ระดับโปรตีเปอร์ติเซอร์ในเชร์มและแยกออกจากชิคเคนท์วิถีมินในคนไทยที่รับทานอาหารเจ

สาเนียร์ กาญจนชุมาพล ¹*, นพรณ ภูมิลา ² และ ไพศาล จิตซารินรม¹

¹สำนักงานวิจัย วิชาการและวัฒนธรรม คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล ²ล่าฝึกหัดสัตวแพทย์ คณะวิทยาศาสตร์ มหาวิทยาลัยมหิดล

บทคัดย่อ

วัคูปุระงษ์เพื่อศึกษาระดับโปรตีเปอร์ติเซอร์ในเชร์มและแยกออกจากชิคเคนท์วิถีมินในคนไทยที่รับทานอาหารเจ โดยศึกษาในผู้หญิงไทยที่มีอายุ 30-50 ปี ที่รับทานอาหารเจ จำนวน 109 คน เป็นเพศชาย 49 คน เพศหญิง 60 คน และศึกษาในคนที่รับทานอาหารเจ จำนวน 83 คน เป็นเพศชาย 41 คน เพศหญิง 42 คน เพื่อใช้เป็นกลุ่มควบคุม ทำการวัดระดับ thiobarbituric acid reacting substances (TBARS) เหล็ก กรดยูดิคลีสในเชร์ม และวัดระดับวิถีมินในเหลืองม้า (แยกดอกออกชิคเคนท์วิถีมิน)

จากผลการศึกษาพบว่าในคนที่รับทานอาหารเจจะมีระดับ TBARS เหล็ก กรดยูดิคลีสในเชร์ม และวิถีมินในเหลืองม้าน้อยกว่าคนที่รับทานอาหารปกติอย่างมีนัยสำคัญ เมื่อเปรียบเทียบกับระดับในสัดส่วนระหว่างวิถีมินในคอลสแตตเรส พบว่าคนที่รับทานอาหารเจจะมีระดับมากกว่ากลุ่มที่รับทานอาหารปกติ โดยสรุปคนที่รับทานอาหารเจได้รับสารที่มาจากพืชที่ช่วยเสริมการลดของกรดยูดิเปอร์ติเซอร์และมีการเพิ่มขึ้นของแยกดอกออกชิคเคนท์วิถีมิน

คำที่เชิง: TBARS โปรตีเปอร์ติเซอร์ แยกดอกออกชิคเคนท์วิถีมิน อ้างอิง

*ผู้รับผิดชอบบทความ E-mail address: raskd@mahidol.ac.th
Serum lipid peroxidation and antioxidant vitamin in Thai vegans

Saowanee Kajanachumpol, Noppawan Phumala and Paisarn Jittrontrum

1Research Center, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand
2Department of Pharmacology, Faculty of Science, Mahidol University, Bangkok 10400, Thailand

Abstract

Vegetarian diets with higher content of natural antioxidants may decrease the risk of developing cardiovascular disease.

Serum lipid peroxidation and antioxidants in the serum of Thai vegans were determined.

Forty-nine male and 60 female healthy vegans, aged 30–50 years, who have been on diet devoid of animal products including milk and egg for at least 5 years, volunteered for the study while 41 male and 45 female age-and BMI-matched omnivores served as controls. Overnight fasting blood was determined for levels of serum thiobarbituric acid reacting substances (TBARS), serum iron, uric acid and plasma vitamin E (antioxidant vitamin)

The vegans had significantly lower concentrations of serum TBARS, serum iron, uric acid and plasma vitamin E than the omnivores. Plasma vitamin E: cholesterol molar ratios were slightly higher in the vegans.

The overall effects of vegan nutritional habit and various health promoting non-nutrient of plant origin and probably more healthy lifestyle altogether favorably affects TBARS levels and antioxidant vitamin E, than do apparently healthy omnivores.

Keywords: TBARS, Lipid peroxidation, Antioxidant vitamin, Vegans

*Corresponding author E-mail address: raskd@mahidol.ac.th
Introduction

Under ideal circumstances the body would be in a steady state with free radicals produced and quenched by the endogenous antioxidants. Oxidative stress refers to the situation in which there is a significant imbalance between free radicals and the antioxidant defense system. The resulting harm is termed oxidative damage.

Lipid peroxide, a species of free radicals, are continuously generated in the body during normal process of biological activities by auto-oxidation of polyunsaturated fatty acids, which are primarily an integral component of biological membranes. Free radicals are toxic chemicals, which could damage phospholipids, proteins, enzymes and DNA leading to tissue injury and even cell death. The oxidation damage to biological macromolecules has been suggested to contribute to many human degenerative diseases such as atherosclerosis, certain type of cancers and cataract.

