Thai Journal of Pharmaceutical Sciences (TJPS)

Journal homepage: http://www.tjps.pharm.chula.ac.th

Effect of dietary advice on lipid profiles in Thai HIV-infected patients with dyslipidemia

Ketchaleaw P[1], Pongthananikorn S[1], Meksawan K[1*]

[1] *Department of Food and Pharmaceutical Chemistry, Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok 10330, Thailand*

Keywords: Dietary advice; lipid profiles; dyslipidemia; HIV-infected patients; HARRT

Objectives: To investigate the effect of dietary advice based on the NCEP ATP III guidelines on lipid profiles in HIV-infected patients with dyslipidemia
Methods: Twenty-nine HIV-infected patients with dyslipidemia participated in this study. They were randomly assigned into the control group (N = 14) and the intervention group (N = 15). All patients received general advice on healthy food according to Thai Nutrition Flag, and only the patients in the intervention group additionally received dietary advice following the NCEP ATP III guidelines. The patients were followed every 2 months until finished the study (month 6). Three-day dietary records were performed every visit and blood lipid profiles were determined at baseline and month 6.
Results: The results showed that after receiving dietary advice for 6 months, the patients in the intervention group had significantly decreased percentage of calories from fat, but increased percentage of calories from carbohydrate, compared to baselines ($p < 0.05$). Fat and polyunsaturated fat consumption were significantly lowered in the intervention group compared to those in the control group at month 6 ($p < 0.05$). At month 6, total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) levels of the patients in the intervention group were significantly decreased from baselines ($p < 0.05$), but these levels were not changed in the control group.
Conclusion: Dietary modification is important in managing abnormal blood lipids in HIV-infected patients with dyslipidemia. Following the NCEP ATP III guidelines, individual dietary advice for these patients can improve their dietary intake and thus blood lipid profiles.

* Corresponding author: Department of Food and Pharmaceutical Chemistry, Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok 10330, Thailand; Tel. +66(2)218-8295; Fax. +66(2)218-8291
E-mail address: Kulwara.M@Chula.ac.th

Introduction

AIDS (Acquired Immunodeficiency Syndrome) is a group of immunodeficiency symptoms caused by Human Immunodeficiency Virus (HIV) infection. Treatment for HIV/AIDS with highly active antiretroviral therapy (HAART) successfully suppresses the HIV replication and improves clinical outcomes; however, HIV-infected patients on long-term HAART are at increased risk for developing many complications[1]. Dyslipidemia is one of metabolic disturbances found to be associated with some antiretroviral therapies, particularly with nucleoside reverse transcriptase inhibitors (NRTIs) and protease inhibitors (PIs)[2,3]. Abnormal changes in blood lipid profiles are risk factors for cardiovascular disease[4]. At present, there are no specific guidelines for management of dyslipidemia in HIV-infected patients. Therapeutic interventions to improve blood lipid profiles usually involve low-fat intake, exercise and smoking cessation. Drug therapy and antiretroviral therapy modification are also included. However, use of lipid-lowering drug, such as HMG CoA reductase inhibitors (statins), with antiretroviral drugs must be considered because of drug-drug interaction[5]. Therefore, the therapeutic lifestyle changes (TLC) based on the recommendations of the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) guidelines for the general people is always suggested as a first line of hypercholesterolemia management[6-8]. Reduction of saturated fats (less than 7%) and cholesterol (less than 200 mg/day) intakes, considerably increase in viscous (soluble) fiber (10-25 g/day) and plant stanols/sterols (2 g/day) intakes, weight reduction, and increased physical activity are recommended.

Previous study showed that dyslipidemia could be prevented in HIV-infected patients when dietary intervention was assigned to the patients together with the first start of HAART[9]. It was found that HIV-infected patients with metabolic syndrome who received the lifestyle modification program had significant decreased systolic blood pressure and waist circumference with no change in lipid profiles[10]. However, the benefit of dietary modification on lipid profiles in HIV-infected patients was shown in the other studies[11,12]. Although appropriate dietary intake seems to have a positive impact on lipid profiles, limited studies on specific dietary advice for HIV-associated dyslipidemia management were conducted, especially in Thailand. This study was thus aimed to investigate the effect of dietary advice on blood lipid profiles of Thai HIV-infected patients with dyslipidemia.

