Palm oil diet may benefit mildly hypercholesterolemic Chinese adults

Zhang Jian, Wang Chunrong, Dai Jianhua, Chen Xiaoshu, Ge Keyou

Institute of Nutrition and Food Hygiene, Chinese Academy of Preventive Medicine, Beijing, PR China

The effects on serum lipids and planetoid fraction of diets prepared with palm oil (PA) and peanut oil (PE) were studied in two groups of mild hypercholesterolemic volunteers (serum TC between 5.5 - 7.0 mmol/L, aged 32-48). There were 15 men and 11 women in the PE group and 16 men and 9 women in the PA group. Dietary fat provided about 30% of total calories, and the total oil was accounted for 60% of dietary fat during the 7 weeks of present period, diets were prepared with peanut oil, the local habitual cooking oil for all subjects. During the next 6 weeks the subjects in PA group consumed a diet prepared with peanut oil while subjects in PE group continued to consume a diet prepared with peanut oil. Compared to the energy levels, the concentrations of serum TC in both control groups, LDL-C (low density lipoprotein cholesterol) and plasma triglycerides were significantly decreased in PA group (4.5%, -4.0%, -11.5%, and -22.4%) while not appreciably altered in PE group by the end of the test. No significant change was observed on the whole blood platelet aggregation in both groups. In conclusion with the results from our previous study in normocholesterolemic Chinese adults, palm oil, used as cooking oil in Chinese diet, will not add to any adverse effect on blood lipids and thus will not increase CVD risks.

Introduction
Cardiovascular disease (CVD) is one of the major causes of death in developed countries and the death caused by CVD is increasing rapidly in China. It is generally believed that high concentrations of serum total cholesterol (TC) and low density lipoprotein cholesterol (LDL-C) are positively related to the risk of CVD and that saturated fatty acids (SFAs) have the potential to increase the blood lipids and promote thrombosis.

Palm oil is the second largest volume of vegetable oil produced in the world. As it is highly saturated and contains about 50% SFAs, palm oil was discounted like saturated animal fats, such as butter, lard and tallow. The conclusion that palm oil raises total serum cholesterol, thereby increasing the risk of coronary heart disease, however, was not based on actual experimental studies. Recently, studies in animals and in humans indicate that palm oil is quite different from other hypercholesterolemic fats such as lard or coconut oil. Therefore, the scientific community needs to conduct controlled studies on the effects of palm oil and its relation to cardiovascular disease and maintain a responsible perspective when reporting its findings or making recommendations concerning consumption of this oil.

The consumption of palm oil in China has increased rapidly in recent years, but the information about the relationship of palm oil to health is very limited. A few papers show that palm oil maintains the normal growth of rats and causes a significant reduction of serum cholesterol in rabbits compared to lard. The reports on palm oil in human studies are difficult to find in China. Therefore, it is necessary to undertake properly controlled studies on the effects of palm oil on blood lipids and on the risk of CVD. The previous study showed palm oil had no harmful effect on normal cholesterol subjects in habitual Chinese diet. This study observes the effects of palm oil on mildly hypercholesterolemic Chinese adults.

Subjects and Methods

Subjects

Excluding known diabetes, hypertension and interrenal and thyroid disorders, 31 males and 20 females, aged from 32-68 years of age, were selected as subjects. Their serum cholesterol concentration ranged from 5.5-7.0 mmol/L. All subjects worked either on a state owned farm or in a local plant producing micro electric motors. The body weight of the subjects ranged from 54.5 - 79.5 kg in males and from 42.0 - 66.5 kg in females. None of the subjects were taking medication known to affect lipid metabolism.

Diet

Experimental diet was composed of rice, flour, lean pork, chicken, bean curd, and some local green vegetables. The menu was developed around subjects' preferences and daily diet. All the meals were prepared in habitual manner by a local cook under the direction of professionals to meet the experimental requirements. RBD palm oil was purchased from the Biodiesel Company Singapore, while peanut oil was purchased from local edible oil company. According to the food inventory charges, average nutrient intakes were calculated based on the Chinese food composition table. The fatty acids profile and the main nutrients of the test diets were shown in Tables 1 and 2.

Correspondence address: Dr. Zhang Jian, Institute of Nutrition and Food Hygiene, Chinese Academy of Preventive Medicine, 29 Nan Wei Road, Beijing 100000, P.R. China
Tel: +86-10-63038-761 ext 149; Fax: +86-10-63011-875

Table 1. Fatty acids profile of two test diets.

