Micro-Anatomical Effect Of Tahitian Noni Dietary Supplement On The Heart Of Caffeine-Treated Sprague-Dawley Rats

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Citation


Abstract

AIM: This study was designed to assess the effects of Tahitian Noni on the heart of Caffeine-treated rats.

METHODS: Thirty adult Sprague-Dawley rats, weighing between 105-200 g were used. They were divided into 6 groups of 5 rats each. Group 1 was the control. Group 2 received 200mg/kg of caffeine for 8 weeks, group 3 received 200mg/kg of caffeine for 4 weeks and 5ml/kg of Noni for another 4 weeks, group 4 received both 200mg/kg of caffeine and 5ml/kg of Noni for 8 weeks, group 5 received 5ml/kg of Noni for 8 weeks, group 6 received 5ml/kg of Noni for 4 weeks and 200mg/kg of caffeine for another 4 weeks. RESULTS: There was no significant difference in cholesterol levels and body weights of treated groups when compared to control. The histological sections showed focal necrosis in groups 2, 3 and 4 with degenerative changes observed in group 2. Groups 5 and 6 tended towards normal.

CONCLUSION: Tahitian noni dietary supplement modulates the effect of a high dose of caffeine on the heart.

INTRODUCTION

Caffeine is the world’s most widely consumed psychoactive substance, but unlike most other psychoactive substances, it is legal and unregulated in nearly all jurisdictions [5]. An estimated 80% of the world’s population consumes a caffeine-containing substance daily [1].

Caffeine is considered a psychoactive substance since it stimulates the central nervous system and alters mood and behavior. Heroin, cocaine, marijuana, nicotine and alcohol are also examples of psychoactive drugs. Physiological effects may be seen in adults after as little as one cup of coffee or two cans of cola [4].

Heart disease is currently the number one cause of death for both men and women in the United States and in many other developing countries [11]. Caffeine and coffee consumption adversely affects cholesterol and other lipid levels, homocysteine, blood pressure, arrhythmias and stress levels, increasing the risk of heart disease [8].

For people who are genetically slow metabolizers of caffeine, drinking coffee significantly raises the risk of developing a heart attack, or experiencing a myocardial infarction [3].

The Tahitian Noni dietary supplement is a liquid dietary supplement. Noni, a common name for Morinda citrifolia is one of the most common plants used in herbal remedies. The fruit juice is in high demand in alternative medicine for different kinds of illnesses such as Arthritis, Diabetes, High blood pressure, Muscle aches and pains, Menstrual difficulties, Headaches, Heart disease, AIDS, Cancer, Gastric ulcers, Sprains, Mental depression, Senility, Poor digestion, Atherosclerosis, Blood vessel problems, and Drug addiction [10].

This work is therefore designed to evaluate experimentally the effect of Tahitian Noni on the heart of caffeine-treated rats.

MATERIALS AND METHODS

Thirty adult male Sprague-Dawley rats, 16-20 weeks old and weighing between 105-200 g were obtained from the Department of Biochemistry, College of medicine, University of Lagos. The rats were housed in well-ventilated metal cages under standard conditions of temperature (25 ± 5°C) in the department of Anatomy, College of medicine, University of Lagos. Animals were exposed to a photo period of 12 hours light, alternating with 12 hours darkness. They were allowed access to standard laboratory food and
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water ad libitum throughout the experiment. The animals were kept for at least 2 weeks to acclimatize to the laboratory conditions before experimentation.

The thirty male rats were divided randomly into six groups of five rats each. The experimental groups received daily oral doses of the drugs as follows: Group 1, the control received daily oral dose of distilled water. Group 2 received 200 mg/kg of caffeine for 8 weeks, Group 3 received 200 mg/kg of caffeine for 4 weeks and 5 ml/kg of Noni for another 4 weeks, Group 4 received both 200 mg/kg of caffeine and 5 ml/kg of Noni for 8 weeks, Group 5 received 5 ml/kg of Noni for 8 weeks, Group 6 received 5 ml/kg of Noni for 4 weeks and 200 mg/kg of caffeine for another 4 weeks. Body weight was recorded weekly for every group.

AUTOPSY SCHEDULE

At the end of the experiments, the animals were sacrificed a day after last dose of extract. All sacrifices were done under mild anaesthesia with intra-peritoneal ketamine hydrochloride at a dose titrated against consciousness starting with 0.01 ml. The heart was dissected out and processed for histological work as follows: the heart from each animal was fixed, embedded in paraffin wax, sectioned at 5 micrometer and stained with Haematoxylin and Eosin stain.

STATISTICAL ANALYSIS

Results were expressed as mean ± standard deviation. Analysis was carried out using one-way analysis of variance (ANOVA) and the Scheffe’s post hoc test. The level of significance was considered at p < 0.05.

RESULTS

HISTOPATHOLOGICAL FINDINGS/SUMMARY

The microscopic examination of the prepared histological sections showed a normal endocardium in all the groups but in the myocardium, focal necrosis was observed in groups 2, 3 and 4 with degenerative changes observed in group 2. Dilated blood filled pericardial vessels was also observed. Groups 5 and 6 tended towards normal when compared with control.

BODY WEIGHT

There was a statistically significant decrease (p<0.05) in the body weight of the animals from a mean value of 224.1±1.2 (control) to 149.4±11.1 in the group treated with caffeine only (group 2) and an increase in that of the groups treated with Noni as shown in Table 1.

SERUM CHOLESTEROL

The results showed that there was a statistically significant increase in cholesterol levels from 45.2±3.4 (control) to 55.4±4.7 in the groups treated with caffeine only (group 2). There was no statistically significant difference (p<0.05) in the groups treated with caffeine then noni (group 3), both caffeine and noni (group 4), noni only (group 5) and noni then caffeine (group 6) as shown in Tables 2.