Methods

***Subjects*:** HIV-infected patients aged 18 years old and over were recruited from HIV-outpatient clinic at Banbung Hospital, Chonburi Province. All of them had received stable combination antiretroviral therapy for at least 3 months and had been diagnosed with dyslipidemia. Patients who had at least one of the followings: low-density lipoprotein cholesterol (LDL-C) level greater than or equal to 130 mg/dl or LDL-C of 100 mg/dl if they had cardiovascular disease, total cholesterol (TC) level at least 200 mg/dl and triglyceride (TG) level at least 150 mg/dl were included. Subjects were excluded if they had viral load more than 400 copies/ml or 50 copies/ml after taking antiretroviral drugs every day at least 6 or 12 months respectively, had new serious opportunistic infection, received lipid-lowering drug or dietary supplement which has an effect on lipid levels and were diagnosed with diabetes mellitus.

***Study design*:** At the beginning of the study, each patient completed the 3-day dietary records. Blood samples were collected to determine LDL-C, TC, TG, and high-density lipoprotein cholesterol (HDL-C). Weight and height were measured. The patients were randomly assigned into the intervention group and the control group. At baseline, the patients of both groups received general advice about a healthy diet daily required for Thai people based on Thai Nutrition Flag (Bureau of Nutrition, Department of Health, Ministry of Public Health). At month 2 and month 4, the patients completed the 3-day dietary records again, and only intervention group were given dietary advice following NCEP ATP III guidelines. At the end of the study (month 6), dietary intake and lipid profiles were determined again. The study protocol was approved by the Ethics Committee of the Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok, Thailand.

Dietary assessment: All participants were instructed on how to record their 3-day dietary records (2 days of the weekdays and 1 day of the weekend). The form was done by the patients at the baseline, month 2, month 4, and month 6. The dietary record form contained the dates on which data were recorded, all items and portions of food consumed included the name of food, portion size using standard household measuring cups and spoons, method of preparation and cooking. The records were calculated for daily dietary intake including carbohydrate, protein, fat, cholesterol, and dietary fiber using the software THAI NUTRISURVEY developed for Thai food by Department of Health, Ministry of Public Health and Faculty of Tropical Medicine, Mahidol University, Thailand.

***Biochemical assessment*:** At baseline and the end of study, 12-hour fasting blood samples were obtained from the patients. The samples were collected for determining LDL-C, TC, TG, and HDL-C. These parameters were measured at laboratory department of Banbung Hospital.

Statistical analysis: Continuous data were presented as mean ± standard deviation (SD). Demographic data between the two groups were compared at baseline by Chi-square tests. The differences between the data in both groups were analyzed by independent *t*-test and analysis of variance (ANOVA). The paired *t*-test was used for comparisons of variables within the group. For each analysis conducted, the significance level was set at the p-value < 0.05.

Results

Subject characteristics: Thirty-nine HIV-infected patients were enrolled in this study. The control group comprised of 14 patients (6 males and 8 females), and the intervention group comprised of 15 patients (7 males and 8 females). There were no significant differences between groups at baseline for all parameters. Most of the subjects in both groups were aged between 31-40 years old and had duration of HIV infection for 6-10 years. The most commonly prescribed HAART regimen in the control group was the combination of stavudine, lamivudine and nevirapine (42.9%), but the combination of zidovudine, lamivudine and nevirapine were mostly prescribed in the intervention group (26.7%). In the control group, 21.4% of the patients were underweight and overweight and 7.1% were obese, while in the intervention group, 13.3% were overweight and obese and 6.7% were underweight.

