〈原著論文〉

ベトナムの高所得地域における脂肪摂取状況について

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要約

ベトナムでは、脂肪摂取量が低い(10%–15%)が近年は、都市部高所得地域において増加傾向にある。そこで、我々は、ベトナム人の脂肪摂取量とその質の適正な改善のためにホーチミン市の2つの高所得地域において、脂肪摂取量その内容について調査した。また、バランスのよい食用油脂の選択を提言するために、食用油脂の脂肪酸組成とビタミンE含量をも分析した。その結果、これらの地域では、ラードよりも「大豆、ピーナッツ、パーム、ココナッツ油」を配合したクッキングオイルの方が頻繁に摂取されていることが明らかとなった。また、1人1日当たりの摂取量は約8–14gであった。これらの結果から、脂肪摂取量については、ベトナム人の油脂摂取量をエネルギー比20%のRDAレベルまで高める必要性を提言したい。また、脂肪の質については、大豆油の選択又は、大豆油とクッキングオイルの併用がn-6系PUFAとn-3系PUFAの適正な供給を可能にすることがわかった。さらに、n-3系PUFAとビタミンEを多く含むその他の食品の摂取も推奨したい。

Fat Intake of Vietnamese in High-income Districts

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Summary

In Vietnam, although energy intake from fat is low (10%-15%), a trend toward increasing fat consumption has recently been recognized in urban, high-income areas. To obtain information which would allow improvement of the quantity and quality of dietary fat consumed by Vietnamese people, we investigated the types and amount of fat consumed in two high-income districts of Ho Chi Minh City. We also analyzed the fatty acid compositions and vitamin E contents of these fats, with the aim of identifying suitable choices for dietary fat consumption. The results showed that oil, especially cooking oil (a mixture of soybean, peanut, palm and coconut oil), was consumed more frequently than lard in these districts. The lower and upper limits of daily visible fat intake per capita were estimated to be 8g and 14g, respectively. From these results, in terms of fat quantity, an increase in visible fat consumption is needed to attain the RDA (Recommended Dietary Allowance) for a fat energy ratio of 20% in the Vietnamese population. As for fat quality, soybean oil, or cooking oil in combination with soybean oil, provides adequate amounts of n-6 PUFA and n-3 PUFA. In addition, the consumption of other foods rich in n-3 PUFA and vitamin E should be encouraged.

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Introduction

According to food availability data from the FAO Food Balance Sheets for the Asia Pacific region, countries with high coronary heart disease (CHD) mortality rates tend to consume higher proportions of dietary energy from fat¹⁾. In Vietnam, although energy intake from fat is below 15%, a recent trend toward increased

fat consumption in urban, high-income areas has been reported²⁾. Therefore, in this study, we investigated the types and amounts of visible fats frequently consumed in high-income Vietnamese populations. We focused on Ho Chi Minh City in South Vietnam because it is a large city, experiencing rapid economic development, and has an increasing number of high-income districts. A fat consumption survey was carried out in two high-income districts of Ho Chi Minh City, and the quality of consumed fats was clarified by analyzing fatty acid compositions and vitamin E contents. As there is no information about the quality of fat consumed by Vietnamese people, all data in this study are reported for the first time. Our aim is to provide basic information allowing improvement of the quantity and quality of dietary fat, and thereby contribute to adequate nutritional status and prevention of CHD in Vietnamese.

Methods

Survey

The survey was conducted in February 2000 in the 1st and the 5th districts of Ho Chi Minh City. These districts have been evaluated as high-income areas by the Department of Statistics of Ho Chi Minh City. One subdistrict was randomly selected from each district. People living in these two subdistricts are mostly small traders whose incomes are high. A total of 123 households participated in this survey, 65 in the 1st district and 58 in the 5th district. Information was obtained through home visits made by trained interviewers, who used questionnaires covering a number of items relating to fat consumption. A list of commercial fats was used to help the interviewees in selecting the types of fat they consumed frequently. The interviewees were also questioned about the amounts of fats they purchased, household size, and how long it took the use of the purchased fats. From these data, daily visible fat intake per capita was estimated.