<table>
<thead>
<tr>
<th>Fatty acid</th>
<th>Palm oil diet %</th>
<th>Peanut oil diet %</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:0</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>16:0</td>
<td>32.7</td>
<td>16.0</td>
</tr>
<tr>
<td>18:0</td>
<td>2.1</td>
<td>0.6</td>
</tr>
<tr>
<td>18:3</td>
<td>3.7</td>
<td>5.7</td>
</tr>
<tr>
<td>18:1</td>
<td>38.8</td>
<td>31.4</td>
</tr>
<tr>
<td>18:2</td>
<td>19.6</td>
<td>1.7</td>
</tr>
<tr>
<td>18:3</td>
<td>1.7</td>
<td>1.5</td>
</tr>
<tr>
<td>20:0</td>
<td>0.2</td>
<td>1.1</td>
</tr>
<tr>
<td>20:1</td>
<td>0.1</td>
<td>1.2</td>
</tr>
<tr>
<td>20:2</td>
<td>1.8</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Average daily intakes of nutrient for cholesterol subjects on palm oil and peanut oil diets.

<table>
<thead>
<tr>
<th>Test Energy</th>
<th>Fat Protein Carb-</th>
<th>Carbon</th>
<th>Hydroxyl</th>
<th>100g Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE</td>
<td>10.38</td>
<td>7.60</td>
<td>36.2</td>
<td>156</td>
</tr>
<tr>
<td>PA</td>
<td>10.46</td>
<td>7.65</td>
<td>36.4</td>
<td>163</td>
</tr>
</tbody>
</table>

Biochemical Analyses

Serum TC and TG (triglyceride) levels were determined using enzymatic kits (Chinese Zheng Sheng High-Tech Bioengineering Company, ZS 89001) on Beckman 700s system analyzer. HDL-C was assayed using enzymatic kits after a precipitation with phosphatetic acid and magnesium chloride. LDL-C was calculated using the formula of Friedwald. Plasma TXB2 and PGI2, were determined by using 125I-radio-immunassay kits purchased from radio-immunassay laboratory, General Hospital of the People's Liberation Army of China. Platelet aggregation in whole blood was determined with a chronolog 500 aggregometer after interaction of collagen (obtained from Sigma chemical company) using the impedance method. Collected in a 3.8% solution of sodium citrate (9 parts blood to 1 part citrate), each blood sample was assayed with an hour and the final concentration of collagen was 1 mg/mL.

Statistical analyses

The data were analyzed with the SPSS/PC+ statistics program (V4.0, SPSS, Chicago, IL). The differences between the two test groups were assessed with t test (two-tailed). In all cases, statistical significance is P < 0.05 and data are presented in the text and tables as means ± SD.

Discussion

A substantial body of data implies that dietary saturated fats tend to increase serum cholesterol concentrations and promote thrombosis. Analysis of some saturated fats, such as palm oil, lard, and coconut oil reveals that each has distinct profiles and exert different metabolic effects. Recently, studies from humans and experimental animals show that palm oil, despite a high concentration of SFA (mainly palmitic acid), does not increase serum cholesterol concentrations or thrombotic tendencies.

The Chinese diet contains more vegetables but less animal foods than the western diet. The average per capita intake of cholesterol is less than 300mg/d in most urban area and less than 200mg/d in rural areas. Our former study showed that palm oil used in Chinese diet did not increase serum cholesterol concentration in normocholesterolemic subjects. Some studies show that palmitic acid appears to increase plasma cholesterol in hypercholesterolemic subjects. The results in the present study show that in comparison with PE diet, PA diet induced a reduction of serum TC, LDL-C and TC/HDL-C ratio in mildly hypercholesterolemic rat.
Palm oil diet may benefit mildly hypercholesterolaemic Chinese adults

Zhang Jian, Wang Chunrong, Dai Jianhua, Chen Xiaoshu, Ge Keyou

Institute of Nutrition and Food Hygiene, Chinese Academy of Preventive Medicine, Beijing, P.R. China

The effects on serum lipids and platelet function of diets prepared with palm oil (PA) and peanut oil (PE) were studied in two groups of mildly hypercholesterolaemic volunteers (serum TC between 5.5 - 7.0 mmol/L, aged 32-48 years). There were 15 men and 11 women in each PE group and 16 men and 9 women in PA group. Dietary for provided about 30% of total caloric, and the test oil accounted for 40-60% of total dietary fat. After 3 weeks of normal diet, diets were prepared with peanut oil, the local habitual cooking oil for all subjects. During the next 6 weeks the subjects in PE group continued to consume a diet prepared with peanut oil. Compared to the energy levels, the concentrations of serum TC (total cholesterol), LDL-C (low density lipoprotein cholesterol), TC/HDLC ratio and plasma TPX2-keto-PGFR ratio were significantly decreased in PA group (-5.9%, -0.9%, -1.1%, and -2.4%) while not significantly altered in PE group by the end of the test. No significant change was observed on the whole blood platelet aggregation in both groups. In conclusion, the results from our previous study in noncholesterolemic Chinese volunteers, the positive effect on blood lipids and thus will not increase CVD risks.

