The nutrient intake and health conditions in zen monks

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禅宗修行僧の栄養摂取状況と健康状態

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植物性食品を中心とした食事を摂取しているとされている曹洞宗の禅宗修行僧を対象に、栄養摂取状況や健康状態に関する調査を行い、その食生活が生活習慣病の予防、改善に応用できるか否かについて検討を行った結果、以下のことを明らかにした。

- 1) 禅宗修行僧の栄養摂取状況は高炭水化物, 高食物繊維, 低脂肪, 低コレステロールであったが、特に動物性食品非摂取群で顕著であった。
- 2) このような禅宗修行僧の食生活は、エネルギー消費量が比較的高い生活習慣とあいまって、生活習慣病の予防、改善に有効に作用する可能性が示唆された。
- 3) 禅宗修行僧の一般血液検査値および生化学検査値は良好であることから、脂質やコレステロールが低い食生活を継続したとしても、健康状態に問題が生じる可能性は低いものと考えられた。したがって、禅宗修行僧の食生活は、中性脂肪、総コレステロール値を基準値内に下げなければならない者にとって、参考になるものと考えられた。

Introduction

The traditional non-animal food diet of zen monks is frequently pointed out to be effective for preventing lifestyle-related diseases¹⁾²⁾. In fact, epidemiological studies in western countries have shown that vegetarian diets reduce the risks of obesity³⁾⁴⁾, ischemic heart diseases⁵⁾, cancer⁵⁾, high blood pressure⁶⁾⁷⁾, diabetes⁸⁾, etc.

The results of these studies indicate that in modern day Japan, which has been infiltrated by western diet to the extent that lifestyle-related diseases have become a serious social problem, the medical effects of the vegetarian diet seen in western countries can be obtained from the diet of zen monks.

Originally, the diet of the Japanese was similar to the vegetarian diet, consisting mainly of grain and vegetables combined with beans as a source of protein and small amounts of fish⁹⁾. Therefore, it is comparatively

easy to adopt that advantage for our dietary habits if the diet of the zen monks, who takes it around vegetables such as the cereals, beans, nuts and seeds, and seaweed, is useful for the prevention of the lifestyle-related disease and its improvement.

In this study, we conducted the investigations on the diet and health of zen monks training at zen monasteries to examine their nutrient intake and health conditions, as well as reviewed whether their diet can be applied in order to prevent and minimize lifestyle-related diseases. The following are the obtained results.

Subjects and Method

Subjects

This study was conducted using a total of 47 zen monks, in their twenties training at five Soto zen monasteries. Specifically, nine were from monastery A, 12 from monastery B, 7 from monastery C, 6 from

monastery D, and 13 from monastery E. Because there were differences in the intake of animal foods depending on the monastery, the subjects were divided into two groups; 21 zen monks training at monasteries A and B, who were not consuming animal food during the survey, were categorized as the non-animal food consuming group (hereafter referred to as non-consumption group A/B) and 26 zen monks training at monasteries C, D and E, who were consuming animal food, were categorized as the animal food consuming group (hereafter referred to as consumption group C/D/E). The survey results are separately indicated for both groups.

The subjects were described in writing on the purpose, details, and methods of this survey, as well as precautions on information leakage in accordance with the Helsinki Declaration, and asked for signatures for informed consent. This study has been approved by the Seitoku University Ethics Committee.

Dietary Survey

A diet survey was conducted for three consecutive days. We asked the person in charge of the meals at the zen monasteries, called "Tenzo", to record all the ingredients, including the name of the dish and flavorings used for breakfast, lunch, and dinner that were consumed by all the monks of each monastery, as well as photographing the actual meals. The portion size was estimated based on these color pictures of the food products and portions⁽¹⁰⁾⁽¹¹⁾.

Each monk was also asked to record whether they had second helpings or snacks, and the details of these actions, such as name of the dish, name of food products, and portion size. The nutritional value was calculated using the Standard Tables of Food Composition in Japan⁽¹²⁾.