Analysis of fatty acids and vitamin E

Five samples of each kind of fat were obtained in different retail stores in Ho Chi Minh City. The samples were stored at -30°C until the analyses. The fatty acid composition was determined by means of gas-liquid chromatography (GLC), with a GL Sciences gas chromatograph (GC-390B) equipped with a capillary column (fused-silica BPX-70, 25m $\times$ 0.5mm i.d., GL Sciences). Methyl esters

were prepared by esterification with BF₃/ methanol. The carrier gas was helium at a flow rate of 115mL/min. The split ratio was 20:1. Both the injection and detector temperatures were kept at 230°C. The column temperature was programmed from 85°C to 230°C at a rate of 15°C/min (85°C- 160°C), 0.8°C/min (160°C- 170°C), and 10°C/min (170°C- 230°C). The fatty acid methyl esters were detected by a flame ionization detector and peak areas were calculated with an integrator (Hitachi D-2500). Peak identifications were determined from the standard of each fatty acid. Fatty acid composition data are presented as weight percent of each fatty acid methyl ester (FAME) in total fatty acid methyl ester (Table 2). The actual content of each fatty acid in 100 grams of food (Table 3) was calculated by the following formula: weight% FAME × F × grams of lipid/ 100g food. F is defined as the conversion factor, being 0.956 for vegetable oils and 0.953 for lard^{3,4}.

The analysis of vitamin E content was carried out by high performance liquid chromatography (HPLC). The method of the Japan Oil Chemist's Society was employed⁵. Alpha, beta, gamma, delta and total tocopherol content were expressed as mg percent of 100g food. Total biologically active vitamin E was calculated as the sum of the amount (in milligrams) of each form multiplied by the appropriate factors. These factors, proposed by Hjarde et al. ⁶, are 1 for the alpha, 0.4 for the beta, 0.1 for the gamma, and 0.01 for the delta form.

Results and Discussion

Types and amounts of dietary fats

The commercial fats available in Vietnam contain lard and various kinds of vegetable oils. There are 4 kinds of vegetable oil on the market: soybean, peanut, sesame, and cooking oil. Cooking oil is a mixture of soybean, peanut, palm, and coconut oil. Data from home visit interviews showed the percentage of households using vegetable oil to be highest (72.4%), with the use of both oil and lard being much lower (18.7%), and lard use the lowest (8.9%) (Table 1). The data also showed that, among the 4 kinds of oil, the consumption of cooking oil was highest (60.5%); followed by soybean oil (23.9%); and that peanut and sesame oils were not very popular in these populations (8.7%, 6.9%, respectively). The average daily visible fat intake per capita was also estimated to be 8.1g in households using lard, 10.3g in households using oil, and 14.0g

Table 1 Types and Amounts of Dietary Fat in High-Income Vietnamese Populations

Variables	Frequency (n=123)	Average daily intake per capita ²
Households using lard	8.9%	8.1g
Households using lard and oil ¹	18.7%	5.9g lard, 8.1g oil
Households using oil ¹	72.4%	10.3g

¹ Oils consumed in Vietnam: soybean oil, peanut oil, sesame oil and cooking oil. Cooking oil is a mixture of soybean, peanut, palm and coconut oil.

² Average daily intake per capita = the amount of fat purchased (g) / the duration of use (days) / the household size (persons).

(5.9g lard and 8.1g oil) in households using both lard and oil (Table 1). According to a previous report²⁾ on fat intake in Vietnamese, in 1985 the fat energy ratio was 8 - 13%, with a visible fat intake of 8.5 - 10.5g/capita/day and a non-visible fat intake of 9.1 - 16.5g/capita/day. A comparison was made with annual food intake in Japan⁷⁾. During the post - World War II (1946 - 1960), the visible fat consumption of Japanese was only approximately 1.7g - 5.8g/capita/day. Visible fat intake in Japan then rapidly increased in the period of high economic development (1960 - 1975), from 6.1g to 15.8g/capita/day. Thus, considering the total energy consumption of 1800 - 2000 kcal/capita/day and the fat energy ratio of 10 - 15% reported previously in Vietnamese populations²⁾, an increase in fat consumption including visible fat may be necessary to reach the RDA for a fat energy ratio of 20% in Vietnamese. However, selecting the optimal dietary fat for balancing the intake of n-6 and n-3 fatty acid contents remains an important problem. Therefore, we analyzed the compositions of lard and oils available in markets in Vietnam.

