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# Hypotensive effect of the acetone fraction of the crude methanol extract of *Stereospermum kunthianum* (Bignoniaceae) stem bark

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**Abstract**

Hypertension is a leading cause of cardiovascular disease worldwide. Despite a diversity of pharmacological agents to treat high blood pressure, suboptimal control remains a significant problem in as many as 43% of patients and this rate has not significantly improved over the two decades. There are several factors contributing to this including patient's non-adherence due to complex drug regimes and medications side effects, under-treatment and treatment resistance. There, thus, remains a need to find herbal treatment to antihypertensive therapy that facilitate attainment of optimal blood pressure levels. *Stereospermum kunthianum* (Bignoniaceae) herb is used in Hausa ethnomedicine in treating bronchitis, venereal diseases, diarrhea, ulcers, leprosy, skin eruptions, respiratory ailments and gastritis. It is also used as abortifacient and as antihypertensive agent. General phytochemical investigation of methanolic extract of the stem bark of *Stereospermum, kunthianum* revealed the presence of sterol/triterpenes, coumarin, saponins, flavonoids, steroids, tannins, carbohydrates while alkaloids are rare. Acetone fraction of the crude methanol extract was subjected to biological studies to investigate the antihypertensive properties of the plant. The effect of acetone fraction of the *Stereospermum kunthianum* was compared with normal basal rhythm and Acetylcholine. The drugs and various doses of the extract were injected through a cannula inserted in the femoral vein. The extract dependently decreased Cat blood pressure and the decrease in the blood pressure was not blocked by atropine. The antihypertensive effects of the stem bark of *Stereospermum kunthianum* examined in this study showed that the plant is capable of exerting effect on the hypertensive patients.

*Keywords*: Antimicrobial; *Stereospermum kunthianum*; Phytochemical; Antihypertensive.

## INTRODUCTION

Hypertension involves mainly two types, essential and secondary. The pathogenesis of essential hypertension is multi factorial and highly complex which will be caused by increase in sympathetic nervous system activity, increase in production of sodium-retaining hormones and vasoconstrictors, deficiencies of vasodilators such as prostacycline and nitric oxide, inappropriate or increased rennin secretion resulting in increased production of angiotensin II and genetic predisposition [1]. Pathogenesis of secondary hypertension will be caused by chronic kidney disease, renovascular disease, Cushing's syndrome,

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pheochromocytoma, drugs such as non-steroidal anti-inflammatory drugs and oral contraceptives. All these factors will cause increase in preload, increase in contractility, functional constriction and structural hypertrophy, which result in increase in cardiac output and peripheral vascular resistance, will lead to hypertension [1].

The first-line of treating hypertension is considered as diuretics. Diuretics reduce blood pressure by inducing frequent urination. By urination, body is able to flush out excess salts and water in which if left in the body there will be increased in blood pressure. Angiotensin converting enzyme inhibitors (ACE) another group of antihypertensive drugs causes dilation of the blood vessels that will leads to an increase in blood flow and decrease in blood pressure. Calcium channel blockers is another set of drugs for treating hypertension, they cause widening of the blood vessels by blocking the entry of calcium into the cells of the heart and blood vessels. The different side effects such as muscle cramps, dehydration, dizziness, extreme tiredness, skin rash, blurred vision, abnormal heart rate, cough, vomiting etc. that come with the use of these drugs are by far their biggest disadvantages. Therefore, scientific studies suggest different lifestyle changes and use of appropriate herbal medicine in treatment of hypertension [2]

In Hausa ethnomedicine of Northern Nigeria, some medicinal plants are used frequently for treating hypertension and these include *Stereospermum kunthianum* (Bignoniaceae). The bark is valued by both Hausas and Fulanis as a remedy for diarrhoea and dysentery. It is also used for venereal disease, a decoction boiled with natron, or, as in Sokoto, the bark mixed with a white variety of Guinea-corn to which red natron is added in boiling, being used for gonorrhea. The root, along with other roots, including that of the palm *Hyphaene thebaica* is a remedy for the disease called 'rana' with symptoms of haematuria [3].