Physical Measurement

The TANITA TBF-102 (TANITA, Tokyo) was used to measure the height, weight, body mass index (BMI), and body fat percentage of the zen monks.

Calculation of Energy Consumption

A survey on their daily activities was conducted at the same time as the dietary survey.

Referring to the Dietary Reference Intakes for Japanese⁽¹³⁾, the activity intensity was determined for each daily activity, and by multiplying this by the activity time, the total energy consumed per day was calculated.

General Blood Tests and Biochemical Tests

Intravenous blood was sampled

on an empty stomach in the early morning of the last day of the dietary survey. From the general blood test, the white blood cell count, red blood cell count, hemoglobin, hematocrit, and blood platelet count were measured. From the biochemical tests, the serum was separated after blood sampling, and the serum total protein, albumin, total cholesterol, HDL-cholesterol, triglyceride, blood sugar, thyroid stimulating hormone, free triiodothyronine, and free thyroxine were measured.

Statistical Analysis

Values were indicated in the form of average $\pm$ standard deviation. To compare the survey results between the non-consumption group and consumption group, the difference in the average value of all items was tested (t-test), and less than a 5% risk rate was taken as a significant difference.

STATISTICA™ Pro2000 (Stat Soft JAPAN) was used for the statistical analysis.

Results

Characteristics of Subjects

Table 1 shows the physical characteristics and energy consumed by the non-consumption group A/B and consumption group C/D/E. No significant difference was seen in the age, weight, and height. No significant difference was also seen in the BMI and body fat percentage, and the figures of both groups were within the standard range. The energy consumed was basically the same between the two groups.

Nutrient Intake

Table 2 shows the results of surveying the amount of nutrients consumed by the non-consumption group A/B and consumption group C/D/E. No significant difference was seen in the amount of energy consumed. The amount of protein and fat consumed by the consumption group C/D/E was significantly higher than the non-consumption group A/B, however, the consumption level of both groups was lower than The National Nutritional Survey JAPAN⁽¹⁴⁾ (hereafter referred to as J-NNS). The

Table 1 Characteristics of subjects

	Non-consumption group (n=21)	Consumption group (n=26)	P
Age(year)	25.2 $\pm$ 3.0	24.2 $\pm$ 2.0	0.184
Height(cm)	171.4 $\pm$ 3.9	173.2 $\pm$ 5.5	0.223
Weight(kg)	63.7 $\pm$ 7.1	67.4 $\pm$ 8.8	0.127
Body mass index(kg/m ²)	21.7 $\pm$ 2.1	22.5 $\pm$ 2.5	0.255
Body fat mass(%)	17.1 $\pm$ 3.1	18.1 $\pm$ 3.7	0.399
Energy consumption(kcal)	2,749 $\pm$ 375	2,731 $\pm$ 372	0.875

All values are mean $\pm$ SD.

