqualis indica* were collected during Januaryfrom the local surroundings in Lucknow, Uttar Pradesh. Further plant was authenticated from taxonomic NBRI Lucknow . An herbarium of plant was deposited in the division of botany. A plant specimen was deposited for future reference .

3.2 Extraction procedure

The collected aerial parts (2.5 kg) of *Qisqualis indica* were air dried and followed by tray dryer under favourable condition and powdered it. The powdered crude drug (1.2 kg) was extracted with PE to for defatting the substances; the mark was further treated methanol and water (Hydroalcoholic) to along with methanol by Soxhlet extractor. The crude extract was further filtered and concentrated under reduced pressure at 4^0C and kept in desiccator.

Table - Common reagents and chemicals

ChemicalName	Supplier
1-amino-2 napthol 4-sulphuricacid	Sd. finechemicals,Mumbai
Aceticacid	Same
Aceticanhydride	Same
Acetone	NiceChemicals,Kerala
Albumin	SpanDiagnosticsLtd.
Carboxymethylcellulose	Sd. finechemicals,Mumbai,
Ammoniummolybdate	Same
Ascorbate	Same
Gallic acid	Chemsworth,Surat
Chloroform	Sd. finechemicals,Mumbai,
Dipotassium-monohydrogenphosphate	Same
DPPH	SigmaChemicals,USA
Ethanol(AR)	NiceChemicals,Kerala
EthylAcetate(AR)	Sd. finechemicals,Mumbai,
Formalin	SigmaChemicals,USA
Hydrogenperoxide	Same
Isopropanol	Same
Methanol(AR)	Same
Diazepam	Same
Pentylenetetrazol	Same

Table - Apparatus used:

S.no.	Equipment	Company
1	Electronic Balance	OHAUS SP202
2	Laboratory Centrifuge	REMI Motors Ltd.
3	Semiautomated chemistry analyser	Lab life chem. Master
4	Laboratory heating plate	Surya Scientific Industries
5	Electronic compact scale	Virgo
6	Magnetic stirrer	Navyug India

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Table - Animals

Animal	Strain	Weight range
Rats	Wistar albino	130-150 gm
Mice	Swiss albino	20-25 gm

Table - Enzyme Diagnostic equipment's:

S.no	Kits	Supplier
1	cholesterol	Auto span diagn pvt Ltd.
2	Glucose	Minios Global diagnostic
3	Triglycerides	Auto span diagn pvt Ltd.
4	HDL-cholesterol	---Do--
5	LDL-cholesterol	---Do--
6	VLDL-cholesterol	---Do--
7	Creatine-Kinase	---Do--

3.3 Phytochemical Analysis:

The parameters were taken from Khandelwal, (2010)for detection of phytoconstituents using following methods (Khandelwal 2010; Kokate et al., 2002):

3.3.1 For alkaloids:

Mayer's reagents:Crude extract+ Potassium mercuric iodide gives cream precipitate.

Hager's reagents: The test solution + saturated 5% picric acid (Hager's reagent) yields instant yellow color precipitate.

3.3.2 For carbohydrates:

Fehling's Reagent:Mix equal vol of Fehling‟s solutions A & B, followed by heating for some times+ test extract in equal proportion. Gently boil for 5-10 min at water bath. Suddenly yellow, followed by brick red color ppt. is produced.

Barfoed's reagent:Test solution + Barfoed‟s reagent, gently boil. Observed that brick red ppt suggests the indicatations of saccharides.

Molisch's test: PlantExtracts mixed with α-naphthol simultaneousluy add Conc. H2SO4, purple colour is producd indicate the confermation of carbohydrates.

Benedict's test:Plant Extracts mixed with Benedict Reagent (173 g Sodiumcitrate + 100 g Sodumcarbonate + 17.3 g Coppersulphate) and boiled it for few min and allowed to cool, A red, green or yellow ppt. produced indicate the confermation of carbohydrates.

3.3.3 Fixed oils & fats:

Cellupose paper:Cellulose filter paper gets completely treat with fixed oils.

3.3.4 Test for Proteins & Amino acids:

Biuret test:Extract treated with NaOH solution and Dill. CuSO4 solution. A deep Blue colour indicates the confermation of protein.

Ninhydrin test:Extract + ninhydrin exhibits blue color ppt.

Millon's test:extract + reagent, mild heated, they produce yellow colouration.

3.3.5 flavanoids:

$FeCl_3$ test:Extract/fraction + little amount of $FeCl_3$ aq. solution give dark green colour.

Alkaline reagent test:Extract/fraction + NaOH sol. suddenly produces deep yellow ppt later on turns colourless by the addition of Dill Acidic solun.

Lead acetate reagent:Extract/fraction + little quantity of 10% lead acetate produces yellow color precipitate.

Zinc-HCL reduction test: Extract/fraction + zinc dust + HCl produces magenta red colour.

Shinoda test:Extract/fraction + magnesium turnings + conc. HCL, exhibits pink to magenta red colour upon heating.

3.3.6 Test for sterols:

Salkowski reagent:Extract/fraction + Con H_2SO_4, mixed well and keep aide for few mion. The base layer changes red coour suggesting the sterols are reported.

3.3.7 Saponin Glycosides:

Foam formation test**:** Extract treated + water mixed up toughly a persist froth formation was obsereved.

