Palm kernel oil is a form of edible vegetable oil obtained from the processed fruits of oil palm tree (Elaeis guineensis 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 C12 (Lauric acid) about 48%, C14 (Myristic acid) about 16% and C16 (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, palm kernel oil is also very stable to oxidation. The major fatty acid in their composition of lauric oils (Pantzaris, 1999) 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, composed 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 (C2-C6), medium chain fatty acids have eight to twelve (C8-C12) and long chain fatty acids have fourteen to twenty four (C14-C24) carbon atoms comprising their backbone. The medium chain fats in lauric oils are comparable to fats in mother's milk and have similar nutraceutical effects (Kabara, 1990). 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°C, 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 Elaeis 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%). Palm kernel oil may result to oxidative stress and hepatotoxicity.

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 oil is produced by oil palm (Elaeis guineensis 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 C12 (Lauric acid) about 48%, C14 (Myristic acid) about 16% and C16 (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, palm kernel 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°C, 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.

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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 rubber 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 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-tubes, 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.

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>
<thead>
<tr>
<th>Organs/Parameters</th>
<th>0% Oil Control</th>
<th>10% PKO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney AST (U/L)</td>
<td>1712 ± 834.6</td>
<td>832 ± 286.2</td>
</tr>
<tr>
<td>ALT (U/L)</td>
<td>448 ± 234.9</td>
<td>304 ± 131.5</td>
</tr>
<tr>
<td>Heart AST (U/L)</td>
<td>944 ± 279.4</td>
<td>1104 ± 482.1</td>
</tr>
<tr>
<td>ALT (U/L)</td>
<td>416 ± 235.9</td>
<td>304 ± 104.3</td>
</tr>
<tr>
<td>Liver AST (U/L)</td>
<td>496 ± 143.1</td>
<td>912 ± 451.1</td>
</tr>
<tr>
<td>ALT (U/L)</td>
<td>256 ± 104.3</td>
<td>496 ± 255</td>
</tr>
<tr>
<td>Plasma AST (U/L)</td>
<td>130 ± 36.1</td>
<td>128 ± 26.8</td>
</tr>
<tr>
<td>ALT (U/L)</td>
<td>42 ± 36.3</td>
<td>34 ± 37.8</td>
</tr>
</tbody>
</table>

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 Tadduq 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 antibiotics. 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>
<thead>
<tr>
<th>Parameters</th>
<th>0 % Oil Control</th>
<th>10% Palm Kernel oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver/body weight ratio</td>
<td>0.039 ± 0.0034a</td>
<td>0.0043 ± 0.050b</td>
</tr>
<tr>
<td>Heart / body weight ratio</td>
<td>0.0036 ± 0.00040a</td>
<td>0.0044 ± 0.00076b</td>
</tr>
<tr>
<td>Kidney/body weight ratio</td>
<td>0.0070 ± 0.00075a</td>
<td>0.0080 ± 0.0011a</td>
</tr>
<tr>
<td>Weight gain (g)</td>
<td>3.00 ± 0.00</td>
<td></td>
</tr>
</tbody>
</table>

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.

ACKNOWLEDGEMENT

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REFERENCES