Table 2 Nutrient intake

	Non-consumption group (n = 21)	Consumption group (n = 26)	P	Typical Japanese*
Energy (kcal)	2,070 ± 583	2,229 ± 618	0.148	2,224 ± 647
Protein (g)	48.0 ± 16.4	60.3 ± 26.6	0.002	80.7 ± 27.8
Lipid (g)	24.9 ± 9.7	51.5 ± 22.9	<0.001	70.3 ± 29.1
Carbohydrate (g)	409.6 ± 114.9	360.7 ± 94.9	0.007	305.2 ± 96.4
Potassium (mg)	2,893 ± 958	2,190 ± 1,007	<0.001	2,209 ± 873
Calcium (mg)	434 ± 190	488 ± 296	0.210	488 ± 268
Magnesium (mg)	319 ± 104	275 ± 121	0.025	246 ± 92
Phosphorus (mg)	853 ± 262	927 ± 409	0.217	1,082 ± 378
Iron (mg)	8.3 ± 3.5	8.6 ± 4.3	0.718	8.0 ± 3.5
Zinc (mg)	8.7 ± 2.4	8.2 ± 3.7	0.411	9.9 ± 3.9
Copper (mg)	1.72 ± 0.49	1.41 ± 0.48	<0.001	1.29 ± 0.50
Vitamin A (μg)	264 ± 117	350 ± 294	0.038	833 ± 964
Vitamin D (μg)	0.9 ± 0.5	2.9 ± 4.8	0.001	7.3 ± 8.0
Vitamin E (mg)	4.3 ± 1.4	6.7 ± 4.2	<0.001	9.0 ± 4.0
Vitamin K (μg)	263 ± 216	208 ± 125	0.059	229 ± 187
Thiamine (mg)	0.80 ± 0.17	0.78 ± 0.29	0.594	1.02 ± 0.57
Riboflavin (mg)	0.56 ± 0.14	0.84 ± 0.36	<0.001	1.22 ± 0.55
Niacin (mg)	11.1 ± 2.6	12.3 ± 6.0	0.144	16.1 ± 7.8
Vitamin B ₆ (mg)	1.04 ± 0.33	0.92 ± 0.47	0.086	1.16 ± 0.49
Vitamin B ₁₂ (μg)	<0.1	2.5 ± 3.2	<0.001	6.9 ± 6.8
Folate (μg)	311 ± 75	269 ± 121	0.016	266 ± 143
Pantothenic acid (mg)	5.43 ± 1.45	5.58 ± 1.98	0.615	5.90 ± 2.16
Ascorbic acid (mg)	131 ± 62	80 ± 68	<0.001	73 ± 59
Cholesterol (mg)	1 ± 2	172 ± 240	<0.001	390 ± 219
Dietary fiber (g)	22.1 ± 7.3	15.6 ± 6.8	<0.001	12.8 ± 5.7
The amount of salt equivalent (g)	11.7 ± 4.6	14.3 ± 5.8	0.004	12.1 ± 4.9

All values are mean ± SD.

*Reference No14 ; men, age group : 18-29y

amount of carbohydrates consumed by the non-consumption group A/B was significantly higher than the consumption group C/D/E, and the consumption level of both groups was higher than the J-NNS. As for the consumption of minerals, the amount of potassium, magnesium, and copper consumed by the non-consumption group A/B was significantly higher than the consumption group C/D/E, and the consumption level of both groups was higher than the J-NNS. As for the consumption of vitamins, the consumption group C/D/E consumed vitamins A, D, E, and B₂ significantly more than the non-consumption group A/B, but again the consumption level of both groups was lower than the J-NNS. The difference was especially significant for vitamins A and D. Vitamin B₁₂ was almost not totally consumed by the non-consumption group A/B, and the amount consumed by consumption group C/D/E was drastically lower than the J-NNS. The amount of folic acid and vitamin C consumed was significantly higher in the non-consumption group A/B than the consumption group C/D/E, but for both groups, the level consumed was higher than the J-

NNS. The amount of cholesterol consumed was lower than the J-NNS for both groups, and the difference was especially significant for the non-consumption group A/B. The amount of dietary fiber consumed by the non-consumption group A/B was significantly higher than the consumption group C/D/E, the level of which was higher for both groups than the J-NNS. The amount of salt consumed by the consumption group C/D/E was significantly higher than the non-consumption group A/B, the level of which was higher than J-NNS.

Food Group Intake

Table 3 shows the amount of food consumed by the non-consumption group A/B and consumption group C/D/E. No significant difference was seen for sugars and sweeteners, pulses, and both groups indicated higher consumption levels than J-NNS. The amount of cereals, potatoes and starches, fruits, mushrooms, and algae consumed by the non-consumption group A/B was significantly higher than the consumption group C/D/E. In particular, the consumption level of cereals and mushrooms was higher than the J-NNS for both groups.