3.3.8 Test for Starch:

Iodine test:Extract + Aq Iodine solution. Appears navy blue color, and becomes disappears on heating at water bath and again reappears navy blue color on cooling.

Tannic acid :Extract + 5% tannic acid. Buff ppt.

3.3.9 Tannins & polyphenolic:

$FeCl_3$:Plant extract + few ml of ferric chloride solution exhibits dark red colour.

3.4 Physicochemical analysis

The following physicochemical parameters were taken from guidelines of (WHO, 2002; Khandelwal, 2010; Mushtaq et al., 2014).

3.4.1 Determination of loss on drying:

2 g of fine powdered material was transferred in a tarred disc (without preliminary drying) dried at temp. 105˚C for 30 min and weigh accurately. Again dry the drug and weigh after 1 h time difference until no any changes b/w two successive readings and to not more than 0.25%. This weight loss is considered as moisture content and percentage of moisture loss was calculated.

3.4.2 Total ash:

weighed 2 g accurately of fine crude drug was incinerated in porcelain dish at a temp 450˚C all the organic content will burn out only inorganic residue is there then measured after refrigeration and then determine the %age total ash as copared to to the fresh drug (Khandelwal, 2006).

3.4.2.1 Calculation of water-soluble ash:

The total ash was heated in 25ml pure water and the insoluble content was filtered off using ashless filter paper followed by rinsed alongwith fresh boiled aqueous and incinerate again at temp upto 450˚C till constant weight changes, subtracted the %age of water-soluble ash as compared to fresh air dried powdered material and analyzed.

3.4.2.2 Calculation of acid insoluble ash:

The totalash has been heated along with 25ml Dill. HCl and filter the insoluble content by ashless filter paper, and again rinsed with boiled water and further incinerated at a temp 450˚C up to no changes and determine the %age of acidinsoluble matter as compared to air-dried fresh drug.

3.5 Calculation of methanol soluble extractive value

5 g of dried fine powdered plant was extracted with 100ml of solvent for one day, frequently mixed it after 6 h kept aside for 18 h, followed by filtration and to take precautions to avoid loss of menstruum concentrated to 25 ml in the dish, ml of supernatant was purified and concentrated 105˚C temp up to constants amount changes. The %age of manstrum-missible matter as compared to the fresh dried material was determined.

3.6 HPTLC Analysis

Wagner, (1996)published that HPTLC is advanced analytical techniques used for purification, isolation, power, reproducibility advanced to the simple TLC. According to the utilization HPTLC micro plates with fine particle sizes and precise sophisticated machine for every step of the chromatographic method (sample injection, chromatogram development and its analysis), thus HPTLC important tool to provides the qualitative and quantitative fingerprinting profile of given sample with reference to standard marker compound

5.6.1 Procedure

HPTLC system equipped (CAMAG) plus Linomat 5 applicator (CAMAG Linomat 5 "Linomat5_130439"S/N130439(1.00.12),TLCscanner3(CAMAGTLCScanner3 "Scanner3_130520" S/N 130520 (1.15.26), with illuminating instrument reprostar 3(CAMAG Reprostar 3: 130516 (Repro3_130516) with digital camera type: snr &Lens(DXA252:275584707,Computar,16mm,f5.0) forvisual detection,operated by softwareWinCATS wereused.Allthe analytical grade manstrum requiredforHPTLCfingerprinting technique was procured by Merck. About100 mg BVE were mixed in 5mlCH_3OH for HPTLC fingerprinting evaluation served as test sample. The solute (4, 8, 10 µl)spotted in the HPTLC silica gel 60F-255 plate with length of 6.0 mm with the help of Camag microliter syringe. Toluene: acetone: methanol: formic acid (7: 2: 0.8: 0.2 v/v) wasselected as MP for extract. Linear ascending chromatogram was development to achieve good resolution of phytochemicals using glass chamber saturated with both the solvent system with the same chromatographic column. The chromatographic plate was placed at fluoresce cabinet and taken a picture under normal light, and UV visible light at 254and 366nm respectively. 3D analysis was analysed on CAMAG-TLC scanner3&governed by operating system WinCATS (V 1.15.26Camag). The HPTLC fingerprinting evaluation of theMECT Leaves wasperformed atNBRI,Lucknow.

Table ParametersusedinHPTLCanalysis ofMethanolicextractof Aerial part of *Qisqualis indica*(MEQI).

Plant name:	Aerial part of *Qisqualis indica*
Plantpartused:	Leaves
Spottingofsample:	
Track1	CTL
Track2	CTL
Track3	CTL
TLC Band Length	6.0 mm
TLCplatesize	5.0x10.0cm
2 banddistance	15.0 mm
Sampleconc	20mg/ml
Total Samplevol	4,8,10µl
MP	Toluene: acetone: methanol: formic acid (7: 2: 0.8: 0.2 v/v)
Slitdimension	6.0x0.30mm, Micro

3.7 IN-VITROANTIOXIDANTSCREENING

3.7.1 DPPH assay

The 1, 1-diphenyl-2-picrylhydrazyl (DPPH) was considered as free radical are stable in nature by the delocalization of spare of thenegative charged electron in to molecule, that's why the same atom doesn't dimerize,similar to another free particles. An delocalized unpaired electron participate to produce a dark violet light color, analyzed uv visible spectrophotometer by taking an absorption at 517nm. TheDPPHwasuniformaly mixed with sample and releases hydrogen atom, (Kedare et al., 2011) then they disappearance of this violet tint, the form has been decreased.