The antioxidant defense system of the body consists of endogenous and exogenous antioxidants. Endogenous antioxidants are enzymes that are primarily physiologic in origin; exogenous antioxidants include nutrients and non-nutrients that enter the body through the diet.

The dietary sources of antioxidants in the body include several micronutrients such as vitamin A, vitamin C, vitamin E and extranutrients such as carotenoids, polyphenols including flavonoids, phyto-estrogens, organosulpher compounds, plant sterols, phytic acid. The major food groups from which the dietary antioxidants are obtained include fruits and vegetables, whole grains, legumes, green tea, red wine and vegetable oil. Therefore, diets can have important roles in modulating antioxidant status by directly increasing levels of dietary antioxidants or by indirectly influencing endogenous antioxidant capacity.

In general, vegetarian diets provide relatively large amounts of cereals, pulse, nuts, fruits and vegetables as comparison with non-vegetarian diet. In terms of nutrients, vegetarian diets are usually rich in antioxidant such as vitamins C and E, carotenoids and phytochemicals. Because the eating patterns of vegetarian very considerably and relatively few studies examined the levels of lipid peroxidation and antioxidant in vegans. The purpose of this study was to assess serum lipid peroxidation and antioxidant vitamin among Thai vegans.

Materials and Methods

This study was conducted on 195 apparently healthy subjects, aged 30–50 years. One hundred and nine vegans; 49 men and 60 women, were volunteer from Buddhist Sect (Practitioner Association Pathrom Asoke and Thienjon, Bangkok). All subjects were interviewed before participating in this study. A vegan was defined as someone who
ate no meat, no eggs and no dairy products or ate eggs and dairy products less than 5 times per year and each time ate a little. They practise their diets for \( \geq 5 \) years prior to enroll this study. Eighty-six omnivores; 41 men and 45 women, were selected from the staff of Farmer Bank and Krungthep Banks, Bangkok served as the controls. The major excluding criterias were as follows; body weight \( \geq 120\% \) ideal, a history of chronic disease (renal disease, cancer, diabetes mellitus, heart disease, hypertension), alcohol intake, cigarette smoking, took oral contraceptive, hormonal therapy, pregnancy, excessive physical exercise and vitamin supplementation or stop supplements less than 5 years. The study protocol was approved by the Human Ethics Committees of Ramathibodi Hospital, Mahidol University and was explained to the subjects before they gave their informed consent.

Blood samples were collected after an overnight fast. Plasma from heparinized containing tubes and serum were separated by centrifugation at 3,000 rpm for 10 minutes and aliquoted, then stored at \(-70^\circ\text{C}\) until analysis. The concentrations of thiobarbituric acid reacting substances (TBARS) in serum was measured fluorometrically using a modification of the methods of Asakama and Matsushita\(^7\) and Uchiyama and Mihara.\(^8\) The concentration of TBARS was determined by a spectrofluorometer (Jusco) with 515 nm excitation and 553 nm emission, 1,1,3,3- tetraethoxypropane was used as the standard. Serum iron levels were photometrically measured assay.\(^9\) Plasma vitamin E levels (EDTA blood) were measured by using a reverse phase HPLC. The chromatographic system consisted of Water 715 ULTRA WISP sample processor equipped with an automatic sample injector, a Waters 600E system controller pump and a Waters 470 fluorescence detector. The detector was operated at 295 nm excitation and 370 nm emission. The levels of uric acid were determined by using a commercial kit (Roche, Germany).

**Statistical Analysis**

Statistical analysis was performed with SPSS sofware, version 11.0. Data are presented as mean \( \pm \) SD. Normal distribution of the data were checked by using the Kolmogorov-Smirnov test. The differences between dietary groups were compared with student t-test. The levels of statistical significance were set at \( p<0.05 \).