## EXPERIMENTAL

**Chemicals and drugs.** All chemicals and drugs used were of analytical grade. Heparin, sodium Thiopentane, Atropine, Acetylcholine, Adrenaline (Aldrich Chemical Company, Gillingham England) were obtained from Department of Pharmacology Ahmadu Bello University, Zaria, Nigeria.

**Plant material.** The plant *Stereospermum kunthianum* CHAM (Bignoniaceae) was collected in the month of March 2012. The plant was authenticated at herbarium unit, Department of Biological Sciences, A.B.U., Zaria. The plant material was compared with the existing Herbarium Sample, (voucher No. 1381). The fresh plant material was carefully cut, air-dried and made into powder using pestle and mortar and subsequently referred to as powdered plant material of stem bark.

**Extract preparation.** The powdered Stem bark (2.00 kg) of the plant was extracted with methanol using maceration method for 11 days. Solvent used was recovered at reduced pressure to afford a black oily material (337.56 g) that was there after referred to as the methanolic extract coded ME. The methanol extract (200 g) was treated successively with hexane, ethyl acetate and acetone that afforded hexane (6.71 g), ethyl acetate (5.25 g), and acetone (33.67 g) fractions respectively.

**Phytochemical Analysis.** The phytochemical assay of alkaloids, flavonoids, cardiac glycosides, tannins and saponins was carried out according to established procedures [4,5].

**Experimental design.** Male cats weighing between 1.33 and 1.72 kg were used for the experiment. The animals were anaesthetized using Thiopentane sodium 40 mg/kg intraperitoneally. The animals lost consciousness after 30 minutes of

administration, after which it was properly secured on the dissecting table by using twine to tie its limbs, to prevent unwanted movement of the animal during the experiment. The basal blood pressure was recorded on a filter paper of the micro-dynamometer after the administration of the Heparinised normal saline to prevent blood clotting. The femoral vein was exposed and cannulated for drug administration. The right carotid artery was also exposed and canulated for blood pressure recordings. The trachea was exposed to assist in respiration. The paper speed was set and maintained at 95mm/min. The Microdynamometer (Ugo basile 7050) was set at sensitivity of 3.9. 0.9% Normal saline was injected through the femoral vein and subsequently Acetylcholine and Adrenaline (0.1 ml of 10 µg/ml), Acetone fraction (0.1 – 0.4 ml of 10 mg/ml) was administered and the responses recorded. Acetone fraction (0.2ml of 10mg/ml) was administered in the presence of Atropine (0.1 ml - 0.2 ml of 10 µg/ml) and the response was also recorded. Flushing was properly done after every administration of extract and drugs until it was brought back to normal

## RESULTS

**Phytochemical analysis.** The preliminary phytochemical screening of the methanol crude extract of *Stereospermum kunthianum* revealed the presence of flavonoids, tannins, saponins, steroids, coumarins and carbohydrates while alkaloids are rare.

**Effect of acetone fraction on cat blood pressure.** Normal saline (0.9%) when administered produced no effect on the cat blood pressure (Figure 1). Acetylcholine at concentration of 0.75 µg/kg decreased the cat blood pressure (Figure 2). The acetone fraction (3.4 mg/kg – 6.79 mg/kg) concentrations dependently decreased the cat blood pressure (Figures 3, 4 and 5). The decreased in the blood pressure induced by the acetone fraction was not blocked by atropine (3.4 mg/kg – 4.5 mg/kg) (Figures 6 and 7). Decrease in blood pressure by acetylcholine did not block the action of Atropine as observed in (Figure 8). Adrenaline (1 µg/kg) when administered alone, increased the cat blood pressure (Figure 9), Adrenaline (1 µg/kg) and acetone fraction (1.5 mg/kg – 6.79 mg/kg), there was a slight increase in the cat blood pressure (Figure 10 and11). However, at a higher dose of 1 µg/kg of adrenaline and 13.75 mg/kg of acetone fraction, the fraction blocked the action of adrenaline (Figure 12 and 13).