Fatty acid composition

The fatty acid compositions of lard and vegetable oils consumed in Vietnam are shown in Table 2. Vegetable oils are lower in SFA but higher in PUFA than lard. Lard is rich in MUFA with 18:1 fatty acid. A comparison with the fatty acid compositions of fat and oils used in Japan⁸⁾, excluding cooking oil, revealed the compositions of lard and oils available in Vietnam to be quite similar to those used in Japan. Of the 4 kinds of oil consumed in Vietnam, cooking oil has the highest MUFA content, but the lowest SFA and n-6 PUFA contents. The n-6 PUFA content is highest in soybean oil and also relatively high in sesame oil. The amounts of n-3 PUFA such as alpha-linolenic acid (18:3) in cooking oil and soybean oil, 8.8% and 7.7%, respectively, are much higher than in other oils

Table 2 Fatty Acid Compositions of Various Fats and Oils Consumed in Vietnam

Fatty acid ¹	Cooking oil	Soybean oil	Peanut oil	Sesame oil	Lard
14:0	—	—	—	—	1.4
16:0	8.1	10.8	12.4	9.0	22.5
18:0	2.1	4.1	4.2	5.5	9.7
20:0	0.3	0.2	0.02	0.04	0.09
22:0	0.4	0.4	3.5	0.1	—
24:0	0.2	—	1.2	0.1	—
Total SFA ²	11.1	15.5	21.3	14.7	33.7
16:1	—	—	—	—	2.2
18:1	44.8	22.3	40.5	37.1	47.0
20:1	0.5	0.3	1.7	0.6	0.2
Total MUFA ²	45.3	22.6	42.2	37.7	49.4
18:2 (n-6)	33.8	53.9	35.2	46.7	14.6
18:3 (n-3)	8.8	7.7	0.3	0.6	0.7
20:2 (n-6)	0.8	0.2	0.7	0.2	0.9
Total PUFA ²	43.4	61.8	36.2	47.5	16.2

¹ Unit: Weight% of fatty acid methyl ester (FAME) in total fatty acid methyl ester.

² SFA: Saturated fatty acid, MUFA: monounsaturated fatty acid, PUFA: polyunsaturated fatty acid.

(Table 2). Soybean oil and cooking oil have the highest P/S ratios, 4 and 3.9, respectively, of the various oils (Table 3). This means that, soybean oil and

Table 3 Quality of Various Fats and Oils Consumed in Vietnam

Fatty acid ¹	Cooking oil	Soybean oil	Peanut oil	Sesame oil	Lard
SFA ²	10.6	14.8	20.5	14.1	32.4
MUFA ²	43.4	21.6	40.4	36.0	47.4
PUFA ²	41.6	59.2	34.7	45.4	15.5
Total fatty acid	95.6	95.6	95.6	95.5	95.3
P/S ratio ³	3.9	4.0	1.7	3.2	0.5
n-6/n-3 ratio ⁴	3.8	7.0	117.3	77.8	18.9

¹ Unit: gram of fatty acid in 100g lard or oil, calculated by the formula given in the text.

² SFA: saturated fatty acid, MUFA: monounsaturated fatty acid, PUFA: polyunsaturated fatty acid.

³ P/S ratio: polyunsaturated fatty acid/ saturated fatty acid.

⁴ n-6/n-3 ratio: n-6 polyunsaturated fatty acid/ n-3 polyunsaturated fatty acid.