**Results**

The characteristics of the omnivore and vegan subjects are shown in Table 1 as separated by sex. The mean age, weight and height were significantly lower in vegan group as compared with the omnivore group but the BMI values were similar in both dietary groups. The averages of vegan diet practice were 11.5 \( \pm \) 5.7 years (ranges 5–29 years).
Table 1  Characteristics of omnivore and vegan subjects (mean ± SD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Males</th>
<th>Females</th>
<th>Both sexes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Omnivores (n = 41)</td>
<td>Vegans (n = 49)</td>
<td>Omnivores (n = 45)</td>
</tr>
<tr>
<td>Age, years</td>
<td>39.8 ± 5.6</td>
<td>41.0 ± 6.6</td>
<td>37.7 ± 5.9</td>
</tr>
<tr>
<td>Weight, kg</td>
<td>64.6 ± 7.9</td>
<td>61.4 ± 8.4</td>
<td>52.9 ± 6.8</td>
</tr>
<tr>
<td>Height, cm</td>
<td>167.0 ± 6.0</td>
<td>167.0 ± 5.4</td>
<td>158.0 ± 5.6</td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
<td>22.9 ± 2.0</td>
<td>21.9 ± 2.6</td>
<td>21.1 ± 2.4</td>
</tr>
<tr>
<td>Duration on vegan diet, years</td>
<td>10.9 ± 5.0</td>
<td>12.0 ± 6.1</td>
<td>(5-26)*</td>
</tr>
</tbody>
</table>

*range

Table 2  Levels of serum lipid peroxide and antioxidant vitamin in Thai vegans and omnivores (mean ± SD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Males</th>
<th>Females</th>
<th>Both sexes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Omnivores (n = 41)</td>
<td>Vegans (n = 49)</td>
<td>Omnivores (n = 45)</td>
</tr>
<tr>
<td>TBARS (μmol/L)</td>
<td>2.16 ± 0.89</td>
<td>1.68 ± 0.33</td>
<td>2.26 ± 0.73</td>
</tr>
<tr>
<td>Vitamin E (μmol/L)</td>
<td>27.1 ± 8.7</td>
<td>21.3 ± 6.5</td>
<td>25.3 ± 8.3</td>
</tr>
<tr>
<td>Vitamin E/chol (μmol/mmol)</td>
<td>5.12 ± 0.85</td>
<td>5.46 ± 0.91</td>
<td>5.19 ± 1.35</td>
</tr>
<tr>
<td>Vitamin E/chol+Trig (μmol/mmol)</td>
<td>4.19 ± 0.50</td>
<td>4.35 ± 0.71</td>
<td>4.62 ± 1.18</td>
</tr>
<tr>
<td>Serum iron (μmol/L)</td>
<td>30.0 ± 9.2</td>
<td>19.3 ± 9.0</td>
<td>26.5 ± 7.5</td>
</tr>
<tr>
<td>Uric acid (mg%)</td>
<td>5.88 ± 1.13</td>
<td>5.47 ± 0.91</td>
<td>4.14 ± 0.69</td>
</tr>
</tbody>
</table>

TBARS = thiobarbituric acid reacting substances
As shown in Table 2, the vegans had lower significantly of TBARS concentrations than in the omnivores in respective sex. Plasma vitamin E per millimolar cholesterol or millimolar cholesterol plus triglyceride levels were slightly higher. The mean serum iron concentrations were significantly lower in vegans than those of the omnivore subjects. Mean serum uric acid levels were slightly lower in the vegans but significantly different in only female vegans.

Discussion

Studies indicate that vegetarians often have lower morbidity\(^{10}\) and mortality\(^{11}\) rates from several chronic degenerative diseases than do nonvegetarians. Although nondietary factor, indicating physical activities and abstinence from smoking and alcohol, may play a role, diet is clearly a contributing factors. The active protective plant components are thought to include fiber, antioxidant vitamin (vitamin C, vitamin E and β-carotene), nonnutrient antioxidants such as flavonoids and other polyphenols and the degradation products of glucosinolates, i.e., isothiocyanates and indoles\(^{12-14}\), the exact compounds responsible for the beneficial effects have not been identified.

Most of the studies concern the antioxidant vitamin status of heterogenous vegetarian groups consisting mainly of semi-vegetarians or lactovegetarians. Relatively few studies examined in vegan subjects. Therefore, we did the study to determine the effect of vegan diet on lipid peroxidation and antioxidant status in Thai adult vegans.