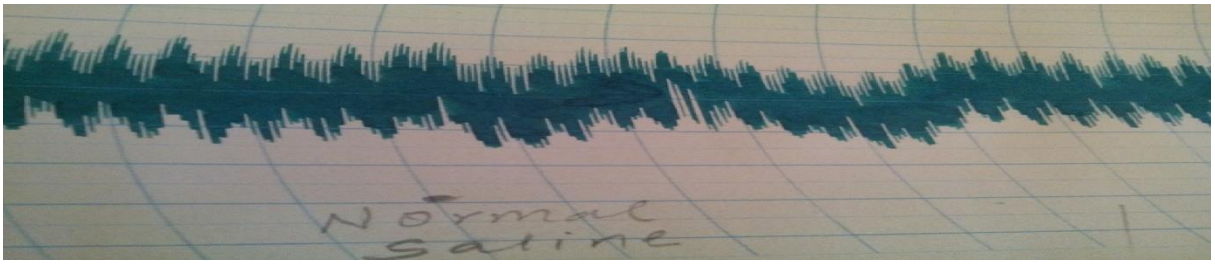


Figure 1: Effect of 0.9% Normal Saline on cat blood pressure

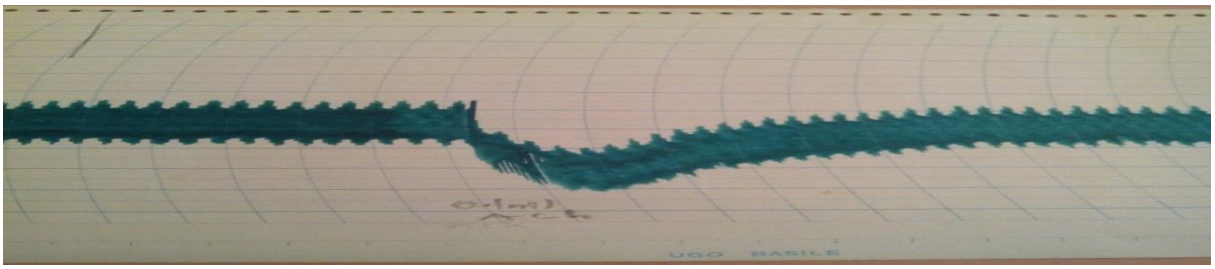

Figure 2: Effect of Acetylcholine (0.75 µg/kg) on cat blood pressure

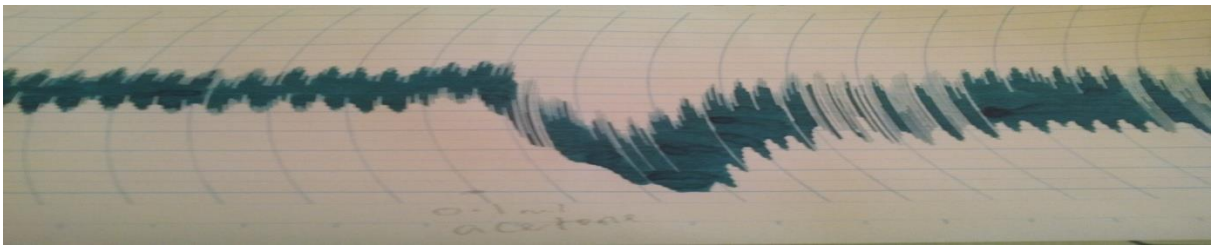

Figure 3**:** Effect of Acetone fraction (3.4 mg/kg) on cat blood pressure

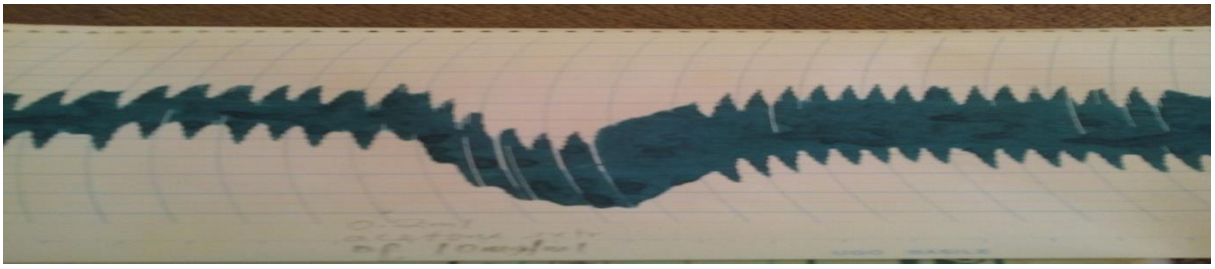

Figure 4**:** Effect of acetone fraction (4.5 mg/kg) on cat blood pressure

