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Short Communication

## Anti-Stress Potential of Aqueous Seed Extract of *Aframomum Melegueta*

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### Abstract

This study presents the results of the phytochemical screening and anti-stress potential of aqueous seed extract of *Aframomum melegueta* (MS) in mice. The forced swimming endurance test was utilized as a model for the evaluation of the anti-stress property of MS. The phytochemical tests showed the presence of alkaloids, reducing sugars, flavonoids, phenols and glycosides in the extract of *A. melegueta*. In the forced swimming test, MS (50-200 mg/kg, i.p) significantly prolonged the duration of immobility in a dose-related manner. The duration of immobility (s) was increased from 236.67±18.2 in the control group to 410 ±11.57 and 579 ±28.71 in groups pretreated with 100 and 200 mg/kg of MS respectively. The inability of the extract of this plant to reduce the duration of immobility, therefore suggests a lack of anti-stress property.

### Keywords:

Forced swimming test, immobility, *Aframomum melegueta*, *a-methylidopa*, *amphetamine*

### INTRODUCTION

Stress is a biological response to aversive conditions that tend to threaten or perturb the homeostasis of the organisms (Bhattacharya and Ghosal, 2000; Piazza and Lemoal, 1998; Hoffman, 2001). Stress has been shown to induce a marked rise in the brain levels of biogenic amines such as adrenaline and nor-adrenaline (Subarnas *et al.*, 1993; Anisman and Zacharko, 1991). These chemical substances are released in response to stress signals and are meant to assist the organisms to cope with stress (Anisman and Zacharko, 1991; Bishayee and Chatterjee, 1995). However, increased utilization of the amines resulting in their depletion in prolonged severe stress is responsible for fatigue, reduced stamina, lowered mood (hopelessness) or despair seen in individuals under intense stress (Subarnas *et al.*, 1993; Bhattacharya and Ghosal, 2000). It has been reported that drugs with anti-stress properties induce a state of non-specific resistance against stressful conditions (Bhattacharya and Ghosal, 2000). Amphetamine, caffeine and anabolic steroids are the most widely used drugs by people to combat stress (Piazza and Lemoal, 1998; Nhling *et al.*, 1992; Sapolsky

*et al.*, 2000; Hoffman, 2001). However, the incidence of toxicity and dependence has limited the therapeutic usefulness of these drugs in the control of stressful events (Piazza and Lemoal, 1998; Nhling *et al.*, 1992; Sapolsky *et al.*, 2000; Hoffman, 2001). The potential utility of safer and cheaper herbal medicines as anti-stress agents have been reported in literature (Ellis and Reddy, 2002; Balandrin *et al.*, 1993; Grover *et al.*, 1995; Josey and Tackett, 1999; Subarnas *et al.*, 1993). Moreover, a number of plants such as *Asparagus racemosus*, *Ocimum sanctum*, *Nithamla somnifera*, *Phyllanthus*, *Panax ginseng*, *Hypericum perforatum* and *Ginkgo biloba* have been shown to possess anti-stress properties (Ellis and Reddy, 2002; Grover *et al.*, 1995; Bhattacharya and Ghosal, 2000).

The natives of northern Nigeria widely chewed the seeds of *Aframomum melegueta* k. Schum (Zingiberaceae) for its presumed central nervous system (CNS) stimulant and endurance promoting effects (Enyikwola, 1994). Although, the antimicrobial, anti-ulcer, cytoprotective and analgesic properties of the seed extract of this plant have been reported (Galal, 1996; Rafatullah *et al.*, 1995; Umukoro and Ashorobi, 2001), no studies have shown its anti-stress or endurance

promoting activity. This study reports on the phytochemical constituents and anti-stress potential of aqueous seed extract of *Aframomum melegueta* in mice.

## MATERIALS AND METHODS

**Laboratory Animals:** Swiss albino mice of either sex (18-25 g) used in the study were obtained from the Laboratory Animals center, College of Medicine, University of Lagos, Nigeria. They were kept in a well-ventilated environment, had free access to food and water ad libitum.

**Drugs:** Amphetamine sulphate (Sigma, USA) and ?-methyldopa hydrochloride (Sigma, USA) were used as reference drugs in the study.

**Plant material:** The dried fruits of *Aframomum melegueta* were purchased from Mushin market, Lagos and identified and authenticated at the Department of Botany and Microbiology, University of Lagos, Nigeria. Voucher specimen of the fruit was deposited in the herbarium of the Department of Pharmacognosy, College of Medicine, University of Lagos, Nigeria.

**Preparation of plant extract and drug administration:** The aqueous seed extract of MS was prepared as previously described (Umukoro and Ashorobi, 2001). The seeds of *A. melegueta* were ground into fine powder and 200 g of the powdered seeds was soaked in 500 ml of distilled water for 48 hr. The solution was thereafter filtered and the filtrate was evaporated to a brownish sticky residue in an oven at 38°C. The yield of the extract was 12.5 % with reference to the powdered seeds. On any experimental day, 200 mg of the residue was dissolved in 10 ml of distilled water and ready for use. Mice were divided into 6 groups, each group containing 10 animals. The first 3 groups received intraperitoneal (i.p) injection of MS in doses of 50, 100 and 200 mg/kg respectively. The fourth and the fifth group received ?-methyldopa (10 mg/kg, i.p) and amphetamine (5 mg/kg, i.p) respectively. The sixth group received normal saline (10 ml/kg, i.p). The modified method described by Subarnas et al., (1993) was used in this study. The animals were forced to swim individually in a transparent tank (30 x 45 x 40 cm) containing water at room temperature. The total duration of immobility was measured for 30 minutes. The mice were judged to be immobile whenever they remained floating passively in water with their head above the water (Subarnas et al., 1993).