Effect of dietary advice on dietary intake: The intakes of total energy, protein, fat, and polyunsaturated fat in the intervention group were significantly decreased from baselines at month 6 ($p < 0.05$) (Table 1). After receiving dietary advice for 6 months, the patients in the intervention group had significantly decreased percentage of calories from fat, but increased percentage of calories from carbohydrate, compared to baselines ($p < 0.05$). At month 6, cholesterol consumption of the patients in the intervention group was significantly decreased from month 2 ($p < 0.05$). There were no significant changes in daily dietary intakes from baselines in the control group at month 6. The results showed that fat and polyunsaturated fat consumption were significantly lowered in the intervention group compared to those in the control group at month 6 ($p < 0.05$). At month 4, the percentage of calories from carbohydrate and dietary fiber intake of the patients in the intervention group were significantly higher than those in the control group ($p < 0.05$).

Effect of dietary advice on lipid profiles: No significant differences in lipid profile at baseline between groups were observed (Table 2). At month 6, TC and LDL-C levels of the patients in the intervention group were significantly decreased from baselines ($p < 0.05$), but there were no changes of these parameters in the control group. When compared with the control group at month 6, the patients in the intervention group had significantly lowered TC and LDL-C levels ($p < 0.05$).

Discussion

The present study revealed the importance of dietary advice on dietary blood lipid profiles. The results showed that HIV-infected patients who received dietary advice based on NCEPT ATP III for 6 months had significant reduced blood TC and LDL-C levels, compared to their baselines and the levels of these parameters in the control group. In this study, the patients consumed daily calories from carbohydrate less than 50%, from protein more than 15% and from fat more than 25%. These were considered inappropriate as the intake did not follow NCEP ATP III guidelines. In addition, they consumed more polyunsaturated fat and cholesterol but less dietary fiber than recommendations.

Table 1 Daily dietary intakes of the patients

Parameters	Control group (n = 14)				Intervention group (n = 15)			
	Baseline	Month 2	Month 4	Month 6	Baseline	Month 2	Month 4	Month 6
TE (kcal)	1959.10 ± 390.28	1944.10 ± 715.56	1779.26 ± 429.17	1935.98 ± 428.47	2159.57 ± 574.74	2024.48 ± 403.80	1996.65 ± 609.77	1847.51 ± 602.31[a]
Protein, g	106.16 ± 34.39	125.78 ± 64.64	105.81 ± 41.18	116.43 ± 50.75	126.48 ± 52.62	114.67 ± 42.44	115.29 ± 40.55	93.93 ± 30.74[a]
% TE	21.93 ± 5.43	26.29 ± 9.35[a]	24.07 ± 6.73	24.07 ± 7.68	23.13 ± 5.48	23.07 ± 6.96	23.93 ± 6.61	20.80 ± 4.18
CHO, g	230.16 ± 59.38	213.51 ± 85.62	198.75 ± 61.36	211.92 ± 36.23	252.45 ± 77.50	237.35 ± 66.43	260.35 ± 79.07[d]	266.09 ± 90.79
% TE	48.43 ± 10.80	45.00 ± 8.21	45.43 ± 8.48	45.43 ± 6.15	48.27 ± 9.71	45.60 ± 8.68	53.87 ± 9.61[b,d]	58.73 ± 8.82[a,b,c,d]
Fat, g	66.13 ± 23.85	62.79 ± 29.02	60.39 ± 17.93	67.69 ± 24.54	69.80 ± 28.61	66.59 ± 16.46	52.23 ± 32.36	42.65 ± 21.39[a,b,d]
% TE	29.64 ± 8.31	28.71 ± 9.95	30.21 ± 6.78	30.71 ± 7.73	28.53 ± 9.57	31.20 ± 8.91	22.27 ± 9.92[b,d]	20.47 ± 7.05[a,b,d]
PUFA (g)	15.94 ± 9.59	13.36 ± 5.04	12.51 ± 4.50	17.77 ± 9.48	15.13 ± 7.38	17.47 ± 9.35	13.70 ± 5.33	9.35 ± 2.59[a,b,c,d]
Cholesterol (mg)	558.04 ± 256.48	574.19 ± 383.80	519.49 ± 200.99	510.97 ± 294.05	551.55 ± 354.28	593.46 ± 280.20	451.65 ± 334.28	395.18 ± 243.85[b]
Dietary fiber (g)	14.41 ± 6.34	13.13 ± 8.61	12.12 ± 6.40	15.54 ± 8.42	14.75 ± 6.46	16.38 ± 6.84	17.36 ± 6.83[d]	15.31 ± 5.69