Similarly, The scavenging property of the test solution's free radicals was observed, as was a modification in the optical density of DPPH free radicals. After diluting the solute (0.2 ml) with methanol and 2 ml of 0.5 mM DPPH solution, the absorbance was measured using the formula given below (Sánchez, 2010).

$$\boxed{\% \text{ Inhibition of DPPH radical} = ([A_{br} - A_{ar}) / A_{br}] \times 100}$$

Where;

A_{br}: UV-absorbance just before chemical interaction

A_{ar}: U V absorbance just after chemical interaction (Kedare*etal.*, 2011).

3.8 PHARMACOLOGICAL EVALUATION

3.8.1 Experimental Animals:

Young adult male 7-8 weeks old, wistar rats,150-200 gm bw were purchased from C.D.R.I., Lucknow. The all animal were placed in Polypropylene boxes in a regular atmosphere, alternating 12 hours of daylight and 12 hours of night-time at 25°C. The animals received a regular laboratory standard pellet meal and granted free access to water ad libitum. All rats are housed properly with well-ventilated animal house and adjust to the standard norms up to min 15 days just before the commencement of experiment. The experimental methods were passed by Institutional Animal Ethical Committee (IAEC) animals and the care of the laboratory was governed according to the regulation of C.P.C.S.E.A. (Reg. No. UIP/IAEC/April-2021/03).

3.8.2 Determination of oral acute toxicity

The LD_{50} dose were determined in experimental rats by an OECD Guideline 423. A unit dose of the plant extract (i.e., 5, 50, 300, as well as 2000 mg/kg) in prescribed quantity of water was given orally through gavage to all the groups of rats (each group having 3 animals). All the rats were providing food and clean water are both freely available to supply. However, the animals are avoiding of food for 2 hours prior to administer of sample and four hr after dosing. For the starting half day, the animals were initially carefully monitored for the changes of any adverse effects for four hr and then monitored at one hr after time intervals. They were later noticed twice in a day for any abnormal alternation throughout the experimental period (last 14 consequent days). The median lethal dose of the 95% methanolic extract of *Qisqualis indica*(MEQI)was 2000 mg/kg bw. $1/10^{th}$ of the maximum concentration of the plant extract examined for the acute toxicity study later on for pharmacological evaluation (200 as well as 400 mg/kg bw) (Chinedu, et al., 2013).

3.9 Cholesterol–diet induced hypercholesterolemia

Groups: 7 groups (N=6 rats in each droups) was taken and are divided in to following groups:

- Group I : Contrl Group
- Group II : Cholesterol diet
- Group III :Cholesterol diet + Standard Atrovastatin(10 mg/kg p.o.)
- Group IV :Cholesterol Diet + Methanolic extract(100 mg/kg p.o.)
- Group V:Diet Cholesterol + Aqueous extract(100 mg/kg p.o.)
- Group VI : Diet Cholesterol + Aqueous extract(200 mg/kg p.o.)

3.9.1 Evaluation parameters:

1. Total cholesterol
2. HDL, LDL

3.9.1.1 Determination of Total Cholesterol:

For estimation of Total-Cholesterol the reagents used are

- ***Cholesterol***
- ***Standard Cholesterol kit.***
- ***Blank solution:*** 1000 µl of 1, 10 µl of 2.
- ***Standard solution:*** 1000 µl of reagent 1, 10 µl of reaent 2.

Blank: contained 1000 µl of reagent 1.

Standard: contained 1000ul of reagent 1 and 100 µl of reagent 1 and 100 µl of reagent 3.

Test: contained 1000ul of reagent of reagent 1 and 100 µl of serum.

Mixed well, incubate at 37^{0}C for 10 minute or at room temperature (15-30^{0}C) for 30 minutes. Programmed the analyzers as per assay parameters given in kit.

- Blank the analyzers with reagent blank.
- measure absorbance of standard followed by the test at wavelength 505 nm.
- Calculate the results as per given calculation formula.

Calculation:

HDL-Cholesterol concentration (mg/dl) = Abs of test/Abs of standard X50X2

Abs- absorbance, *(2 dilution factor as sample is diluted 1:1 in step 1)

3.9.1.2 Determination of Triglycerides (TG)

TG are determined by using exact amount of TG kit from span dagnostic center Pvt. Ltd.

1) triglycerides mono reagent and

2) triglycerides standard.

Procedure: 3 different following solutions had been taken they are:

Blank: contained 1000 µl of reagent 1 and 10 µl of reagent 2.

Test: contained 1000 µl of reagent 1 and 10 µl of test serum.

Standard: contained 1000 µl of reagent 1 and 10 µl of reagent 2.

Mixed well and incubated at 37^{0}c for 10 minutes. Programmed the analyzers as per assay parameters given in kit.

- Blank the analyzer with Reagent Blank.
- Measure absorbance of standard followed by the test.

Calculation:

Triglycerides (mg/dl) = Absorbance of test/ Absorbance of Standard X 200

3.9.1.3 Estimation of Low-density lipoprotein (LDL) & Very-low density lipoprotein (VLDL)

The amount of LDL-Cholesterol and VLDL-cholesterol were calculated using fridwald's equation.

