THE EFFECTS OF AFRAMOMUM MELEGUETA AQUEOUS EXTRACT ON THE ADRENAL GLAND OF ADULT WISTAR RATS

Obike H I, Ezejindu D N, Akingboye AJ
Department of Anatomy, College of Health Sciences, Nnamdi Azikiwe University, Nnewi Campus, Anambra, Nigeria.
Corresponding authors e-mail: obikehenry@gmail.com
Phone number: +2347038786655

ABSTRACT

Grain of paradise (Aframomum melegueta [Roscoe] K. Schum.) seeds are used in West Africa as a remedy for variety of ailments such as stomachache, snakebite, diarrhea and they have reported anti-inflammatory properties. Additionally, the seeds contain gingerols and related compounds that may be useful against cardiovascular disease, diabetes, and inflammation. A 28-day sub-chronic toxicity study in adult wistar rats was conducted to evaluate the safety of Aframomum melegueta aqueous extract on the adrenal gland. Twenty wistar rats weighing between 180-215kg were used. They were grouped into four groups of five animals. Group A served as the control and received 0.35ml of distilled water, the experimental groups B,C & D received 0.55ml, 0.65ml and 0.75ml of aqueous extract of Aframomum melegueta respectively for twenty eight days. Twenty four hours after the last administration, the animals were weighed, anaesthetized using chloroform inhalation method and dissected. Organ (adrenal gland) tissues were removed, weighed and trimmed down to a size of 3mm x 3mm thick and fixed in 10% formalin for histological studies. There were body weight gain in the experimental groups compared with the control. The organ (adrenal gland) weight of the experimental groups were statistically similar with the control. There was no apparent toxicity assessed by histological examination.

Keywords: Aframomum melegueta, Adrenal gland, Body weight, Wistar rats

1. INTRODUCTION

Aframomum melegueta of the family zingiberaceae is a spice in the ginger family with the common name “Alligator pepper” [1]. The spice is used in West Africa for the purpose of alleviating stomachache and diarrhea [1] as well as hypertension [2] with some limited reports on it being used for tuberculosis[3] and a remedy for snakebites and scorpion stings[4]. The seeds are used for culinary reasons (due to the pungency of the seeds, it is common used as seasoning on food products [5]. The seeds also tend to have general antimicrobial properties similar to many spices [5][6] and has some molluscidal [7] and repellent [8][9] properties as well. It is one of many pungent herbs said to aid in sexuality and aphrodisiac [10]. Aframomum melegueta appears to have a polyphenolic content of 2.28 ± 0.02mg/g (0.2% dry weight) with 0.55mg/g (0.06%) flavinoids which is comparatively high to other Africa spices tested although low relative to other herbs [11].

This study is aimed at investigating the effects of Aframomum melegueta on the adrenal gland using adult wistar rats.

1. MATERIALS AND METHOD

Breeding of Animals
Twenty healthy adult wistar rats were procured from the animal house of Anatomy Department University of Calabar, Cross River State and
bred in the animal house of Nnamdi Azikiwe University, Nnewi Campus. They were allowed for seven days acclimatization under normal temperature before their weights were taken. They were fed ad libitum with water and guinea feed pallets from Agro feed mill Nigeria Ltd.

Drug Preparation

*Aframomum melegueta* were obtained from Nkwo market in Nnewi Anambra State, Nigeria and grinded into powder with a grinding machine. 200mg/1kg body weight were dissolved in 5mls of distilled water and administered to the animals.

Experimental protocol

The twenty healthy adult wistar rats were allocated into four groups (A, B, C & D) of five animals each. Group A served as the control and received 0.35ml of distilled water, the experimental groups (B, C & D) received 0.55ml, 0.65ml and 0.75ml of aqueous extract of *Aframomum melegueta* respectively for twenty eight days. The control and experimental groups were anaesthetized using chloroform inhalation method and dissected, adrenal glandular tissues were removed, weighed, trimmed down and fixed in 10% formaldehyde for histological studies.

Tissue Processing

The tissues were transferred into an automatic processor where they went through a process of fixation, dehydration, clearing, infiltration, embedding, sectioning and staining. Fixation was carried out in 10% formaldehyde. The tissues were washed over night in running tap water after four hours in 10% formaldehyde. Dehydration of the fixed tissues were carried out in different percentages of alcohol 50%, 70% and 90% absolute. The tissues were then cleared in xylene and embedded in paraffin wax. Serial sections of 5micron thick are obtained using a rotatory microtome. The tissue sections were deparaffined hydrated and stained using the routine haematoxylin and eosin method. The stained sections were then examined under the light microscope.