Table 3 Food group intake

(g)	Non-consumption group (n=21)	Consumption group (n=26)	P	Typical Japanese*
Cereals	1,111.7±287.5	985.6±259.7	0.007	574.7±216.1
Nuts and Seeds	3.2±5.1	5.5±4.7	0.006	1.1±4.5
Potatoes and Starches	99.9±118.3	20.3±34.8	<0.001	54.4±64.6
Sugars and Sweeteners	11.6±20.3	7.3±13.9	0.142	5.9±7.9
Confectioneries	21.8±65.7	12.3±27.9	0.252	24.6±55.2
Fats and Oils	4.4±5.0	21.4±14.7	<0.001	16.1±12.5
Pulses	103.0±97.5	84.3±83.4	0.255	45.4±60.6
Fruits	134.1±136.8	74.3±122.7	0.007	77.7±156.2
Vegetables	244.7±88.6	252.5±123.8	0.678	252.5±154.1
Mushrooms	40.3±21.4	23.5±18.2	<0.001	13.6±21.6
Algae	11.8±9.3	7.4±9.4	0.006	14.9±39.3
Fishes and Shellfishes	-	22.8±52.4	0.001	80.9±76.5
Meats	-	29.7±63.2	<0.001	134.5±102.0
Eggs	-	26.1±49.4	<0.001	40.2±38.3
Milks	-	21.0±65.3	0.013	121.1±183.6

All values are mean ± SD.

*Reference No14 ; men, age group : 18-29y

Table 4 General blood test values and biochemical test values

	Non-consumption group (n=21)	Consumption group (n=26)	P	Normal range
White blood cell(/ μ L)	6,135±2,130	6,532±1,411	0.448	3,500-9,700
Red blood cell(10^4 / μ L)	494±41	480±29	0.188	438-577
Hemoglobin(g/dL)	15.4±1.1	15.2±0.8	0.609	13.6-18.3
Hematocrit(%)	48.1±3.2	48.3±3.2	0.811	40.4-51.9
Platelet(10^4 / μ L)	26.0±5.8	22.4±4.4	0.019	14.0-37.9
Total protein(g/dL)	7.7±0.4	7.3±0.3	0.020	6.5-8.2
Albumin(g/dL)	5.0±0.2	4.7±0.2	<0.001	3.7-5.5
Total cholesterol(mg/dL)	159±26	168±30	0.013	150-219
HDL-Cholesterol(mg/dL)	57±11	55±13	0.510	40-80
Triglyceride(mg/dL)	77±28	78±46	0.644	50-149
Blood glucose(mg/dL)	84±8	88±9	0.130	70-109
Thyroid stimulating hormone(μ U/mL)	1.9±1.1	1.7±0.9	0.639	0.4-4.0
Free triiodothyronine(pg/mL)	3.3±0.5	3.4±0.4	0.556	2.2-4.1
Free thyroxine(ng/dL)	1.1±0.2	1.3±0.2	0.009	0.8-1.9

All values are mean ± SD.

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The amount of nuts and seeds consumed by the consumption group C/D/E was significantly higher than the non-consumption group A/B, and the consumption level was higher than the J-NNS for both groups. Fats were consumed significantly more by the consumption group C/D/E than the non-consumption group A/B, the amount of which was higher than the J-NNS, but the level was extremely low in the non-consumption group A/B. This group did not consume fishes and shellfishes, meats, eggs, and milks, and thus the fat consumption level of the consumption group C/D/E was extremely lower than the J-NNS.

General Blood Test Values and Biochemical Test Values

Table 4 shows the general blood test values and biochemical test values of the non-consumption group A/B and consumption group C/D/E. All items were within the standard range for the two groups. The non-consumption group A/B had a significantly higher platelet count, total protein, and albumin than the consumption group C/D/E, while the consumption group C/D/E had significantly higher values for free thyroxine.