LDL-Cholesterol = Total Cholesterol – Triglycerides/5 – HDL- Cholesterol

3.9.1.4 Estimation of Glucose

Glucose is estimated using accurate Glucose kit of Span Diagnostics Pvt. ltd. the kit contains 2 reagents i.e.

1) Glucose mono reagent and

2) Glucose standard.

Procedure: 3 different following solutions had been taken they are:

Blank: contained 1000 ul of reagent 1 and 10 ul of reagent 2.

Test: contained 1000 ul of reagent 1 and 10 ul of test serum.

Standard: contained 1000 ul of reagent 1 and 10 ul of reagent 2.

Shake thoroughly and incubated at for 10 min at temp 370C.

- BlankReagent.
- Calculate absorbance of standard and test solution

Formula:

Glucose concentration= Absorbance of test/ Absorbance of standard x 200

3.10 Triton x-100 induced hyperlipidemic activity (Gundamaraju et al., 2014)

- Animal: male wistar albino
- Weight: 200-250g
- Group: 7 groups of 4 rats each

From group 2 to 5, lipid conc injected in wistar rats by intraperitoneal route of newly prepared reagent of Triton X 100 at concen. of 100 mg/kg body wt. in saline reagent for full night fasting 18h. standard drug 10 mg/kg, and group 4, 5 received a dose of *Quisqualis indica* p.o. 7 days.

- Group 1 : blanck Control (1% solution Tween 80)
- Group 2 : Control Positive having Triton X-100
- Group 3 : 10mg/kg p.o Atorvastatin andTriton X-100
- Group 4 : less con of methanolic extract 150 mg/kg,po & TritonX-100
- Group 5 : more conc of methanolic extract 300 mg/kg, po + Triton X-100
- Group 6 : less con of of hydroalcoholic extract 150 + Triton X-100
- Group 7 : more conc of hydroalcoholic extract 300 + Triton X-100

3.10.1 Biochemical Measurements

On the 8thday, afterfasting (for 18 h) all animals was make local anesthesia with PE and blood was collected. Serum blood was seprated by blood centrifugation at 3000rpm for 10min and determine the biochemistry of HDL,LDL, TC, VLDL, and Glucose.

3.10.1.1 Determination of HDL (high-density lipoprotein):

The reagents used are described below

- Cholesterol
- PEG-6000 as precipitating substance
- Standard HDL-cholesterol and lipid clearing factor

Three solutions are made for HDL-Cholesterol analysis

3.10.1.2 Doxorubicin induced cardiac toxicity in rats:100

- **Animal:** Albino rats of either sex
- **Weight:** 150-200g
- **Groups:** 5 groups was taken each group contains four animals. Rats are classified into following ways.
  - Group I : normal saline with conc. 5ml/kg bw ip
  - Group II : Doxorubicin(2.5 mg/kg bw/ip
  - Group III: atorvastatin 10 mg/kg followed by doxorubicin.
  - Group IV: animals was administered with methanolic extract of QS (300 mg/kg body weight po) for 2 weeks and then alternatively with vehicle for next 2 weeks .
  - Group V: animals received Hydroalcholic extract of QS (300 mg/kg bw/po, 2weeks) + doxorubicin of grp 2.
  - last treatment after 2 days, orbitalblood samples collected under uv light and anesthesia by heparinized microcapillaries for the analysis of biochemical parameters.

3.10.1.3 Analysis of Total Cholesterol

Reagents and chemicals involved are-

- **Cholesterol**
- **standard Cholesterol kit.**
- **Blank solution:** 1000μlof 1 and 10 μlof reagent 2.
- **Standard solution:** 1000μl of 1 and 10 μl of reagent 2.
- **Test solution:** 100 μl 1 and 10 μlof serum.

Shake thoroughly and incubated at for 10 min at temp 370C.

- Blank Reagent.
- Calculate absorbance of standard and test solution
- Blank the analyser with reagent blank.
- Determine UV-absorbance of reference at 505 nm.

Calculation:

Cholesterol concentration (mg/dl) = Absorbance of test/absorbance of standard X 200.

3.10.1.4 Determination of HDL (high-density lipoprotein):

Reagents involved are-

- **Cholesterol**
- **PEG-6000**
- **Std HDL-cholesterol +PEG-CHOD-PAP**
- **Blank solution:** 1000μlof 1 and 10 μlof reagent 2.
- **Standard solution:** 1000μl of 1 and 10 μl of reagent 2.
- **Test slution:** 100 μl 1 and 10 μlof serum.

Shake thoroughly and incubated at for 10 min at temp 370C.

- BlankReagen.
- Calculate absorbance of standard and test solution
- Blank the analyser with reagent blank.
- Determine uv-absorbance of reference at 505 nm.

Calculation:

HDL-Cholesterol concentration (mg/dl) = Abs of test/Abs of standard X50X2

3.11 STATISTICAL ANALYSIS

The findings of animal tests were performed as a mean standard deviation (standard deviation). GraphPad Prim version 6.03 program, GraphPad prizm, Inc. was used to do mathematical comparisons using one-way ANOVA followed by the Newmans-Keuls technique.

