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Research Article

PALM KERNEL OIL EFFECTS ON THE ACTIVITY OF ASPARTATE AMINOTRANSFERASE (AST) AND ALANINE AMINOTRANSFERASE (ALT) IN THE PLASMA AND TISSUES OF ALBINO RAT

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ABSTRACT

The effect of palm kernel oil consumption on the activity of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) was investigated in the liver, kidney, heart and plasma of albino rats. The rats were divided into two groups (n=5). The first group was fed with growers mash only (control), while the second was fed with 10% palm kernel oil respectively in their diets. This treatment was carried out for 47 days. The activity of AST and ALT was significantly ($P<0.05$) increased in the heart (1104+482.1 and 304+104.3 U/L) and liver (912+451.1 and 496+255 U/L) when compared to the control group (Heart 944+279.4 & 416+235.9 and liver 496+143.1 & 256+104.3 U/L). However, there was AST and ALT decrease in kidney (832+286.2 and 304+131.5 U/L) and plasma (128+26.8 and 34+37.8 U/L) of albino rat fed with palm kernel oil when compared with the control group (kidney 1712+834.6 & 448+243.9 U/L and plasma 130+36.1 & 42+36.3 U/L). The rats fed with 10% palm kernel oil was significantly ($P<0.05$) increased in liver/body weight ratio ($0.0043+0.050^b$), heart/body weight ratio($0.0044+0.00076^b$) and body weight gain($30.0+0.0^b$g) when compared to the control group liver/body weight ratio ($0.039+0.0034^a$), heart/body weight ratio($0.0036+0.00040^a$) and body weight gain ($10.0+7.1^b$). However, no significant difference was observed in the kidney/body weight ratio (10% PKO $0.0080+0.0011^a$ & 0% Control $0.0070+0.00075^a$) of rats in all the experimental groups. The result obtained suggests that consumption of palm kernel oil may result to oxidative stress and hepatoxicity.

Keywords: Palm kernel oil, Aspartate aminotransferase, Alanine aminotransferase, Plasma, organ/body weight ratio and body weight gain.

INTRODUCTION

Palm kernel oil is a form of edible vegetable oil obtained from the processed fruits of oil palm tree (Koh, 2006).This form of edible oil has surpassed soya bean oil in the world (Pantzaris and Ahmed, 2004).

Palm kernel is produced by oil palm (*Elaeisguineesis Jacq*), which consist of a hard kernel (Seed) inside a shell (endocarp) which is surrounded by a fleshy mesocarp and the mesocarp contains 50% PKO (Koh, 2006). The major fatty acids in PKO are C_{12} (Lauric acid) about 48%, C_{14} (Myristic acid) about 16% and $C_{18:1}$ (Oleic acid) about 15% (Codex Alimentarius Commission, 1999). No other fatty acids are present at more than 10% and it is this preponderance of lauric acid, which gives PKO sharp melting property, meaning hardness at room temperature combined with a low melting point (Pantzaris, 2000). This is the outstanding property of lauric oils which determines their use in the edible field and justifies its higher price compared with most other oils. Because of its low unsaturation, the lauric oil is also very stable to oxidation.

Most palm kernel oil levels in the diet induce toxicity to the liver; however the consumption of moderate amounts of palm kernel oil and reduction in the level of oxidation may reduce the health risk believed to be associated with the consumption of palm kernel oil (Pantzaris, 2000). In addition, as the chain lengthens, the melting point increases and the chain becomes less water-soluble developing the tendency to aggregate or stick together with other fatty acids. Aggregation protects these longer chain fatty acids especially the unsaturated fatty acids from oxidation (Isaac et al., 1992). PKO is high in tocotrienols, its presence in vitamin E has been found to have many beneficial properties among them are antioxidant and anti-cancer activities (Nosaretnam, 1993). Tocotrienols have also been demonstrated to lower blood cholesterol levels, by reacting with certain enzymes in the liver, which produces cholesterol. Its antioxidant properties bring many benefits to the human body, such as preventing skin ageing, preventing fatty acids oxidation, reducing blood pressure and many more (Okwu, 2004). In a study comparing many types of fats, PKO appears to be the most protective against the development of cardiovascular disease. Platelet aggregation was reduced by palm kernel oil. Research has also shown that physician use PKO as conjunctive treatment in liver disease. Palm kernel oil can also be used industrially to produce ice-cream because of its high solid, fat content (S.F.C) at about 0^oC, low melting point and perfectly bland taste (Pantzaris, 2000). In addition lauric oil, which is the major component of palm kernel oil, is indispensable oil for soap making and food such as margarines, filled milk etc.