Discussion

There were no significant differences in the daily activities of a zen monk between the different monasteries, and the energy consumption of both groups was basically the same. As these zen monks spend a vast amount of time cleaning, preparing meals, clearing etc, their daily physical activity is greater than expected. Key et al.¹⁵⁾ reported that vegetarians have higher levels of physical activity than non-vegetarians, and this plays a major role in the significantly lower incidence rate of chronic heart diseases in the vegetarians. Consequently, such lifestyle habits of zen monks significantly contribute to preventing and improving lifestyle-related diseases like the vegetarians in western counties.

In a previous report¹⁶⁾, the consumption amount of nutrients, which can be acquired by zen monks from breakfast, lunch, and dinner, was calculated based on their dietary record. The results suggested that the consumption level of all nutrients is very low, and the consumption of only the food recorded in their dietary record will cause a lack of important nutrients, and so they may be obtaining considerable nutrients from second helpings and snacks not recorded in their dietary record. The consumption amount of energy, protein, fat, and carbohydrates, which can be obtained from breakfast, lunch, and dinner, was calculated on the basis of the results of this survey indicated $1,365 \pm 66\text{kcal}$, $34 \pm 7\text{g}$, $20 \pm 6\text{g}$ and $259 \pm 19\text{g}$ for the non-consumption group A/B, and $1,733 \pm 242\text{kcal}$, $48 \pm 13\text{g}$, $40 \pm 10\text{g}$ and $285 \pm 40\text{g}$ for the consumption group C/D/E. In particular, the consumption amount was very low for the non-consumption group A/B as seen from the results of the dietary record. This indicates that zen monks acquire most of their nutrients from second helpings and snacks to make up for the lack of nutrients obtained from their breakfast, lunch, and dinner.

On converting the consumption amount of protein, fat, and carbohydrates to energy consumption rate, the non-consumption group A/B was $9.2 \pm 1.4\%$, $10.8 \pm 3.1\%$ and $80.0 \pm 4.3\%$, and the consumption group C/D/E was $10.6 \pm 2.3\%$, $20.5 \pm 4.9\%$, $68.9 \pm 5.7\%$, indicating that the distribution of nutrients of both groups is low fat and high carbohydrates. This tendency was especially marked in the non-consumption group A/B. The diet of the non-consumption group A/B brings up concerns for the lack of the n-3 fatty acid such as docosahexaenoic acid and icosapentaenoic acid. However, there is a report the a similar function for α -linolenic acid as well which is the precursor substance of docosahexaenoic acid and

icosapentaenoic acid¹⁷⁾, and in the non-consumption group A/B, which has difficulty getting it from fish and supplements, need to make the efforts to actively consume α -linolenic acid from vegetables.

The non-consumption group A/B also indicated low consumption levels of vitamins except for folic acid and vitamin C. In particular, this group consumed more or less no vitamin B₁₂. Because activated vitamin B₁₂ is not provided from sources other than animal foods, such a deficiency is often a problem amongst strict vegetarians¹⁸⁾¹⁹⁾, and today, the use of supplements is recommended²⁰⁾. However, because vitamin B₁₂ is stored and reused in the body²¹⁾, in the case of the non-consumption group A/B, the consumption situation of animal food before the monks in this group went into training may affect their health conditions during training.

The nutrient consumption of strict vegetarians is a high dietary fiber and low cholesterol, and it has been reported that this prevents lifestyle-related disease and as a result, reduces the death rate²²⁾. It has also been reported that when ischemic heart disease patients were given low saturated fatty acid and low cholesterol vegetarian foods, their blood cholesterol level dropped, and progress of arteriosclerosis lesion was inhibited²³⁾. It is thought that the same effects exist in the diet of the non-consumption group A/B, which consumes minimal fat and cholesterol and very high amounts of dietary fiber.