4.0 RESULS

4.1 Identification, collection and authentication of plant material:

The Aerial part of *Qisqualis indica* were collected during Januaryfrom the local surroundings in Lucknow, Uttar Pradesh. Further plant was authenticated from taxonomic NBRI Lucknow . An herbarium of plant was deposited in the division of botany. A plant specimen was deposited for future reference .

4.2 Extraction procedure:

The collected aerial parts (2.5 kg) of *Qisqualis indica* were air dried and followed by tray dryer under favourable condition and powdered it. The powdered crude drug (1.2 kg) was extracted with PE to for defatting the substances; the mark was further treated methanol and water (Hydroalcoholic) to along with methanol by Soxhlet extractor. The crude extract was further filtered and concentrated under reduced pressure at 40C and kept in desiccator.

4.3 Physicochemical parameters

Thefindingsofabove analysisofpowdered*Quisqualis indica* aerial partare given in Table 6.1. The findings of all data are represented as a % age ofair-dried plant sample.

Table - Physicochemicalanalysisofcrudepowderof *Quisqualis indica* aerial part

S. No.	Particulars	Percentage(%w/w)
1.	Lossondrying	3.8
2.	Totalash	5.7
3.	Watersolubleash	3.6
4.	Acid insolubleash	0.5
5.	Sulphatedash	2.1
6.	Methanol solubleextractivevalue	1.9
7.	Hydroalcoholic solubleextractivevalue	2.3

4.4 Phytochemical test of *Quisqualis indica* aerial parts

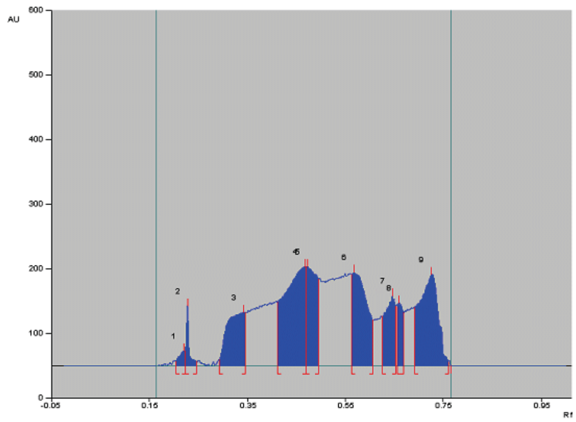
Qualitative chemical screening was performed for crude extracts *Quisqualis indica* aerial partsto identify different phytoconstituents is shown in Table 6.2.

Table 6.2: Metabolites in the extract of *Quisqualis indica* aerial parts

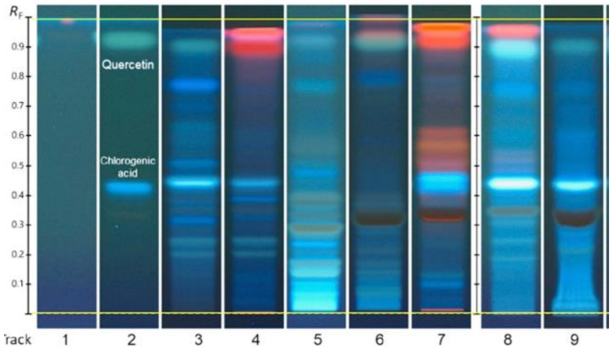
METABOLITES	METHANOLIC EXTRACT	HYDROALCOHOLIC EXTRACT
Acidic compound	+	+
Alkaloid	+	+
Amino acid	+	++
Anthraquinones	-	-
Flavonoids	++	+++
Carbohydrates	+	+
Glycosides	+	++
Saponin	+	++
Steroids	-	-
Tannin	-	-
Triterpenoids	-	-
Aromatic oil	-	-
Edible oil	+	-

+; present, **-;** absence

4.5 HPTLC finger printing analysis of methanolic extract of aerial part of *Qisqualis indica*



HPTLC chromatogram of aerial parts of *Qisqualis indica*extract has been shown under UV-254 nm wavelength



HPTLC photograph of methanolic extract of *Qisqualis indica*extract at 254 nm.

The most simple and fastest separation technology available today is HPTLC, which provides improved quality and reliability with extraordinary adaptability for varied processes. The protocol used for the isolation as well as identification of different metabolites in methanolic extract of*Qisqualis indica* (MEQI) by densitometry is identified at seven-point measurement curves in that amount of Quercetin in the MEQIwere found to be 0.034%. MEQI showed seven compounds having an R_f value of 0.12, 0.18, 0.31, 0.38, 0.49, 0.54, 0.61, 0.69 and 0.73 at λ max 254nm. A mobile phase comprising of toluene: EA: FA (8: 2: 1v/v/v) showed excellent separation amongst many other components of the sample among the other different solvents investigated. Reference chemicals and methanolic extracts have been used to create HPTLC calibration curve and densitograms. Figures 6.1 and 6.2 demonstrate the isolation of all spectra of leaf extracts, with Quercetin as the reference.

4.6 Antioxidant Activity

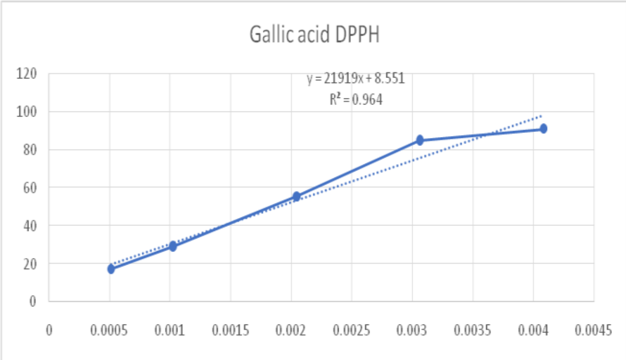
The ability of extract in scavenging DPPH radical are shown in Table 6.3 & 6.4. The leaf has the highest ability to scavenge free radicals than other parts.