The free radical oxidation of polyunsaturated fatty acids in biological system is known as lipid peroxidation. The measurement of thiobarbituric acid reacting substances TBARS is widely used as an indicator of lipid peroxidation in various biological samples. Our results demonstrated that both in male and female vegan group had significantly lower concentrations of TBARS when compared with omnivore group in respective sex (Table 2). This finding was similar to previous finding in vegetarians\(^{15}\), but Szeto et al.\(^{16}\) reported no difference in plasma malondialdehyde concentrations between two dietary groups. Lower lipid peroxidation in vegans may be partly due to the lower of serum iron (Table 2) and ferritin (data not shown) in vegans. Iron ions are themselves free radicals\(^{17}\), and ferrous ions can take part in electron transfer reactions with molecular oxygen. Generation of superoxides by any source in the presence of iron ions can lead to the formation of hydroxyl radicals by Fenton chemistry. High-energy radication studies have shown that hydroxyl radicals produced in free solution can initiate lipid peroxidation by hydrogen abstraction.\(^{18}\) Ferritin is also effective at stimulating lipid peroxidation.
Diet plays an important role in the oxidation process by affecting the substrates that are subject to oxidation. The best example is the oxidation of lipids. Polyunsaturated fatty acids (PUFA) having two or more double bonds are increasingly susceptible to free radical attack as the number of double bonds increases. On average, the vegetarian diet has less total fat and consequently less total polyunsaturated fatty acids\(^{(19)}\) Studies performed by Manjari \textit{et al.}\(^{(19)}\) revealed that lactovegetarians had low levels of plasma n–3 fatty acid compared to non-vegetarians.

Diet also plays a vital role in the production of the antioxidant defense system by providing essential nutrient antioxidants such as vitamins E, C and \(\beta\)-carotene, other antioxidant plant phenols including flavonoids and essential minerals that form important antioxidant enzymes.

Vitamin E is the most effective chain breaking lipid soluble antioxidant in biological membranes. Dietary intake of vitamin E by vegetarians has been reported to be as high as 138% to 313% of the recommended daily allowance.\(^{(20,21)}\) Draper \textit{et al.}\(^{(22)}\) reported that in vegans the major source of vitamin E were grains and vegetable oils including safflower, corn, cottonseed, soy bean. Our study in vegan group had significantly lower plasma vitamin E concentrations in both male and female as compared with the omnivore group (Table 2). The lower concentrations could be explained by lower cholesterol and triglyceride concentrations (data not shown). Because concentrations of vitamin E in serum is also strongly associated with blood lipids, adjustment for lipids often improves the correlation between dietary and serum \(\alpha\) tocopherol.\(^{(23)}\) When plasma vitamin E is expressed in relation to serum cholesterol (indicator of low density lipoprotein protection) or cholesterol plus triglyceride (indicator of fatty acid protection), vegans in both male and female had tendency to be higher vitamin E status than omnivores but not statistical significant. There has been only one report on the vitamin E status in the vegan\(^{(24)}\) but several on the other group studied in the vegetarians.\(^{(10,19,25,26)}\) These studies have demonstrated that the vegetarians have vitamin E:cholesterol ratios higher\(^{(19,24,26)}\) or lower\(^{(16)}\) than those of omnivores, but some reported\(^{(25)}\) similar concentrations of plasma vitamin E between vegetarians and nonvegetarians. Tendency to have higher vitamin E:cholesterol ratio indicates a more effective protection of low density lipoprotein against oxidation in vegans compared with omnivore control; a process believe to be important in the pathogenesis of atherosclerosis. In all studies \(^{(16,19,24)}\) reviewed that the vegetarians had a significantly higher concentrations of vitamin C in their serum or plasma than did the omnivore controls. Vegetarians daily consume between 500 and 1200 g of fresh fruits and vegetables, ad thus receive an
abundance of vitamin C in their daily diet. In all reports on adult vegetarians, the dietary intake of vitamin C has been well above the recommended level, between 198% and 973% of the recommended daily allowance.\(^{20}\) Plasma ascorbic acid concentrations were nearly 50% higher in the vegetarians than in the nonvegetarians and made a significantly larger concentration to the total antioxidant capacity of plasma in the vegetarian group.\(^{16}\)

In addition, the vegans had lower serum uric acid concentrations than the omnivores, but significantly decreased in female vegan. This finding was supported by earlier studies.\(^{16,23}\) Uric acid is an important endogenous antioxidant that is present in relatively large amount throughout the body.\(^{23}\) The high content of nucleic acid in meat result in the formation of more purine derived uric acid in meat eaters, then, the lower uric acid concentrations in our vegan group is not unexpected. However, the apparent lack of one antioxidant (uric acid) was compensate for the another.

In conclusion, the overall effects of vegan nutritional habit and various health promoting non-nutrient of plant origin and probably more healthy lifestyle, altogether favorably affects TBARS levels and antioxidant vitamin E. The process of lipid peroxidation (with polyunsaturated fatty acids as substrate) is involved in the etiology of cardiovascular and oncology disease.

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**References**