Introduction

Cardiovascular disease (CVD) is one of the major causes of death in developed countries and the death caused by CVD is increasing rapidly in China[1-3]. It is generally believed that high concentrations of serum total cholesterol (TC) and low density lipoprotein cholesterol (LDL-C) are positively related to the risk of CVD and that saturated fatty acids (SFAs) have the potential to increase the blood lipids and promote thrombosis. Palm oil is the second largest volume of vegetable oil produced in the world. As it is highly saturated and contains about 50% palmitic acid, palm oil was discarded like saturated animal fats, such as butter, lard and tallow. The allegation that palm oil raises total serum cholesterol, thereby increasing the risk of coronary heart disease, however, was not based on actual experimental studies. Recently, studies in animals and in humans indicate that palm oil is quite different from other hypercholesterolaemic fats such as lard or coconut oil[4-5]. Therefore, the scientific community needs to conduct controlled studies on the effects of palm oil and its relation to cardiovascular disease and maintain a responsible perspective when reporting its findings or making recommendations concerning consumption of palm oil.

The consumption of palm oil in China has increased rapidly in recent years, but the information about the effects of palm oil to health is very limited. A few papers show that palm oil maintains the normal growth of rats and causes a significant reduction of serum cholesterol in rabbits compared to[6]. The reports on palm oil in human studies are difficult to find in China. Therefore, it is necessary to undertake properly controlled studies on the effects of palm oil on blood lipids and on the risk of CVD.

The previous study showed palm oil had no harmful effect on normal cholesterolemic subjects in habitual Chinese diet[7]. This study observes the effects of palm oil on mildly hypercholesterolaemic volunteers.

Subjects and Methods

After excluding known diabetes, hypertension and liver renal and thyroid disorders, 31 males and 20 females, aged from 32-68 years of age, were selected as subjects. Their serum cholesterol concentration ranged from 5.5-7.0 mmol/L. Subjects worked either on a state owned farm or in a local plant producing micro electric motors. The body weight of the subjects ranged from 54.5 - 79.5 kg in males and from 46.5 - 66 kg in females. None of the subjects were taking medication known to affect lipid metabolism. Diet

Experimental diet was composed of rice, flour, lean pork, chicken, bean curd; and some local green vegetables. The menu was developed around subjects' preferences and daily meals were prepared by habitual cooks under the direction of professionals to meet the experimental requirements. RBD palm oil was purchased from the Brother Oil Company, Singapore, while peanut oil was purchased from local edible oil company. According to the food inventory, average nutrient intakes were calculated based on the Chinese food composition table. The fatty acids profile and the main nutrients of the test diets were shown in Tables 1 and 2.

Table 1. Fatty acids profile of two test diets.

<table>
<thead>
<tr>
<th>Fatty acid</th>
<th>Palm oil diet %</th>
<th>Peanut oil diet %</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:0</td>
<td>0.8</td>
<td>0.4</td>
</tr>
<tr>
<td>16:0</td>
<td>32.7</td>
<td>16.0</td>
</tr>
<tr>
<td>18:0</td>
<td>6.1</td>
<td>2.0</td>
</tr>
<tr>
<td>18:1</td>
<td>3.7</td>
<td>5.7</td>
</tr>
<tr>
<td>18:2</td>
<td>38.8</td>
<td>39.3</td>
</tr>
<tr>
<td>18:3</td>
<td>19.6</td>
<td>31.4</td>
</tr>
<tr>
<td>20:0</td>
<td>1.7</td>
<td>1.5</td>
</tr>
<tr>
<td>20:1</td>
<td>0.2</td>
<td>1.1</td>
</tr>
<tr>
<td>20:2</td>
<td>0.1</td>
<td>1.2</td>
</tr>
<tr>
<td>22:0</td>
<td>1.8</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Average daily intakes of nutrient of hypercholesterolaemic subjects on palm oil and peanut oil diets.

<table>
<thead>
<tr>
<th>Test Energy Fat Protein Carbo-</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hydrocarb oil</td>
</tr>
<tr>
<td></td>
<td>(MJ)</td>
</tr>
<tr>
<td>PE 10.33</td>
<td>82</td>
</tr>
<tr>
<td>PA 10.65</td>
<td>86</td>
</tr>
</tbody>
</table>

Table 3. Effect of test oil on serum lipids in hypercholesterolaemic Chinese adults.