Table Antioxidant DPPH Scavenging Activity.

							Applied Concentration	Abs.	Inhibition Conc.
Control	0mg	0ml	0ml	0ml	2ml	2ml	0mg/ml	0.627	
Gallic acid	10.2mg	100ml	1ml	10ml	0.1ml	2ml	0.00051mg/ml	0.518	17.38437
	10.2mg	100ml	1ml	10ml	0.2ml	2ml	0.00102mg/ml	0.444	29.186603
	10.2mg	100ml	1ml	10ml	0.4ml	2ml	0.00204mg/ml	0.28	55.342903
	10.2mg	100ml	1ml	10ml	0.6ml	2ml	0.00306mg/ml	0.095	84.848485
	10.2mg	100ml	1ml	10ml	0.8ml	2ml	0.00408mg/ml	0.058	90.749601

Table Determination of IC_{50} of MEQI

							Applied Concentration	Abs.	Inhibition Conc.
MEQI	50.2 mg	50 ml	1 ml	1 ml	0.5ml	2ml	0.251mg/ml	0.453	27.751196
	50.2 mg	50 ml	1 ml	1 ml	1ml	2ml	0.502mg/ml	0.286	54.385965
	50.2 mg	50 ml	1 ml	1 ml	2ml	2ml	1.004mg/ml	0.216	65.550239



Antioxidant capacity of MEQI with reference to Gallic acid

Cholesterol diet induce hypercholesteremia:

Table - Effect of pure methanol & hydroalcoholic samples of *Quisqualis indica* on total cholesterol, Total glycerides, VLDL, LDL, HDL, Glucose in Serum of Control and rats

S.N.	TREATMENT	TC	GLUCOSE	TG	HDL	LDL	VLDL
1	Control	151.84±0.84***	115.13±1.20***	111.42±1.78***	44.05±.49***	85.02±0.56***	22.28±0.35***
2	Cholesterol diet induced	271.54±0.60	153.62±1.08	262.82±1.63	25.12±0.39	194.46±1.2	52.56±0.32
3	Atorvastatin (10mg/kg)	174.79±.029***	115.2±.82***	153.07±0.81***	43.45±0.51***	101.37±.45***	30.50±0.19***
4	Low dose methanolic (150 mg/Kg)	183.14±0.17***	117.67±0.29***	138.56±0.25***	37.47±1.13***	118.43±.78***	27.71±0.05***
5	High dose methanolic (300 mg/kg)	181.41±0.31***	118.20±0.39***	136.17±0.41***	38.15±0.42***	92.65±.34**	27.32±0.08***
6	Low dose hydroalcoholic (150 mg/kg)	171.78±0.85***	114.52±0.29***	149.4±1.29***	41.2±0.54***	100.07±.28***	29.87±0.25***
7	High dose hydroalcoholic (300mg/kg)	158.08±0.58***	116.30±0.65***	125.54±0.86***	38.96±0.21***	95.78±.76**	25.10±0.17***

*Values are expressed in mean±SE; N = 4, ***p< 0.05 Gr. l Vs Gr ll; *** ** *p<0/05 Vs Gr ll. compared with control by using one way ANOVA and dunnet test.*

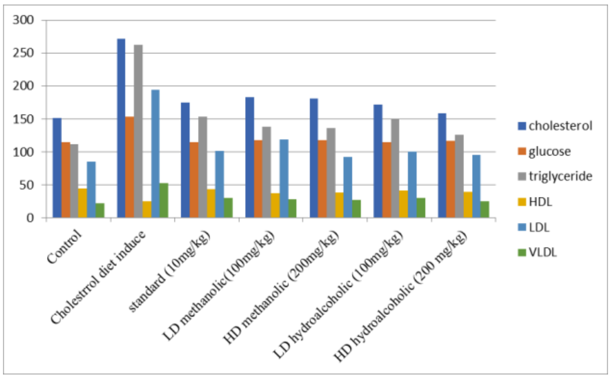


Figure for Represents several cholesterol serum level in between Control, Induced & test group

Acute toxity study suggests that the alcoholic fractions were reported non-toxic up to the dose level of 150 to 200 mg/kg that's why the proscribed dosages are same. By preliminary chemical test it was noticed that the plant extracts contain compound, such as glycosides, saponin, alkaloid, flavonoid, carbohydrates, and fixed oil. A current investigation revealed that utilization of rich source of cholesterol diet faceplates hyperlipidemia in test animals due to elevated level of cholesterol level i.e. VLDL, LDL, TC, TG and glucose whereas reduces the level of HDL as expressed in table number 6.5 and figure number 6.4. Both fractions decrease the total lipid and triglycerides level and LDL and very LDL and elevated the LDL level due to arresting of lipid peroxidation by the natural medicinal agents such as antioxidants from flavonoids. The above findings finalizes that the both extracts of plant are serve as a leading antihyperlipidemic agent at low and higher dose level along with it also reduces the toxic effects of cholesterol level and serve as effective as reference standard Atorvastatin drug.