Palm kernel oil has similar uses to coconut oil owing to their similarity in composition. Among the seventeen (17) major oils in world trade, there are only two lauric oils, palm kernel oil and coconut oil obtained from *Elaies guineensis* (oil palm tree), (oil world annual 2000) they are called lauric oil because lauric acid is the major fatty acid in their composition at about 50%. While no other major oil contains more than about 1% (butter fats contain 3%). This oil, compose of fatty acids which are unusually rich in saturated short and medium chain fatty acids. Short chain fatty acid have two to six carbon atoms (C_2-C_6), medium chain fatty acids have eight to twelve (C_8-C_{12}) and long chain fatty acids have fourteen to twenty four (C_{14}-C_{24}) carbon atoms comprising their backbone. The medium chain fats in lauric oils are comparable to fats in mother's milk and have similar nutriceutical effects (Kabara, 1990). As the chain lengthens, the melting point increases and the chain become less water-soluble, developing the tendency to aggregate or stick together with other fatty acids. Shorter chains saturated fatty acids allow fatty acid to be metabolized without the use of carnitine transport system. Comparative studies have shown that added carnitine shuttle had the opposite effect, promoting the oxidation of unsaturated fats during stress and increasing oxidative damage to cells (Isaac *et al.,* 1992). The preparation of palm kernel oil promote luxurious hair growth and protect the skin from bacteria and fungi infections and also exhibit a wide range of biological and pharmacological activities such as anti-inflammatory , anti-oxidant and immune enhancer properties (Kabara, 1990; Enig, 1998). Monolauric which is a component of palm kernel oil has been specifically found to have adverse effect on potentially pathogenic microorganism such as S*taphylococcus epodermidis* and group B Gram-positive staphylococcus (Isaac et al., 2002)

Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) are tissue enzymes that catalyses the transfer of amino and keto groups between alpha- amino acids and alpha-keto acids hence they are called transferase (Stroev and Makarova, 1984), AST and ALT are found in high concentration in the liver and heart with moderate amount in the kidney and skeletal muscle (Tietz, 1982). Both enzymes are used in diagnosis and monitoring of hepatic injury. When there is damage in these organs, AST and ALT leak out giving rise to elevated level of these enzymes in the blood (Reena, 2001).

The numerous benefits and widespread use of palm kernel oil underscore the need for studies on its toxicity. Moreover, studies on the comparative effects of palm kernel oil are scarce in the literature. The aim of the present study is to evaluate the effect of this oil on liver function parameters in rats.

MATERIALS AND METHODS

Collection and Preparation of Plant Materials

The palm kernel nut 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 for about 40-60 minutes after which the oil was separated from 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 (AOAC, 2006).

Experimental animals

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

Experimental Design

The animal management and experimental procedures was carried out according to the requirement of the national Research Council's Guild for the care and use of laboratory animals (NRC, 1985). The female albino rats were divided into two groups with each group consisting of five rats housed in a stainless robber cages in a well-ventilated room at about 27^0C. 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 10% palm kernel oil respectively in their diets (10g of oil plus 90g of growers mash).

Collection of Blood Sample

At the termination of the experiment, the rats were anaesthetized with chloroform in a dessicator, 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 punchure using sterilized syringes into lithium heparinized test-tube. The blood and organs were kept in the refrigerator until required.

Treatment of Tissues and Analysis of Plasma Enzyme Activities

The different tissues were weighed and 10% homogenates were prepared with 0.9% NaCl solution 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 (1957) with the enzyme kits of Randox laboratories Ltd, Crumlin, North Ireland, and U.K.

