Medicinal Plants with Cardioprotective Potency and Some Possible Cardiac Biomarkers for Monitoring and Diagnosing Myocardial Infarction: A Review

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**ABSTRACT**
Following the increasing rate of Cardiovascular diseases, actions have been taken and geared towards the discovery of new leads (drugs) since the existing drugs treat and manage some of these Cardiovascular ailments but with proven adverse effects on the side of the patients. Coronary artery disease which is also called Ischemic heart disease is a crucial problem worldwide, and it's known as a major non-transmissible disease. A good example of ischemic heart disease is acute myocardial infarction (MI), and its manifest due to inequality between coronary blood supply and myocardial demand. Sustained ischemia causes myocardial infarction, which leads to myocardial cell death. Cardiac biomarkers are enzymes/proteins that are used as essential tools in cardiology for primary and secondary prevention, diagnosis and management of acute myocardial infarction and other heart-related issues. The treatment and management of diseases in the African continent are achieved mostly with traditional medicine, and Plants are known to contain active components which possess medical properties that are harnessed for the treatment of different diseases. So many medicinal plants have shown to be potent in the treatment and management of this life-threatening condition known as acute myocardial infarction (heart attack). Some research-proven cardioprotective plants and possible tools for evaluating their potency are reviews in this article.

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**INTRODUCTION**
Following the increasing rate of Cardiovascular diseases, actions have been taken and geared towards the discovery of new leads (drugs) since the existing drugs treat and manage some of these Cardiovascular ailments but with proven adverse effects on the side of the patients.

The treatment and management of diseases in the African continent are achieved mostly with traditional medicine and Plants are known to contain active components which possess medical properties that are harnessed for the treatment of different diseases (Feher and Schmidt, 2003). Human survival is next to impossible without the heart. Significant reduction or blockage in the blood supply to the heart cause myocardial infarction and necrosis of myocytes is the pathological indication of myocardial infarction (Raja et al., 2016). Several cardiac biomarkers can be used to monitor the effectiveness of any cardioprotective medicinal plant and for the diagnosis of myocardial infarction and other heart-
related issues (Johannes et al., 2015). This article reviewed some of the medicinal plants with cardioprotective potency and possible cardiac biomarkers for monitoring and diagnosing myocardial infarction.

Cardioprotective Properties of some Medicinal Plants

Moringa plant

Moringa plant is a herbaceous plant commonly used and widely known for its medicinal effects. A report from Mahendra et al. (2010) revealed that Moringa oleifera has some cardioprotective activity where the aqueous extract of Morning oleifera was administered to the Isoproterenol induced rats and it showed significant activity in lowering the cholesterol in the rats. Further study confirmed its cardioprotective activity in rats, where it reveals that the antioxidant defense system of the butanolic fraction of Moringa oleifera could be responsible for the Protection of the myocardium (Panda, 2015). Moringa oleifera leaf also has the ability to reduced cardiac function biomarkers in rats. Okwari et al. (2013) reported that Moringa oleifera increased serum HDL-C and reduced AST which are pointers that Moringa oleifera leaf extract might exhibit cardioprotective action as well.

Vernonia amygdalina

V. amygdalina (bitter leaf) is a widely used local plant in Nigeria. It is used for both therapeutic and nutritional purposes. Imafidon and Okunrobo (2012) reported that aqueous extract of V. amygdalina exerts significant protection against oxidative stress induced by the Red dye adulterated palm oil. Asuquo et al. (2009) reported that Ocimum gratissimum and V. amygdalina possess some cardiac protection on Streptozocycin induced rats, although the cardiac activity of Ocimum gratissimum was higher than V. amygdalina.

Garcinia kola

Bitter kola is a much-appreciated ingredient in African traditional medicine. Kolaviron has been revealed to exhibit many pharmacological effects such as antioxidant, antiatherogenic, antihypertensive, antidiabetic etc.

A study conducted by Nwaneri et al. (2014) revealed that kolaviron has the ability to reduce cholesterol both in the heart. Hence, Garcinia kola can be used as a dietary supplement in the prevention and treatment of heart diseases.

Furthermore, both cardiac glycosides and steroidal compounds were found in G. kola extracts responsible for the treatment of chest pain and cardiac infection. More also, a review by Raja et al. (2016) described the effect of Garcinia kola on isoproterenol-induced neurosis in rats with a decrease in elevated biomarkers. Additionally, Garcinia kola contains a vasoactive substance that has blood pressure reducing effect.