4.7 Triton causing hyperlipidemia:

Table - Action of *Quisqualis indica* alcoholic and hydroalcoholic extract on TC, TG, HDL, VLDL, LDL, Glucose in blood of Control and rats

GR.	Treatment	TC	Glucose	TG	HDL	LDL	VLDL
1	**Control**	162.54±0.68***	116.23±0.70***	124.26±0.62***	47.3±0.36***	91.45±0.43***	24.84±0.12***
2	**Triton induced (100mg/kg)**	261.38±0.61	152.25±0.81	224.67±0.96	24.93±0.40	192.32±.73	44.54±0.19
3	**Atorvastatin (10 mg/kg)**	173.15±0.17***	122.11±0.63***	143.623±0.83***	45.14±0.38***	100.48±0.12***	28.72±0.16***
4	**Low dose methanolic (150 mg/Kg)**	164.69±0.32***	125.47±0.49***	138.70±0.32***	42.86±0.50***	95.67±0.54***	27.73±0.06***
5	**High dose methanolic (300 mg/kg)**	171.35±0.35***	123.79±0.52***	143.45±0.38***	42.92±0.23***	101.43±0.37***	28.69±0.03***
6	**Low dose hydroalcoholic (150 mg/kg)**	161.99±0.71***	118.19±0.39***	141.74±0.17***	44.19±0.23***	89.34±.24**	28.34±0.03***
7	**High dose hydroalcoholic (300 mg/kg)**	164.92±0.49	121.85±0.54***	144.74±0.49***	45.52±0.33	91.06±0.04***	28.94±0.98***

*Values are expressed in mean±SE; N = 4, ***p< 0.05 Gr. l Vs Gr ll; *** ** *p<0/05 Vs Gr ll. compared with control by using one way ANOVA and dunnet test*

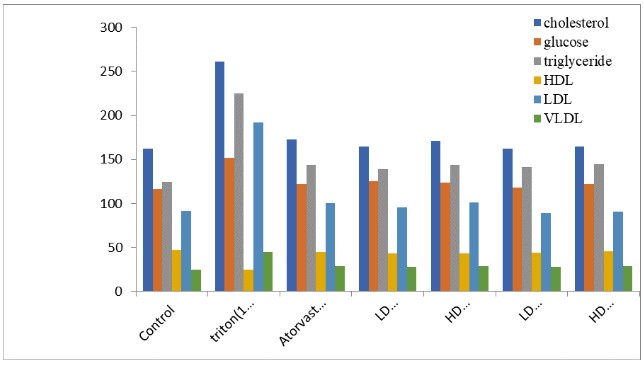


Figure for Expressed various lipid serum level b/w Control, Induced as well as Test gr.

The Present investigation showed that the using of Triton which is surfactant reduces lipid concentration in albino animals due to the increase of toxic level of lipid (LDL, TC, VLDL, TG and glucose) and reducing HDL represent in table 6.6 and figure 6.5. Both fractions decrease the total lipid and triglycerides level and LDL and very LDL and elevated the LDL level due to arresting of lipid peroxidation by the natural medicinal agents such as antioxidants from flavonoids. The above findings finalizes that the both extracts of plant are servedas a leading antihyperlipidemic agent at low and higher dose level along with it also reduces the toxic effects of cholesterol level and serve as effective as reference standard Atorvastatin drug.

4.8 Doxorubicin causing MI (Myocardial infraction)

A doxorubicin started the myocardial toxicity and action of extracts of *Qusqualis indica* was noticed that it remarkably stimulated the cardiac muscles and acts as a myocardial biomarker for MI patients and all the observations of all animal groups are recorded during the entire study. Doxorubicin tested animals, are scruff and produces an light pink tinge. All animals also having red color exudates secreted near eyes and nose regions, watery and soft fecal matter along with swelling of stomach also monitored. Above findings suggests that it has been potentially reduced in *Quisqualis indica* tested animals.

Animals with doxorubin produced promising development in the concentration of lipids and triglycerides as compared with 1 group and make light changes in HDL conc.as compared to group 1. Whereas 3,4 and 5 groups gives potencial reduced in the level lipids.

Table - Action of Methanolic and hydroalcoholic *Quisqualis indica* extract on TC, HDL, LDH, TG, and CPK in Serum of blank and treated animals.

S.N	TREATMENT	TC	TG	HDL	CPK	LDH
1	Control	175.13±0.66***	108.04±0.62***	58.64±0.72***	147.86±2.80**	141.71±9.15**
2	Doxorubicin induced (3.5mg/kg)	227.27±0.64	203.44±1.04	25.2±0.28	289.18±26.25	208.31±6.51
3	Atorvastatin (10mg/kg)	177.33±0.56***	139.79±0.78***	56.08±.40***	230.27±4.37*	175.01±3.90**
4	Methanolic (300 mg/Kg)	181.64±0.69***	123.7±0.71***	57.9±0.34***	180.34±5.12***	155.45±2.34**
5	Hydroalcoholic (300 mg/kg)	175.33±0.42***	127.87±0.68***	56.45±0.26***	190.56±4.44**	160.78±2.89**