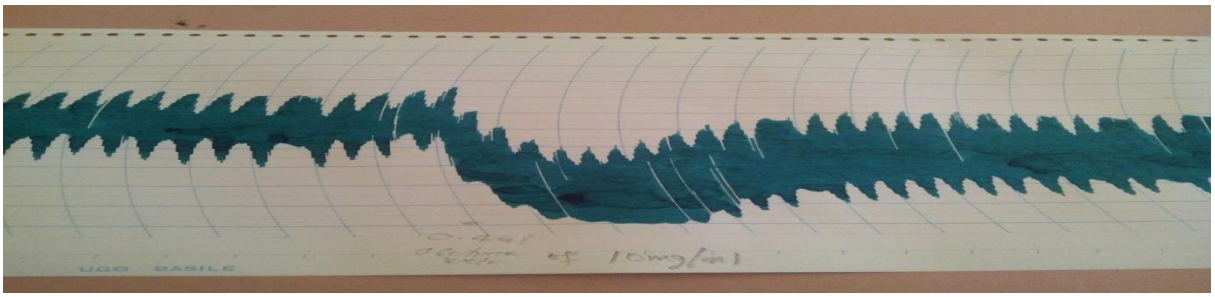

Figure 5**:** Effect of acetone fraction (6.79 mg/kg) on cat blood pressure

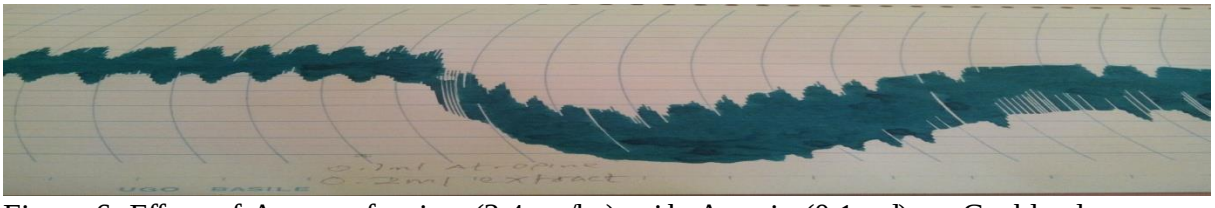

Figure 6**:** Effect of Acetone fraction (3.4 mg/kg) with Atropine(0.1 ml) on Cat blood pressure

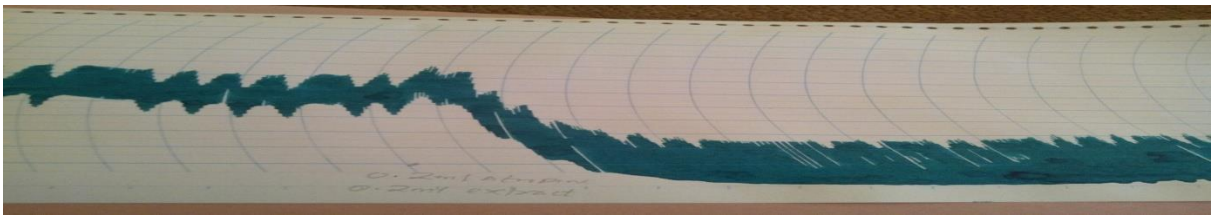

Figure 7**:** Effect of Acetone fraction (4.5 mg/kg) with Atropine (0.2 ml) on cat blood pressure