2. RESULTS

3.1 Morphometric Analysis of Body Weights

<table>
<thead>
<tr>
<th></th>
<th>GROUP A</th>
<th>GROUP B</th>
<th>GROUP C</th>
<th>GROUP D</th>
<th>F-RRTIO</th>
<th>PROB OF SIG</th>
</tr>
</thead>
<tbody>
<tr>
<td>INITIAL BODY WEIGHT</td>
<td>190.20 ± 2.30</td>
<td>192.20 ± 3.60</td>
<td>193.40 ± 4.10</td>
<td>194.10 ± 2.70</td>
<td>64.240</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>FINAL BODY WEIGHT</td>
<td>215.30 ± 4.20</td>
<td>219.40 ± 3.50</td>
<td>220.70 ± 3.20</td>
<td>221.60 ± 2.40</td>
<td>40.180</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>WEIGHT CHANGE</td>
<td>25.10 ± 3.70</td>
<td>27.20 ± 4.10</td>
<td>27.30 ± 3.90</td>
<td>27.50 ± 3.40</td>
<td>19.155</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

The final body weight for the experimental groups increased significantly (P < 0.001) relative to the control.
3.2 Morphometric Analysis of Organ (adrenal gland) Weight

Table 2: Comparison of mean relative adrenal gland weight of all the groups (A, B, C & D) (Mean ± SEM given for each measurement)

<table>
<thead>
<tr>
<th>GROUP A</th>
<th>GROUP B</th>
<th>GROUP C</th>
<th>GROUP D</th>
<th>F RATIO</th>
<th>PROB OF SIG</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIVER WEIGHT</td>
<td>4.95 ± 0.400</td>
<td>5.15 ± 0.310</td>
<td>5.36 ± 0.335</td>
<td>5.45 ± 0.340</td>
<td>50.10 &lt;0.001</td>
</tr>
</tbody>
</table>

The relative weights of the experimental groups increased significantly (P < 0.001) with the control A.

3.3 Histopathological Findings

Plate 1, group A, represents a Photomicrograph of the adrenal gland of Albino Wister rat from control group, showing the normal zona glomerulosa - zg - with cells in small clusters which secrete aldosterone, the zona fasciculata - zf - with cells arranged in columns or strips which secrete cortisol and the zona reticularis - zr - with cells that are somewhat unorganized which secretes sex steroids and may also secrete cortisol. Stained by H & E technique, x 100.

Plate 2, group B, represents a Photomicrograph of the adrenal gland of Albino Wister rat experimental groups (treated with 0.55ml of Aframomum melegueta aqueous extract) showing the normal
zonaglomerulosa - zg -with cells in small clusters which secrete aldosterone, the zonafasciculata - zf - with cells arranged in columns or strips which secrete cortisol and the zonareticularis - zr - with cells that are somewhat unorganized which secretes sex steroids and may also secrete cortisol. Stained by H & E technique, x 100.

Plate 3, group C, represents a Photomicrograph of the adrenal gland of Albino Wister rat experimental groups (treated with 0.65ml of *Aframomum melegueta* aqueous extract) showing the normal zonaglomerulosa - zg -with cells in small clusters which secrete aldosterone, the zonafasciculata - zf - with cells arranged in columns or strips which secrete cortisol and the zonareticularis - zr - with cells that are somewhat unorganized which secretes sex steroids and may also secrete cortisol. Stained by H & E technique, x 100.

Plate 4, group D, represents a Photomicrograph of the adrenal gland of Albino Wister rat experimental groups (treated with 0.75ml of *Aframomum melegueta* aqueous extract) showing the normal zonaglomerulosa - zg -with cells in small clusters which secrete aldosterone, the zonafasciculata - zf - with cells arranged in columns or strips which secrete cortisol and the zonareticularis - zr - with cells that are...
somewhat unorganized which secretes sex steroids and may also secrete cortisol. Stained by H & E technique, x 100.

4. DISCUSSION

A toxicological study in rats feeding *Aframomum melegueta* diet for 28 days noted that, in male rats only, a dose-dependent decrease in blood glucose was observed at 450mg/kg (7.3%) and 1500mg/kg (20%) of the ethanolic extract [12]. In rats given a large amount of Alcohol (4.8g/kg) for 15 days, coingestion of *Aframomum melegueta* (100-200mg/kg water extracts) noted that the higher dose was able to prevent an increase in liver weight and fully abolish lipid peroxidation as assessed by MDA while preserving both GSH and GST; hepatic superoxide dismutase (SOD) was not significantly influenced by *Aframomum melegueta* despite it being reduced with ethanol[13]. The increase in serum AST and ALT was also fully normalized [13]. One study has noted that *Aframomum melegueta* methanolic and chloroform extracts held cytotoxic potential against PANC-1 pancreatic cancer cells *in vitro* with IC$_{50}$ values of 13.8µg/mL and 47.8µg/mL, respectively [14].

*Aframomum melegueta* extract has been shown to moderately inhibited acetylcholinesterase activity with IC$_{50}$ of 373.33µg/ml [16]. In the pancreas of rats treated with sodium nitroprussida (SNP) in vivo, *Aframomum melegueta* was noted to have concentration dependent protection of pancreatic β-cells thought to be through anti-oxidative properties [15].

In the present study, the body weight of the experimental groups increased significantly with the control. The organ (adrenal gland) weight of the experimental groups were similar with the control. Histological appearance of the adrenal glandular cells in the experimental groups showed the normal zonaglomerulosa - zg - with cells in small clusters which secrete aldosterone, the zonafasciculata - zf - with cells arranged in columns or strips which secrete cortisol and the zonareticularis - zr - with cells that are somewhat unorganized which secretes sex steroids and may also secrete cortisol compared with the control.

5. CONCLUSION

From the present study, the aqueous extract of *Aframomum melegueta* has no toxic effects to the adrenal glandular cells in low and high doses thus have protective properties.

6. REFERENCES