Anacardium occidentale

Anacardium occidentale Linn is a plant belonging to the family Anacardiaceae. The plant has been used as folkloric medicine in the treatment of inflammation, diabetes, hypertension etc. Cintia et al. (2018), in his study with A. Occidentale in rats, revealed the antihypertensive activity (hypertension which is a risk factor that can cause heart failure, heart attack or even any possible cardiovascular diseases) Hexane extract of the plant. It is also worthy to note that the bark stem extract of Anacardium occidentale has shown hypotensive activities in vivo and cardio-inhibitory activities (Cintia et al., 2018)

Mucuna puriens

Mucuna pruriens, generally known as velvet bean, belongs to the family Fabaceae. Different parts of the plant possess valuable medicinal properties in the traditional system of medicine. A studies by Krishna and Raja (2018) stated that methanol extract of Mucuna pruriens pre-co-treatment prohibited nearly entire parameters of isoproterenol persuaded myocardial necrosis in rats. Therefore, the protection of the heart against isoproterenol encouraged myocardial necrosis was through sustaining endogenous antioxidant enzyme actions, which provides scientific proof of the traditional values.

Fung et al. (2012) conducted an interesting study were the rats involved were induced with snake venom and was pretreated with M. pruriens extract. The results demonstrated a protective effect of Mucuna pruriens pretreatment against snake venom poisoning, which may involve a direct action on the heart. M. pruriens seed may have a unique cardioprotective agent with potential therapeutic value.

Zingiber officinale

Ginger botanically called Zingiber officinale Roscoe and from the family, Zingiberaceae is one of the world’s best-known spices, and it has also been universally used throughout history for its health ben-
Garlic (Allium sativum) is a well-known medicinal plant that grows in all parts of the world and the bulb is extensively used in both traditional and general medicine. Shackkebaei et al. (2010) reported that chronic oral administration of garlic homogenate protected the rat heart from in vitro ischemic reperfusion injury. allicin which is a principal bioactive compound of garlic juice, may be responsible for the protective role (Shackkebaei et al., 2010).

Findings by Gomaa et al. (2018) provide evidence that administration of Garlic extract can protect the heart through reducing oxidative stress and controlling cardiac Na+/K+ -ATPase activity and Ca²⁺ levels, hence confirming the myocardial protective ability of Garlic.

A study by Senthilkumara et al. (2010) stated that Garlic oil has a cardioprotective activity, which was evident in its ability to low the levels of serum marker enzymes and lipid peroxidation and elevation the levels of GSH (Senthilkumara et al., 2010).

Allium cepa

Allium cepa belong to the family Liliaceae, cultivated for over five thousand years and have been used in herbal medicine and as an indispensable flavouring agent and as a vegetable.

An in vivo study by Geeta et al. (2016) showed that ISO produced significant myocardial injury and administration of A. cepa in the dose of 400mg/kg significantly restored the damage parameters (HR, R-R interval, Troponin-I, Creatine kinase-MB, glutamate-pyruvate transaminase, and oxidative stress markers). Also, Jalaiah et al. (2017) further confirmed in their study that A. cepa leaves possess some cardioprotective function in which there were a significant reduction in ALP, LDH and CK levels together with protection histoarchitectural changes. Additionally, Allium cepa leaves extract possesses antioxidant and cardioprotective activity, which might be due to flavonoids and anthocynidins when administered to Doxorubicin-induced rats.

Curcuma longa

The rhizomes of turmeric botanically called Curcuma longa L. and from a family Zingiberaceae, play an essential role as an ill-health remedy. Nabofa et al. (2018), in their research work, isolated some bioactive compounds from curcuma longa and investigated its cardioprotective activity, and the result showed that the formulated curcumin-nisin based nanoparticle confers a significant level of cardioprotection in the guinea pig and is nontoxic. Another study confirms its activity in Doxorubicin-induced cardiotoxicity in rats where Curcuma longa revealed significant protection, which was proven by a significant reduction in mortality, CK-MB and LDH activities (El-Sayed et al., 2011).

According to Nahar and Akhter (2018), Curcuma longa has cardioprotective effects, which are most likely due to antioxidant and free radical scavenging activity. Hence, Curcuma longa can be used as a home remedy that reduces premature death resulting from myocardial infarction (Nahar and Akhter, 2018). Furthermore, curcumin alone and its combination with piperine showed significant protection against Cylophosphamide-induced myocardial toxicity.