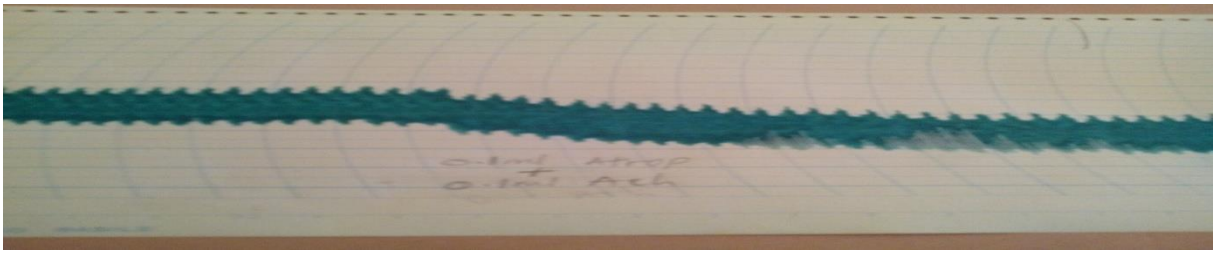

Figure 8 : Effect of Atropine (0.75 µg/kg) and Acetylcoline(0.75 µg/kg) on cat blood pressure

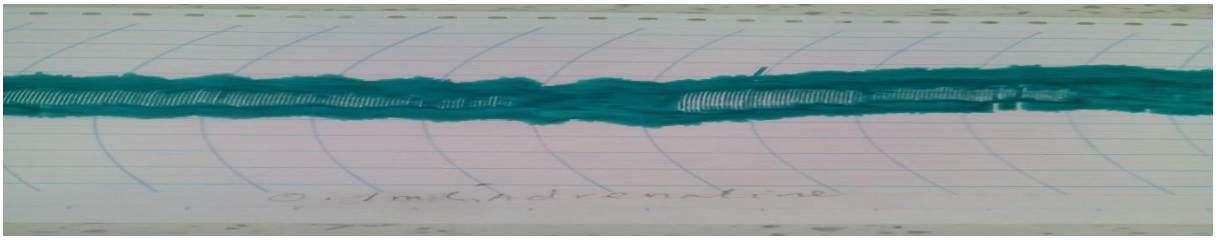

Figure 9: Effect of adrenaline (1 µg/kg) on cat blood pressure

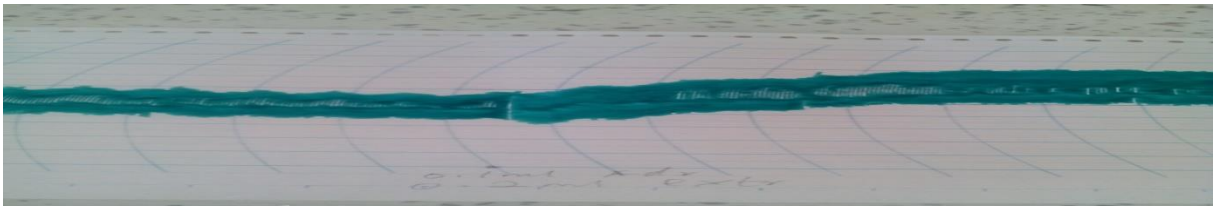

Figure 10: Effect of adrenaline (1 µg/kg) on cat blood pressure

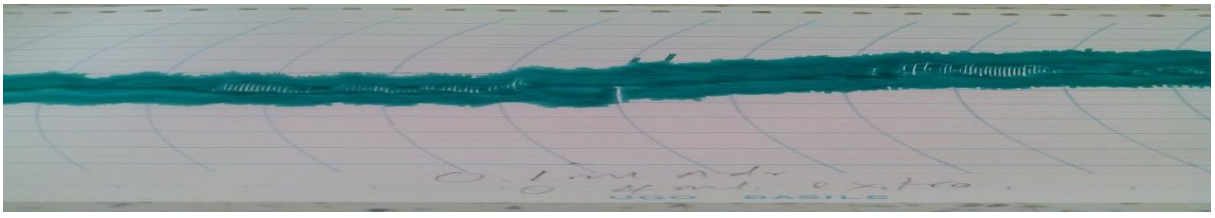

Figure 11: Effect of adrenaline (1 µg/kg) and acetone fraction (1.5 µg/kg – 6.79 µg/kg) on cat blood pressure

