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(RESEARCH ARTICLE)

Effect of coconut oil supplemented diet on some transferase activity in the plasma and tissues of albino rats

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Abstract

Coconut oil supplemented diet on transferase activity specifically aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were investigated in the plasma, liver, kidney, and heart of albino rats. Control group was fed with growers mash and water only, the second group was fed with growers mash and 20% w/w coconut oil and third group was fed with 40% w/w coconut oil respectively. The rats were sacrificed after five weeks of feeding. The activity of AST and ALT was significantly ($P<0.05$) increased in the kidney, heart, liver and plasma of the rats fed with 20 % w/w and 40 % w/w Coconut oil supplemented diet when compared to the control group. The liver/body weight, heart/body weight ratio and mean body weight gain was significantly ($p< 0.05$) increased in both 20 % w/w and 4 0% w/w coconut oil fed rats relative to control rats. No significant difference ($p >0.05$) was observed in the kidney/body weight ratio of the albino rat. The result obtained suggests that consumption of supplemented coconut oil diet may inhibit enzyme activity and other metabolic functions.

Keywords: Coconut oil; Aspartate aminotransferase (AST); Alanine aminotransferase (ALT)

1. Introduction

One of the edible oil broadly known is coconut oil. Its source is from the kernel or meat of mature coconuts harvested from the coconut palm (*Cocos nucifera*). Coconut oil which is one of the sources of dietary fats has been referred to as unhealthy highly saturated fat. The consumption of this edible oil could increase blood cholesterol level and possibly facilitate the chances of coronary heart disease [1].One of the importance of coconut oil is its resistance to oxidation and polymerization, which makes it stable oil for cooking. For example, it is suitable for single-use shallow frying, although it is not recommended for continuous deep-fat frying because of its low smoke point, which may lead to the production of potentially carcinogenic substances upon overheating [2]. Some of the beneficial roles of coconut oil are in nutrition, health and national development [1]. The tissue enzymes specifically aspartate aminotransferase (AST) and alanine aminotransferase (ALT) catalyse the transfer of amino and keto groups between alpha- amino acids and alpha-keto acids [3]. The disorders in some of the tissues could lead to leaking out of AST and ALT which results in the elevation of blood enzyme levels. When there is damage in the cells of the liver, AST and ALT leak out giving rise to elevated level of these enzymes in the bloodstream [3]. The aim of the present study is to evaluate the effect of this coconut oil supplemented diet on the plasma and tissues of albino rats.

2. Material and methods

2.1. Collection and preparation of plant materials

The coconut oil was purchased from New Benin market, Benin City, Edo State, Nigeria. The nut of about 1kg-2kg was weighed and poured into a large cooking pot and heated to about 40-60 minutes after which the oil was separated from

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the burnt kernel using a filter (Sieve). The oil was analyzed for its physicochemical variables by the methods of the Association of Official Analytical Chemists [4].

2.2. Experimental animals

Albino rats of the Wistar strain breed aged 27-29 days were kept in the animal house of College of Medicine, Delta State University, Nigeria.

Experimental design

The animal management and experimental procedures were carried out according to the requirement of the National Research Council's Guide for the care and use of laboratory animals [5]. Approval was obtained from the animal ethical committee in the Department of Zoology, Delta State University for the use of animals in this research.

The female albino rats were divided into three groups with each group consisting of five rats housed in a stainless robber cages in a well-ventilated room at about 27°C. All the animals had free access to food and water all through the period of treatment. The rats in group A (Control) were fed with growers mash only mixed with water. Rats in group B were fed with 20% w/w coconut oil and rats in group C was fed with 40% w/w coconut oil respectively in their diets.

2.3. Collection of blood sample

At the termination of the experiment, the rats were anaesthetized with chloroform in a desiccator, the abdomen of each rat was cut open using dissection kits and the liver, kidney, heart were excised and blood was drawn from all the rats by cardiac puncture using sterilized syringes into lithium heparinized test-tube. The blood and organs were kept in the refrigerator until required.

2.4. Treatment of tissues and analysis of plasma enzyme activities

The different tissues were weighed, 20% and 40% homogenates were prepared with 1.9 and 3.9% NaCl solution respectively under cold condition. Each homogenate as well as the blood sample was centrifuged at 5,000g for 10 minutes. The supernatant were carefully separated from the residues and kept in labeled sample bottles for the analysis of aspartate aminotransferase (AST) and alanine aminotransferase (ALT). Aspartate aminotransferase (AST) and alanine aminotransferase were determined by the method of Reitman and Frankel [6] with the enzyme kits of Randox laboratories Ltd, Crumlin, North Ireland, and U.K.

2.5. Statistical analysis

The results of this experiment were expressed as mean ± S.D. The statistical significance difference was determined by Students paired t-test and analysis of variance (ANOVA) to compare parameters within groups using computer software SPSS version 22. Data from the test group were compared with their respective controls and differences at $P<0.05$ were considered significant.

3. Results and discussion

The result of the effect of coconut oil on the activity of AST and ALT in the plasma and tissues of albino rat is shown in Figure 1 and Table 1 respectively.