*Values are expressed in mean±SE; N = 4, ***p< 0.05 Gr. l Vs Gr ll; *** ** *p<0/05 Vs Gr ll. compared with control by using one way ANOVA and dunnet test*

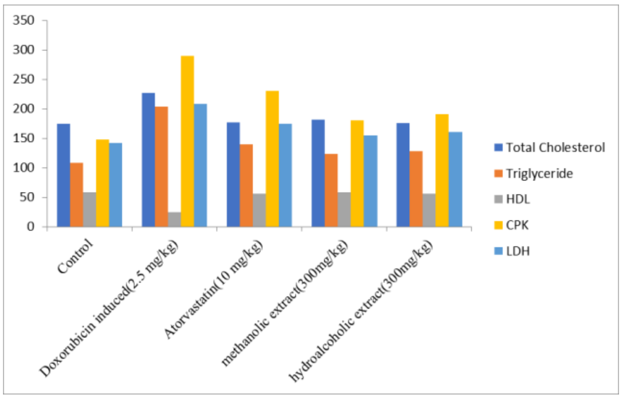


Figure 6.6 Representing various cholesterol serum con., myocadiac biomarker in between blank, Induced as well as Treated animals.

5.0 DISCUSSION

High lipid concentration in serum is due to increase in the consent of cholesterol and triglycerides in the blood. Hyperlipidaemia may be converted in chronic issue known as atherosclerosis in which a plague formation occurs in to the inner wall of arteries which prevent the regular flow of oxygenated blood through arteries to the organs. And cause severe heart attack, or stroke. Now a days heart attack is a common issue globally about 50 percent due to high intake of fat rich diet, cholesterol diet etc. Current study explores the extract of extracts of *Quisqualis indica* exhibits a remarkable control of high lipid concentration in the blood leads to increase in HDL level thus it be used as a cholesterol lowering agent and avoid severe heart attack. Lipid lowering properties of the *Quisqualis indica* extract are well documented. Although, majority of the studies are cantered on alkaloids extracted from *Quisqualis indica* extract, a report on preliminary phytochemical analysis of methanolic and hydroalcoholic extract of *Quisqualis indica* has been reported to be containing high levels of Flavonoids. This thesis is a compile of preventive role of methanolic and hydroalcoholic extract of *Quisqualis indica* against experimentally induced atherosclerosis and myocardial infarction using relevant *in vivo* experimental models. The results obtained herein have been discussed in detail of methanolic and hydroalcoholic extract of *Quisqualis indica* as a therapeutic agent and to decipher the underlying mechanism of its therapeutic potential. The current investigations aimed that to screen for the atherosclerosis & cardioprotective potency of methanolic and hydroalcoholic extracts of aerial part of *Quisqualis indica* against necrosis in rats using three models.

Quisqualis indica Linn is mildly toxic, the symptom of toxicity is bleaching, nausea, vomiting, (toasting the herb decreases its toxicity), and allergic reaction with skin, rashes with or without itching, painful swelling of ankle, increasing body temperature.

The current investigations aimed that to screen for the atherosclerosis & cardioprotective potency of methanolic and hydroalcoholic extracts of aerial part of *Quisqualis indica* against necrosis in rats using three models.

1. Cholesterol-diet induced hypercholesterolemia.
2. Triton induced hypercholesterolemia.
3. Doxorubicin induced myocardial infraction

Many lipid lowering drugs such as statins, fibrates and bile sequestrants are available in the market that decreases the onset and progression of atheromatous plaque formation when detected in its early phase (Chandra et al., 2014). Statins: Statins are HMG-CoA reductase inhibitors that limit cholesterol synthesis hence, are most popularly used for treating atherosclerotic condition in patients. Statins (Lovastatin, Pravastatin, Simvastatin, Fluvastatin, Atorvastatin, and Rosuvastatin) block HMG-CoA reductase by competitive inhibition due to a higher affinity for the enzyme than its HMG-CoA substrate that further trigger proliferation of LDL receptors and their action. Elevated plasma lipid , triglycerides, total cholesterol and HDL concentration of doxorubicin treated animals suggests that doxorubicin have been counteract with biosynthesis of phospholipids and triglycerides. Due to the administration of QS exhibits decreases in blood lipid levels and regularly stimulates in HDL lipids was noticed. Herat stroke and other failure may counteract by the use of doxorubicin in animals were suggested by enhance concentration of biomarker enzymes like LDH s well as CPK. Thus, QS is one of the options for the prevention and treatment and control of heart attach while the lipids are accumulated in to the inner wall of arteries wall in the serum of rats.

6.0 CONCLUSIONS

The current study explores the preventive role of methanolic and hydroalcoholic exract of *Quisqualis indica* against experimentally induced atherosclerosis and myocardial infarction using relevant *in vivo* experimental models. The results obtained herein have been discussed in detail of methanolic and hydroalcholic extract of *Quisqualis indica* as a therapeutic agent

It was concluded that use of both extract at dose level 100 and 200mg/kg of *Quisqualis indica* was exhibits a promising result for the controlling of lipids and triglycerides in the blood. The potency of the drug is may be due to the presence of various types of metabolites such as flavonoids, glycosides, alkaloids etc. Thus, the extracts of *QI* exert a remarkable control of toxic cholesterol & elevated the HDL concentration and served as anti-hyperlipidemic drugs. Likewise, Atorvastatin also used as cardiotonic wit lesser toxic effect.

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