**Phytochemical Screening:** The extract of *A. melegueta* seed was screened for the presence of alkaloids, reducing sugars, flavonoids, phenols, tannins, saponins, steroids, anthraquinones and glycosides (Trease and Evans, 2000).

**Data analysis:** Results are expressed as mean ? s.e.m. Statistical comparisons were made Student's t test. P-values less than 0.05 were considered statistically significant.

## RESULTS

MS (50-200 mg/kg, i.p) produced a significant increase in the duration of immobility in mice in a dose-related manner. Similar effects were observed in animals pretreated with ∞-methyldopa (10 mg/kg, i.p). However, 5 mg/kg of amphetamine (5 mg/kg, i.p) significantly reduced the duration of immobility of the treated animals (Table 1). Phytochemical screening revealed the presence of alkaloids, flavonoids, glycosides, phenols and simple sugars in MS.

**Table 1:**

Effects of aqueous seed extract of *Aframomum melegueta* on the duration of immobility in mice

Treatment	Dose (mg/kg, i.p)	Duration of immobility (s)
Saline-control	-	236.67 ± 18.2
<i>A. melegueta</i>	50	*338.83 ± 9.30
<i>A. melegueta</i>	100	*410 ± 11.57
<i>A. melegueta</i>	200	*579 ± 28.71
∞-methyl-dopa	10	*548 ± 29.88
Amphetamine	5	*29 ± 2.50

Each value represents the mean ± SEM of 10 animals/group. \*P < 0.05 compared with saline-control group (Students' t test).

## DISCUSSION

The results of the study showed that the extract did not demonstrate anti-stress property, as it could not reduce the duration of immobility in the forced swimming test. The forced swimming test is the most widely used paradigm for the evaluation of anti-stress and antidepressant property of a novel compound (Subarnas, et al., 1993; Anisman and Zacharko, 1991)). This paradigm is based on the observation that animals forced to swim in water eventually assumed a characteristic immobile posture, devoid of any activity (Subarnas et al., 1993). The appearance of immobility therefore, reflects a state of tiredness, fatigue, reduced stamina or a lowered mood (hopelessness) (Subarnas et al., 1993; Bhattacharya and Ghosal, 2000). These signs represent the core symptoms observed in depressed patients and in individuals under

intense stress (Anisman and Zacharko, 1991). It is well known that drugs with anti-stress properties reduce the duration of immobility in animals (Subarnas *et al.*, 1993). The inability of the extract of this plant to reduce the duration of immobility, therefore suggests a lack of anti-stress property.

Central neurotransmitters are functionally involved in the regulation of stress responses (Bishayee and Chatterjee, 1995). These chemical substances are released in response to stress and are meant to strengthen the organisms by providing resistance against the stressful events, a process known as adaptation (Anisman and Zacharko, 1991; Bishayee and Chatterjee, 1995). However, prolonged severe stress creates ineffective adaptation, which results in reduced stamina or mood (Anisman and Zacharko, 1991). Previous studies have shown reduced brain levels of adrenaline and nor-adrenaline in animals exposed to stress such as the forced swimming test (Bishayee and Chatterjee, 1995; Anisman and Zacharko, 1991; Subarnas *et al.*, 1993). It is well established that under stressful conditions, utilization and synthesis of these amines are increased in various regions of the brain (Anisman and Zacharko, 1991; Bishayee and Chatterjee, 1995). However, if the stress persists and becomes uncontrollable, the utilization of the amines exceeds synthesis thereby resulting in their depletion (Anisman and Zacharko 1991; Subarnas *et al.*, 1993). Studies further revealed that drugs that enhance catecholaminergic activity helped the organism to cope better with stress and shorten the duration of immobility (Anisman and Zacharko 1991). Conversely, drugs such as reserpine,  $\alpha$ -methyldopa or 5-hydroxydopamine that deplete catecholaminergic stores has been shown to reduce the capacity of the organisms to cope with stress and prolong the period of immobility (Anisman and Zacharko; Subarnas *et al.*, 1993).

Previous studies have reported the presence of alkaloids and flavonoids-related compounds such as paradols and its analogues as the active constituents responsible for the pharmacological activities demonstrated by the seed extract of *A.melegueta* in previous studies (Galal, 1996; Tackie *et al.*, 1975). It has been shown that some flavonoids and alkaloids possess sedative properties (Trease and Evan, 2000; Madawala *et al.*, 1994). It is likely that the ability of the extract to prolong the period of immobility may have resulted from reduced locomotor activity of the animals that often characterize drugs with sedative properties. The active constituents found in MS may perhaps account for its no resistance to fatigue observed in this study.

In conclusion, the results of this study did not show any evidence that may support the usefulness of *A.melegueta* seed in stress.

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