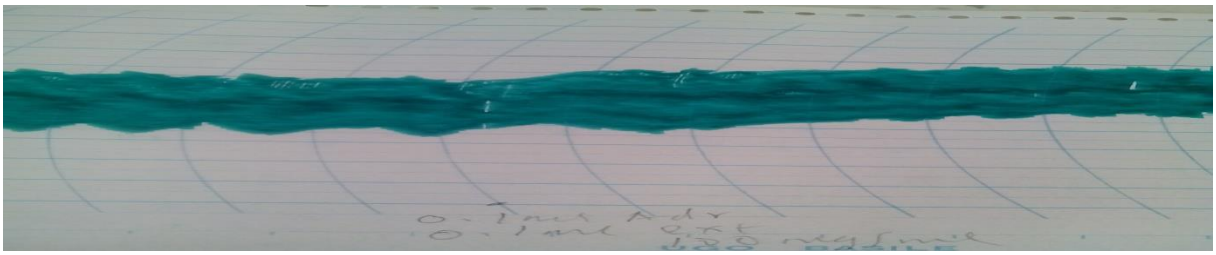

Figure 12: Effect of adrenaline (1 µg/kg) and acetone fraction (1.4 mg/kg – 13.75 mg/kg) on cat blood pressure

## DISCUSSION

The result of preliminary phytochemical screening carried out on the methanolic extract revealed the presence of flavonoids, tannins, steroids/triterpenes and saponins. These phytochemical constituents have been reported to be associated with pharmacological activities of plants [6].

Acetylcholine (ACh) is one of the many neurotransmitters in the autonomic nervous system (ANS). It acts on both the peripheral nervous system (PNS) and central nervous system (CNS) and is the only neurotransmitter used in the motor division of the somatic nervous system. Acetylcholine is also the principal neurotransmitter in all autonomic ganglia.

In cardiac tissue acetylcholine neurotransmission has an inhibitory effect, which lowers heart rate. However, acetylcholine also behaves as an excitatory neurotransmitter at neuromuscular junctions in skeletal muscle [7].

Atropine is commonly classified as an anticholinergic or anti-parasymphathetic drugs. It is termed an antimuscarinic agent since it antagonizes the muscarinic actions of acetylcholine and other choline esters. Atropine inhibits the muscarinic actions of acetylcholine on structures innervated by postganglionic cholinergic nerves, and on smooth muscles, which respond to endogenous acetylcholine but are not so innervated. As with other antimuscarinic agents, the major action of atropine is a competitive or surmountable antagonism, which can be overcome by increasing the concentration of acetylcholine at receptor sites of the effector organ. The receptors antagonized by atropine are the peripheral structures that are stimulated by muscarine. Responses to postganglionic cholinergic nerve stimulation also may be inhibited by atropine but this occurs less readily than with responses to injected choline esters [8].

The results from this showed that acetylcholine lowered blood pressure of anaesthetized cats. Unlike acetylcholine, adrenaline elevated the blood pressure. Acetone fraction decreased blood pressure like acetylcholine and also blocked the action of adrenaline as observed. The blood pressure lowering effect of the acetone fraction was not blocked with the muscarinic receptor antagonist, atropine. Atropine acts by blocking or antagonising muscarinic receptors, this suggests that the acetone fraction might be acting via different mechanism and not through muscarinic receptors interaction; therefore, blood pressure reducing effect of acetone fraction can be observed in this study and non-antagonism of effect by Atropine suggesting non-involvement of muscarinic receptors.

**Conclusion.** From the findings in this study, the use of *Stereospermum kunthianum* in treatment of hypertension has a scientific basis. The dose-dependent decrease in blood pressure, indicating that the acetone fraction might lower the blood pressure by reducing the total peripheral resistances and/or by decreasing the cardiac output via a reduction in the heart rate. This benefit effect of the

plant extract might be attributed to the presence of bioactive compounds such as phenolic components, flavonoids and saponins present in the plant extract. Clinicians and pharmacologists will find this study highly relevant with a view to actually formulating a medicament from the acetone fraction that could be effectively used in humans for the treatment of hypertension.

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