As a result of reviewing the effects of the nutrient consumption state of zen monks based on the general blood test values and biochemical test values, no abnormalities were seen, and both groups were confirmed to be in excellent health. This suggests that continuing a diet with minimal fats and cholesterol as the non-consumption group A/B has little risks of causing major health issues. It also indicates that the diet of the non-consumption group A/B can serve as a reference to those who need to restrict their intake of fats and cholesterol and lower their blood triglyceride and total cholesterol to standard values. However, because a deficiency in fatty acids and vitamins acquired from animal food is a concern, normal people who plan to adopt the diet of the non-consumption group A/B in their daily life and continue the diet over a long period of time, need to seriously take this aspect into consideration.

It has been reported that converting the diet of ischemic heart disease patients to that of a vegetarian resulted in an excellent receptivity²⁴⁾²⁵⁾. Given that the Japanese had originally adopted diets resembling vegetarians mainly consisting of vegetable, it may be comparatively

easy for us to adapt to the diet of the zen monks, which does not consume, or consumes a very small amount of animal foods. In particular, since ischemic patients have the clear motive of having the need to change their diet, the receptivity should be high when they adopt the diet of the zen monks, and it is hoped that the diet will be considered a choice for therapeutic diets.

Though this study picked as subjects zen monks in their twenties, in the future, surveys will be conducted on elderly zen monks with a higher risk of lifestyle-related diseases in order to further review the effectiveness of applying such a diet to patients with lifestyle-related diseases.

Summary

In this study, we conducted investigations on zen monks training at monasteries who adopt a diet centered around vegetables in order to investigate their nutrient consumption state and health, and reviewed if their diet can be applied to prevent and minimize lifestyle-related diseases. The following is a report of the obtained results.

1) The nutrient consumption of zen monks was high carbohydrates, high dietary fiber, low fat, and low cholesterol, and this was especially conspicuous in the non-animal food consumption group.

2) Together with the dietary habits whose amount of energy consumption is high, it is suggested that it is effective for preventing and minimizing lifestyle-related diseases.

3) Given that the general blood test values and biochemical test values of the zen monks are excellent, it indicates that continuing a diet low in fats and cholesterol has low risks of causing health problems. Consequently, the diet of the zen monks can serve as a reference to those who need to lower their triglycerides and total cholesterol to standard levels.