In this investigation, the result displayed a significant increase ($P<0.05$) in AST and ALT activity in both 20 and 40 % w/w coconut oil supplemented diet consumption which is in line with the research of Pouria et al., [7]. The liver status was obtained by evaluating AST and ALT since liver and heart disease can be distinguished by the use of those serum enzymes [3]. The increase in the enzyme activity in the plasma and tissues may be suggestive side effects of coconut oil. Confirmatory or suggestive values can be obtained by evaluating tranferase enzyme activity [8]. Stress is a key factor that may lead to the damage of liver and kidney and facilitate the rate at which enzymes liberate to the blood [9]. Reactions between reactive species and cellular antioxidants may result to antioxidant depletion that could cause oxidative stress [10]. This model displayed that the plasma AST and ALT levels was significantly different at different doses which is also similar with the report of Pouria et al., [7].

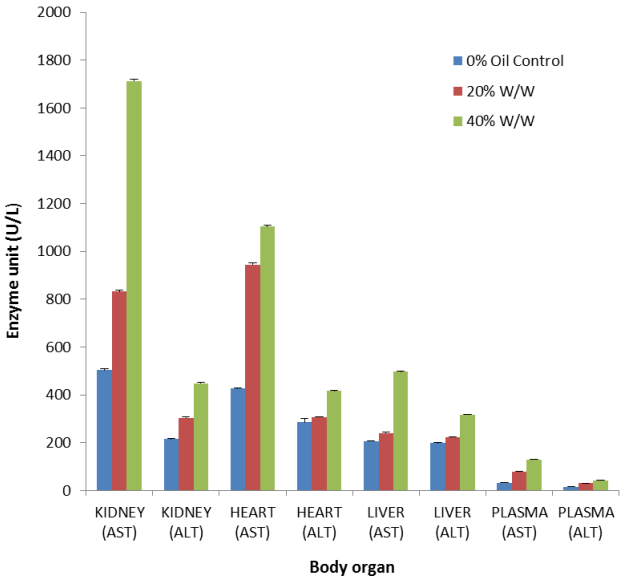

Figure 1 The effect of Coconut oil (CO) supplemented diet on the activity of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) in kidney, heart, liver and plasma of albino rats

According to Smithet al., [11], increase in ALT level may indicate liver damage which is similar to this research. The significant increase in ALT levels is in agreement with the report of Uraku [12] that says viral hepatitis which is a disease associated with hepatocytes death can demonstrate an increase in ALT activity. Also, the report of Uraku [12] states that AST can be located in cardiac and skeletal muscles hence it is a cardiac marker and not specific for liver damage.

Table 1 The effect of coconut oil on organ/body weight ratio and body weight gain of rats

Parameters	0% Oil control	20% w/w Coconut oil	40% w/w Coconut oil
Liver/body weight ratio	0.014 ± 0.0013^{a}	0.039 ± 0.0034^{a}	0.051 ± 0.026^{b}
Heart/ body weight ratio	0.009 ± 0.0002^{a}	0.0036 ± 0.00040^{a}	0.0040 ± 0.00061^{b}
Kidney/body weight ratio	0.0025 ± 0.00013^{a}	0.0070 ± 0.00075^{a}	0.0077 ± 0.00065^{a}
Weight gain (g)	2.3 ± 0.0042^{a}	10.0 ± 6.5^{a}	40.0 ± 14.1^{b}

Values are expressed as mean ± S.D. Means with different letters in a row differ significantly (P <>0.05) using analysis of variance (ANOVA).

The result indicates a significant (P<0.05) increase in the liver/body weight ratio, heart/body weight ratio and body weight gain in the group fed with both 20 and 40% w/w coconut oil compared to the control but with no significant difference in the kidney/body weight ratio in both groups. This body weight gain may be attributed to the presence of some metabolites found in the oil which is consistent with the report of Uraku [12]. According to Odeghe and Asagba [3] changes in body weight gain and organ/body weight ratio is an important parameter used in the assessment of toxicity. The observed increase in the organ/body weight ratio in the treated groups could lead to organ toxicity. Coconut oil is known to be rich source of medium chain saturated fatty acids which have been shown to influence membrane composition, fluidity and functions. However there is evidence that different saturated fatty acids can exert specific and in some cases opposite effects on plasma cholesterol level [13]. The increased liver/body weight ratio of rats fed with coconut oil is an indication that this oil may promote lipid accumulation in the liver. Some lipid metabolic enzyme status can demonstrate lipid accumulation [10].

4. Conclusion

The activity of AST and ALT in plasma and tissues could be altered by feeding rats with 20% and 40% supplemented diets of coconut oil in a dose dependent manner. This diet induced change may lead to oxidative stress, kidney dysfunction, liver injury and cardiac disorder. However, further investigations on the effect of coconut oil on other biochemical parameters and histopathology should be examined.

Compliance with ethical standards

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Disclosure of conflict of interest

Odeghe O.B. was involved in the collection of sample, experimental design, laboratory work and research typing while Ujowundu F.N. was involved in experimental design, laboratory work and statistical analysis.

Statement of ethical approval

Ethical approval was obtained from the Department of Zoology, Faculty of Science, Delta State University, Nigeria.

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