<table>
<thead>
<tr>
<th>Group</th>
<th>Blood Lipids (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>HDL-C</td>
</tr>
<tr>
<td>PE</td>
<td>0.60±0.05</td>
</tr>
<tr>
<td>PA</td>
<td>0.59±0.05</td>
</tr>
</tbody>
</table>

Discussion

A substantial body of data implies that dietary saturated fats tend to increase serum cholesterol concentrations and promote thrombosis[10-12]. Analysis of some saturated fats, such as palm oil, lard, and coconut oil reveals that each has distinct profiles and exert different metabolic effects. Recently, studies from humans and experimental animals show that palm oil, despite a high concentration of SFA (mainly palmitic acid), does not increase serum cholesterol concentrations or thrombogenic tendencies[13-14]. The Chinese diet contains more vegetables but less animal foods than the western diet. The average per capita intake of cholesterol is less than 300mg/d in most urban area and less than 200mg/d in rural areas. Our former study showed that palm oil used in Chinese diet did not increase serum cholesterol concentration in noncholesterolitic subjects[15]. Some studies show that palm oil appears to increase plasma cholesterol in hypercholesterolaemic subjects[16]. The results in the present study show that in comparison with PE diet, PA diet induced a reduction of serum TC, LDL-C and TC/HDL-C ratio. This is consistent with results from other laboratories that palmitic acid appears to be non-hypercholesterolaemic when dietary cholesterol intake is low[17]. Since the 1950s, numerous studies in humans and animals have investigated the effects of dietary fat.
Palm oil diet may benefit mildly hypercholesterolemic Chinese adults

Zhang Jian, Wang Chunjong, Dai Jianhua, Chen Xiaoshu, Ge Keyou


食用棕榈油对中国血脂偏高成人血脂对血脂水平的改善

作者研究了食用棕榈油对血脂偏高成人的血清三酰甘油水平的改善。

摘要

本文研究了食用棕榈油对血脂偏高的成年人的血清脂质水平的影响。在血脂偏高的成年人中，食用棕榈油对血清总胆固醇(TC)、低密度脂蛋白胆固醇(LDL-C)和高密度脂蛋白胆固醇(HDL-C)的水平有影响。食用棕榈油对血清三酰甘油的水平有显著性下降。

结论

食用棕榈油对中国血脂偏高成人的血脂水平有明显的改善。

引用

Palm oil diet may benefit mildly hypercholesterolemic Chinese adults

Zhang Jian, Wang Chunrong, Dai Jianhua, Chen Xiaoshu, Ge Keyou


食用棕榈油对中国血液胆固醇水平偏高成人血脂和血小板功能的的影响

摘要

研究了食用棕榈油和心血管健康的膳食对血清胆固醇水平和血小板功能的影响。膳食总热量的60%由棕榈油提供，连续2周。结果显示，13名男性和11名女性为一组，食用以棕榈油为食的膳食(称PA组)，6名男性和9名女性为一组，食用以菜籽油为食的膳食(称PB组)。结果与预期比较。实验结束时，PA组受试者的血清总胆固醇(TC)、低密度脂蛋白胆固醇(LDL-C)的水平、血清总胆固醇与低密度脂蛋白胆固醇(LDLC)的比值、血清总胆固醇与高密度脂蛋白胆固醇(HDL-C)的比值、血清总胆固醇与血浆总胆固醇(TC)、低密度脂蛋白胆固醇(LDL-C)的水平、血清总胆固醇与低密度脂蛋白胆固醇(LDLC)的比值、血清总胆固醇与高密度脂蛋白胆固醇(HDL-C)的比值、血清总胆固醇与血浆总胆固醇(TC)、低密度脂蛋白胆固醇(LDL-C)的水平、血清总胆固醇与低密度脂蛋白胆固醇(LDLC)的比值、血清总胆固醇与高密度脂蛋白胆固醇(HDL-C)的比值。结果显示，PA组的血清总胆固醇、低密度脂蛋白胆固醇、高密度脂蛋白胆固醇和血浆总胆固醇的水平均显著高于PB组。PA组和PB组在饮食前后的血清总胆固醇、低密度脂蛋白胆固醇、高密度脂蛋白胆固醇和血浆总胆固醇的水平均无显著变化。结合有关棕榈油对中国健康男性青年血脂健康状况的影响的研究结果，作者认为棕榈油用于中国居民膳食中的日常食用不会对血脂水平产生不利影响，也不会增加发生心血管疾病的风险。

References