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 15.Data from the test group were compared with their respective controls and differences at $P<0.05$ were considered significant.

RESULTS AND DISCUSSION

The results of the effect of palm kernel oil on the activity of AST and ALT in the plasma and tissues of albino rat is shown in Table 1-2.

Table 1: The effect of Palm kernel oil (PKO) on the activity of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) in liver, kidney, heart and plasma of albino rats

Organs/Parameters	0% Oil Control	10% PKO
Kidney		
AST(U/L)	1712 + 834.6	832 + 286.2
ALT (U/L)	448 + 243.9	304 + 131.5
Heart		
AST (U/L)	944 + 279.4	1104 + 482.1
ALT (U/L)	416 + 235.9	304 + 104.3
Liver		
AST (U/L)	496 + 143.1	912 + 451.1
ALT (U/L)	256 + 104.3	496 + 255
Plasma		
AST (U/L)	130 + 36.1	128 + 26.8
ALT (U/L)	42 + 36.3	34 + 37.8

Values are expressed as mean + S.D; n=5; Data in the test groups were compared with their respective controls and differences at $P<0.05$ were considered significant.

In this study, the result showed a significant increase ($P<0.05$) in the activity of the liver enzymes which may tend to decrease in prolong intoxication due to damage to the liver cells (Cornelius, 1979). Serum activities of AST and ALT were employed to access liver status because these enzymes can be used to differentiate between liver and heart disease (Nicholas and Lewis, 1989). This enzyme activity increase in liver and heart may be suggestive side effects of palm kernel oil. However, the reduction in the kidney and plasma concentrations may be suggestive of reversible side effects of the drug which may inhibit some cardiovascular disease, platelet aggregation, phagocytosis and many others (Isaac, 1992). Determination of the activity of transaminase enzyme can provide valuable confirmatory or suggestive values (Dufour et., 2000). The elevation of the liver enzymes may be observed after the administration of the drug and are common findings in liver toxicity (Okonkwo et al., 1997., Varley et al., 1991).

Under state of stress, damage to liver, kidney and other organs may occur and these enzymes may be liberated into the blood. (Zikic et al., 2001). This oxidative stress could be as a result of the reaction of reactive species with cellular antioxidants which may cause antioxidant depletion (Jeong, 1999, Timbrel et al; 1980). The report stated by Tasduq et al, 2005. Attri et al; 2001 indicated the existence of a strong correlation between hepatic injury and oxidant stress in experimental animals treated with antituberculosis drugs. Smith et al, 1998 also reported an increase in ALT in oral acetaminophen-induced hepatotoxicity in rats indicating a biochemical evidence of significant liver damage.

Table 2: The effect of Palm kernel oil on organ/body weight ratio and body weight gain of rats

Parameters	0 % Oil Control	10% Palm Kernel oil
Liver/body weight ratio	$0.039 + 0.0034^a$	$0.0043 + 0.050^b$
Heart/ body weight ratio	$0.0036 + 0.00040^a$	$0.0044 + 0.00076^b$
Kidney/body weight ratio	$0.0070 + 0.00075^a$	$0.0080 + 0.001^{1a}$
Weight gain (g)	$10.0 + 7.1^a$	$30.0 + 0.0^b$

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 10% palm kernel oil compared to the control but with no significant difference in the kidney/body weight ratio in both groups.

Changes in body weight gain and organ/body weight ratio is an important parameter used in the assessment of toxicity (Timbrell, 1991). The observed increase in the organ/body weight ratio in the treated groups may suggest that increase in organ weight is a sensitive indicator of organ toxicity (Simon et al., 1995). The enzyme that is involved in the metabolism of lipid damage to the liver may result in lipid accumulation (Timbrell, 1991). The increased liver/body weight ratio of rats fed with palm kernel oil is an indication that this oil may promote lipid accumulation in the liver.

In conclusion, the present investigation showed that aminotransferase activity was increased by palm kernel oil consumption which indicates that consumption of palm kernel oil may lead to oxidative stress, damage to liver, heart and other organs. However, further research should be done on the effect of palm kernel oil on other biochemical parameters, using higher concentration of the oil and extending the time of administration.

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