PHOTOMICROGRAPHS

Figure 1
Fig.1: Section through the heart of Group A (control) at magnification x 400, stained with Heamatoxylin and Eosi

Figure 2
Fig.2: Section through the heart of Group B administered caffeine for 4 at magnification x 400, stained with Heamatoxylin and Eosin.
Figure 3
Fig. 3: Section through the heart of Group C administered caffeine, then Tahitian noni at magnification x 400, stained with Hematoxylin and Eosin.

Figure 4
Fig. 4: Section through the heart of Group D administered caffeine and Tahitian noni at magnification x 400, stained with Hematoxylin and Eosin.

Figure 5
Fig. 5: Section through the heart of Group E administered Tahitian noni at magnification x 400, stained with Hematoxylin and Eosin.

Figure 6
Fig. 6: Section through the heart of Group 6 administered Tahitian noni, then Caffeine at magnification x 400, stained with Hematoxylin and Eosin.

Figure 7
TABLE 1: SHOWING WEEKLY BODY WEIGHTS OF SPRAGUE-DAWLEY RATS

<table>
<thead>
<tr>
<th>GROUP</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
<td>213±2.2</td>
<td>168±2.3*</td>
<td>169±1.7*</td>
<td>127±4.8*</td>
<td>113±2.1*</td>
<td>129±6±4.5*</td>
</tr>
<tr>
<td>BLUE</td>
<td>231±4.9</td>
<td>42±4.2*</td>
<td>176±1.1*</td>
<td>—</td>
<td>87±29.0*</td>
<td>133±4±4.1*</td>
</tr>
<tr>
<td>E-BLUE</td>
<td>219±2.7</td>
<td>168±4.9*</td>
<td>112±37.7*</td>
<td>144±12.6*</td>
<td>113±2.6*</td>
<td>128±4±4.3*</td>
</tr>
<tr>
<td>BLACK</td>
<td>209±0.6</td>
<td>166±1.1*</td>
<td>161±31.2*</td>
<td>122±0.8*</td>
<td>109±2.1*</td>
<td>127±4±1.9*</td>
</tr>
<tr>
<td>WHITE</td>
<td>260±0.5</td>
<td>201±1.7*</td>
<td>138±63.2*</td>
<td>85±49.7*</td>
<td>127±9±1.5*</td>
<td>138±8±5.5*</td>
</tr>
</tbody>
</table>

Values are mean ± standard error of mean; n=5, *p<0.05 compared to control (student’s t-test).
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Figure 8

TABLE 2: SHOWING CHOLESTEROL LEVELS IN SERUM

<table>
<thead>
<tr>
<th>GROUP</th>
<th>DRUG ADMINISTERED</th>
<th>CHOLESTEROL LEVELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>CONTROL</td>
<td>45.2±3.4</td>
</tr>
<tr>
<td>B</td>
<td>CAFFEINE (5 WEEKS)</td>
<td>55.6±4.7*</td>
</tr>
<tr>
<td>C</td>
<td>CAFFEINE (WEEK-1), NONI (WEEK-5)</td>
<td>42.6±3.8</td>
</tr>
<tr>
<td>D</td>
<td>CAFFEINE + NONI (5 WEEKS)</td>
<td>50.8±6.7</td>
</tr>
<tr>
<td>E</td>
<td>NONI (5 WEEKS)</td>
<td>42.0±7.5</td>
</tr>
<tr>
<td>F</td>
<td>NONI (WEEK-1), CAFFEINE (WEEK-5)</td>
<td>38.4±2.3</td>
</tr>
</tbody>
</table>

Values are mean ± standard error of mean; n=5; *p<0.05 compared to control (student’s t-test).

DISCUSSION

Many studies have been done to see if there is a direct link between caffeine and coronary heart disease. The results are conflicting. The histological findings in the result of this study support the fact that a high dose of caffeine predisposes to heart disease.

Of recent, some researchers have reported that cafestol and kahweol are the active chemicals in coffee and are mechanistically responsible for the increase in serum cholesterol level after coffee consumption [9]. Gordon et al [7] have also reported that increased total cholesterol concentration increases the incidence and prevalence of coronary heart disease. The increase in serum cholesterol concentration observed after the administration of caffeine was not statistically significant when compared with control. Many epidemiological studies have shown a strong inverse relationship between serum HDL-cholesterol concentration and the risk of coronary heart disease [6]. Also, increased serum LDL-cholesterol concentration has been associated with increased risk of coronary heart disease [2]. The serum cholesterol concentration observed in this study however does not suggest that caffeine may predispose those who take caffeine-containing beverages to coronary heart disease. Tahitian Noni is a strong antioxidant which can scavenge reactive oxygen free radicals and quench lipid hydroperoxides. It is therefore beneficial for the prevention of heart, lung, and brain diseases, as well as delaying the aging process, and maintaining overall good health [10].

There was a statistically significant decrease in the body weights of the group treated with caffeine. A few studies indicate that drinking coffee or tea with caffeine may slightly boost weight loss or prevent weight gain. But there’s no evidence that increased caffeine consumption results in significant or permanent weight loss [12]. Tahitian Noni however, was able to modulate the effect of caffeine on body weight. It enhances the body’s healing system and as an adaptogen, brings the body into normal balance [10]. There is however a dearth of literature on the mechanisms by which Tahitian noni dietary supplement produces these effects.

CONCLUSION

Tahitian Noni dietary supplement modulates the effect of a high dose of caffeine on the heart.

References