Hibiscus sabdariffa

Hibiscus sabdariffa from the Malvaceae family is cultured and grown naturally in tropical regions. This plant is reported to be used in different countries as a cooking and curative ingredient. In a study by Azar et al. (2017), the protective effect of Hibiscus sabdariffa on Doxorubicin-induced cytotoxicity in H9c2 cardiomyoblast cells was conducted and the findings revealed that pretreatment with hibiscus sabdariffa extract significantly decreased cell apoptosis after 24 hr at a concentration of 31.25-250 μg/mL which suggested that H. sabdariffa could have cardioprotective effects on Doxorubicin-induced toxicity partly by antiapoptotic activity.

Further study by Khattab et al. (2016) confirmed the consumption of Hibiscus sabdariffa attenuated the cardiotoxicity induced by Adriamycin. Hibiscus sabdariffa also has potential effects as a cardioprotective agent in diabetes condition.

A recent study by Israel et al. (2019) suggested that the treatment with an infusion from Hibiscus sabdariffa calices protects the cardiac function from damage by ischemia and reperfusion through the antiox-
Some Biomarkers for Evaluation of Myocardial Infarction

The following are enzymes and proteins used in the analysis of myocardial infarction, of which elevation in their value indicates cardiac cell injury.

Troponin

This is the best commonly useful biomarker for myocardial injury. The cTn complex comprises 2 subunits—C, I, and T which together regulate calcium-mediated interaction of actin and myosin, leading to the contraction and relaxation of striated muscle (Daubert and Jeremias, 2010). Troponin I (cTnI) and troponin T (cTnT) are extremely specific for myocardial damage because they are found only in cardiac muscle (Ahmad and Sharma, 2012). Damage to the cardiac myocyte leads to the continued rise in peripheral levels of troponin. After infarction, cTn remains detectable for days (4–7 days for cTnI and 10–14 days for cTnT) (Ahmad and Sharma, 2012).

Creatine Kinase MB (CK-MB)

In the 1970s and 1980s, CK-MB was the standard for the diagnosis and quantitative assessment of myocardial infarction (Rachel, 2016). CK is an enzyme that catalyzes the reversible transformation of creatine and ATP to creatine phosphate and ADP (Rachel, 2016). Creatine kinase (CK) is mainly found in the heart, skeletal muscles, and brain. The heart, a muscle that frequently contracts without a break, has a high energy requirement. Thus, when the heart muscle dies during myocardial infarction, it discharges many molecules into the bloodstream, one of the more abundant being CK. There are three types of CK called isoenzymes: CKMM, found in skeletal muscle and heart; CK-MB, found in the heart and rises when the heart muscle is damaged; and CK-BB, found mostly in the brain (Bodor, 2016).

Glucagon-like Peptide 1

Glucagon-like Peptide 1, a gut incretin hormone with the ability to induce postprandial insulin secretion, can be used in the prediction of acute myocardial infarction. Glucagon-like Peptide 1 were recently found to be elevated in acute myocardial infarction. It is commonly used in monitoring the risk of a heart attack in a patient with diabetes (Josh et al., 2018).

Lactate dehydrogenase (LDH)

LDH is expressed in many organs and well known to have five isoenzymes. The heart has LDH1, but it lacks specificity due to its presence in skeletal muscle, stomach, erythrocytes, kidney, brain, and pancreas. It surges within 6–12 hours from the onset of chest pain, peaks over 1–3 days, and returns to normal values within 8–14 days (Ayidin et al., 2019).

Aspartate amino transferase (AST)

This was the initial biomarker used in the diagnosis of acute myocardial infarction (AMI) but is not currently used because of its non-specificity to the heart. (Ayidin et al., 2019)

CONCLUSION

Cardiovascular diseases (CVDs) are regarded as the main cause of death worldwide and are mostly refers to Myocardial infarction, angina pectoris, hypertension, stroke and other circulatory diseases. Medicinal plants have been used for centuries to combat many health challenges and are also a useful component in the pharmaceutical industries. The treatment and management of acute myocardial infarction using medicinal plants have been proven by Researchers and simple tools for the diagnosis of myocardial infarction have also been established. Some of the biomarkers for the evaluation and management of Myocardial infarction are Troponin, CK-MB, Glucagon-like Peptide 1, Lactate dehydrogenase, AST and ALT.

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Conflict of Interest

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