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Reference

- 1) Kita T, Yokode M, Kume N, Ishii K, Nagano Y, Mikami A, Kita M, Fujii K, Kawai C, Domae N, Ishihara H, Kimura M, Tonekawa Y : The concentration of serum lipids in zen monks and control males in japan. *Jpn Circ J, Circ J*, 52 (2) 99-104 (1998)
- 2) Otani H, Kita T, Ueda Y, Kawai C, Takama T, Matsuzawa Y, Nakaya N, Ishihara H, Domae N, Yoshii M, Miyazaki S : Long-term effects of a cholesterol-free diet on serum cholesterol levels in zen monks. *N Engl J Med*, 326 (6), 418 (1992)
- 3) Key TJ, Davey GK : Prevalence of obesity is low in people who do not eat meat. *Brit Med J*, 313, 816-817 (1996)
- 4) Spencer EA, Appleby PN, Davey GK, Key TJ : Diet and body mass index in 38000 EPIC-Oxford meat-eaters, fish-eaters, vegetarians and vegans. *Int J Obes Relat Metab Disord*, 27, 728-734 (2003)
- 5) Fraser GE : Associations between diet and cancer, ischemic heart disease, and all-cause mortality in non-Hispanic white California Seventh-day Adventists. *Am J Clin Nutr*, 70 (suppl), 532S-538S (1999)
- 6) Beilin LJ : Vegetarian and other complex diets, fats, fiber, and hypertension. *Am J Clin Nutr*, 59 (suppl), 1130S-1135S (1994)
- 7) Appleby PN, Davey GK, Key TJ : Hypertension and blood pressure among meat eaters, fish eaters, vegetarians and vegans in EPIC-Oxford. *Public Health Nutr*, 5, 645-654 (2002)
- 8) Snowdon DA, Phillips RL : Does a vegetarian diet reduce the occurrence of diabetes? *Am J Public Health*, 75 (5), 507-512 (1985)
- 9) Seijo university folklore laboratory : The record of the Japanese food culture-Showa early days, whole country meal manners and customs-, Iwasakibijyutsusha, Tokyo (1990)
- 10) Yoshiko K : The calorie guidebook of the side dish of the family, Kagawa nutrition university publishing part, Tokyo (2002)
- 11) Nutrition and cooking-home cooking research group : Kagawa nutrition university publishing part, Tokyo (2003)
- 12) Ministry of Education, Culture, Sports, Science and Technology, Japan : Standard Tables of Food Composition in Japan (Fifth Revised and Enlarged Edition). (2005)
- 13) Ministry of Health Labor Welfare, Japan : Dietary Reference Intakes for Japanese. (2005)
- 14) Ministry of Health Labor Welfare, Japan : The National Nutrition Survey in Japan. (2002)
- 15) Key TJ, Fraser GE, Thorogood M, Appleby PN, Beral V, Reeves G, Burr ML, Chang-Claude J, Frentzel-Beyme R, Kuzma JW, Mann J, McPherson K : Mortality in vegetarians and non-vegetarians : detailed findings from a collaborative analysis of five prospective studies. *Am J Clin Nutr*, 70 (suppl), 516S-524S (1999)
- 16) Higashiguchi M, Shinohara Y, Matsumoto N, Sugahara T : Nutritional analysis of dietary records at a zen monastery. *J Integr Stud Diet Habits*, 16 (3), 276-282 (2005)
- 17) Hu FB, Stampfer MJ, Manson JE, Rimm EB, Wolk A,

- Colditz GA, Hennekens CH, Willett WC : Dietary intake of α -linolenic acid and risk of fatal ischemic heart disease among women. *Am J Clin Nutr*, **69** (5), 890-897 (1999)
- 18) Sanders TA : The nutritional adequacy of plant-based diets. *Proc Nutr Soc*, **58** (2), 265-269 (1999)
- 19) Hokin BD, Butler T : Cyanocobalamin (vitaminB12) status in Seventh-day Adventist ministers in Australia. *Am J Clin Nutr*, **70** (suppl), 576S-578S (1999)
- 20) Haddad EH, Sabate J, Whitten CG : Vegetarian food guide pyramid : a conceptual framework. *Am J Clin Nutr*, **70** (suppl), 615S-619S (1999)
- 21) Ellis LN, Duncan BJ, Snow IB : The influence of diet upon the storage of vitamin B12 in liver and kidney. *J. Nutr*, **67** (2), 185-196 (1959)
- 22) Appleby PN, Thorogood M, Mann JI, Key TJ : The Oxford Vegetarian Study : an overview. *Am J Clin Nutr*, **70** (suppl), 525S-531S (1999)
- 23) Arntzenius AC, Kromhout D, Barth JD, Reiber JH, Bruschke AV, Buis B, van Gent CM, Kempen-Voogd N, Strikwerda S, van der Velde EA : Diet, lipoproteins, and the progression of coronary atherosclerosis. The Leiden Intervention Trial. *N Engl J Med*, **312**(13), 805-811 (1985)
- 24) Ornish D, Scherwitz LW, Billings JH, Brown SE, Gould KL, Merritt TA, Sparler S, Armstrong WT, Ports TA, Kirkeeide RL, Hogeboom C, Brand RJ : Intensive lifestyle changes for reversal of coronary heart disease. *JAMA*, **280** (23), 2001-2007 (1998)
- 25) DeRose DJ, Charles-Marcel ZL, Jamison JM, Muscat JE, Braman MA, McLane GD, Keith MJ : Vegan diet-based lifestyle program rapidly lowers homocysteine levels. *Prev Med*, **30** (3), 225-233 (2000)