cooking oil are richer in PUFA than other oils. In order to attain a balanced intake of n-6 and n-3 PUFA, the World Health Organization (WHO) recommended that the ratio of dietary n-6/n-3 be kept between 4 and 10⁹. As to

the n-6/n-3 ratios of visible fats in our study, n-6/n-3 ratios above 50 were associated with sesame oil and peanut oil, which are therefore regarded as n-3 PUFA deficient. Soybean oil has an n-6/n-3 ratio of 7, which is within the recommended range. Cooking oil has an n-6/n-3 ratio of 3.8. It thus appears to be necessary to balance n-6 PUFA and n-3 PUFA in cooking oil by combining cooking oil with soybean oil. However, for appropriate improvement of the dietary n-6/n-3 ratio including both visible and non-visible fat requires further study. Current information on sources of dietary fats and oils in Japan indicate that, vegetable oils account for approximately 87.1% of the total fat intake of Japanese¹⁰⁾. Two kinds of vegetable oil, soybean oil and rapeseed oil, both rich in n-3 PUFA account for more than 60% of total consumed vegetable oils, assuming to a reasonable amount of n-3 PUFA in the Japanese diet¹⁰⁾. Consequently, the dietary n-6/n-3 ratio of the Japanese is approximately 4¹¹⁾. In our previous study, the dietary n-6/n-3 ratio of the Vietnamese in North Vietnam was about 10¹²⁾. Thus, in order to achieve a balanced n-6 to n-3 PUFA ratio in the Vietnamese diet, the intake of fish and vegetable oils rich in n-3 PUFA, such as soybean oil and cooking oil, should be encouraged.

Vitamin E content

Vitamin E content is very low in lard but high in vegetable oils (Table 4). Of the

Table 4 Vitamin E Content¹ of Various Fats and Oils Consumed in Vietnam

	Alpha	Beta	Gamma	Delta	Total vitamin E	Total vitamin E potency ²	α -Toco/PUFA ratio ³
Cooking oil	18.5	1.3	55.3	12.4	87.5	24.7	0.43
Soybean oil	8.9	1.6	60.9	24.7	96.1	15.8	0.14
Peanut oil	17.1	0.4	15.3	1.4	34.2	18.8	0.47
Sesame oil	2.6	0.1	36.6	3.1	42.4	6.3	0.05
Lard	1.5	—	0.7	0.01	2.2	1.6	0.09

¹ Alpha, beta, gamma, delta, and total vitamin E are expressed as mg% of 100g lard or oil.

² Total vitamin E potency was calculated by the method of Hjarde et al., as described in the text.

³ α -Tocopherol (mg/100g lard or oil) / polyunsaturated fatty acid (g/100g lard or oil).

4 kinds of vegetable oil, the vitamin E content is highest in soybean oil (96.1mg%) and also relatively high in cooking oil (87.5mg%), lower in sesame oil (42.4mg%) and lowest in peanut oil (34.2mg%). As to the biological activity of vitamin E calculated by the method of Hjarde et al.⁶⁾, cooking oil has the highest biological effect, while those of peanut and soybean oil are lower, and

sesame oil has the lowest biological effect. However, with its high levels of antioxidants such as sesaminol and sesamol, sesame oil has been regarded as an oil with high antioxidant potential¹³⁾. As to the antioxidant effect of vitamin E, the gamma and delta forms are reportedly more effective than the alpha form. We thus found the antioxidant potency to be highest in soybean oil, followed by cooking oil. The ratio of alpha-tocopherol to PUFA has been suggested as a parameter of the adequacy of dietary vitamin E¹⁴⁾. It has been proposed that a minimal amount, 0.6mg of alpha-tocopherol for every gram of PUFA be recommended as a means of preventing vitamin E depletion¹⁵⁾. Since vegetable oils are major dietary sources of both vitamin E and PUFA, this ratio is of interest. According to our data, the ratios of alpha-tocopherol to PUFA were below 0.6 for all the oils studied. Thus, besides oil consumption, foods rich in alpha-tocopherol, such as nuts, fish and green leafy vegetables, should be included in the Vietnamese diet.

Conclusion

This study has contributed to the clarification of habitually consumed visible fats in high-income Vietnamese populations of Ho Chi Minh City in South Vietnam. In order to reach the RDA for a fat energy ratio of 20% in Vietnamese populations, and to achieve a balanced n-6 to n-3 PUFA consumption ratio, fish and vegetable oils rich in n-3 PUFA, such as soybean oil and cooking oil should be encouraged to consume. As the amount of vitamin E in oil was not sufficient to achieve a PUFA balance, the intake of other foods rich in vitamin E should be also recommended.

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