Data are expressed as mean ± standard deviation (SD); TE = Total energy; CHO = Carbohydrate; PUFA = Polyunsaturated fat;
[a] Significant difference within group from baseline ($p < 0.05$); [b] Significant difference within group from month 2 ($p < 0.05$);
[c] Significant difference within group from month 4 ($p < 0.05$); [d] Significant difference between group at the same time point ($p < 0.05$)

Table 2 Blood lipid profiles of the patients at baseline and month 6

Parameters	Control group (n = 14)		Intervention group (n = 15)	
	Baseline	Month 6	Baseline	Month 6
TC (mg/dl)	204.28 ± 19.73	215.86 ± 31.30	199.13 ± 37.41	170.00 ± 26.01[a,b]
TG (mg/dl)	182.21 ± 93.23	162.71 ± 84.83	143.60 ± 80.03	124.27 ± 55.50
HDL-C (mg/dl)	50.79 ± 8.62	52.93 ± 9.26	56.07 ± 16.83	54.33 ± 15.86
LDL-C (mg/dl)	119.29 ± 32.79	130.50 ± 36.03	114.53 ± 37.71	91.07 ± 20.61[a,b]

Data are expressed as mean ± standard deviation (SD); TC = Total cholesterol; TG = Triglyceride; HDL-C = High-density lipoprotein cholesterol; LDL-C = Low-density lipoprotein cholesterol;
[a] Significant difference within group ($p < 0.05$); [b] Significant difference between group at month 6 ($p < 0.05$)

The results agreed with the previous study that the HIV-infected patients who received antiretroviral therapy consumed high energy from fat[13]. The study by Duran et al.[14] also indicated that most of the HIV-infected patients needed to improve their dietary intake. After dietary intervention, the patients in the intervention group significantly consumed less fat, polyunsaturated fat and cholesterol, but more calories from carbohydrate, compared to baseline. These findings supported the results from the others[9,11].

This study showed that the HIV-infected patients with dyslipidemia who were advised on daily dietary intake according to NCEPT ATP III guidelines had decreased levels of LDL-C and TC. This agreed with Lazzaretti et al.[9] who found that the patients who received step II NCEP diet after starting HAART had controlled TC and LDL-C levels. The improved blood lipid profiles may be the results of modified daily dietary intake. In the present study, it appeared that the patients who received dietary advice consumed less fat and cholesterol from the diet, their TC and LDL-C levels were improved. These findings were similar to previous results that HIV-infected patients who had good compliance to low fat consumption had significantly decreased in TG and TC levels[12]. The results of the present study were also consistent with the recent study conducted in Thailand. Chotivichien et al.[15] demonstrated the improvement of lipid profiles in HIV-positive patients on ART after receiving nutrition counseling that followed the TLC guidelines focusing on LDL-C changes according to the NCEP ATP III. This previous study focused particularly on the patients with abnormal LDL-C levels and used 24-h recall to assess dietary intake of the patients while the present study also included the patients with abnormal levels of the other blood lipid parameters and used 3-day dietary record to assess dietary intake. Although there were some differences in subjects recruited and nutrient assessments, these studies still showed that adapting the NCEP guideline to make it appropriate for Thais was possible, and the modified dietary advice is beneficial to the HIV-infected patients with abnormal blood lipid profiles.

Conclusion

This study showed the importance of individual dietary advice according to the NCEP ATP III guidelines on modification of dietary intake and blood lipid profiles of the HIV-infected patients who were also suffered from dyslipidemia. Eating following NCEPT ATP III guidelines resulted in lower fat and cholesterol intake, which could lead to reduction of TC and LDL-C levels. Therefore, dietary advice for all HIV-infected patients with dyslipidemia should be encouraged.

Acknowledgements

This study was supported by CU Graduate School Thesis Grant, Chulalongkorn University.

References

1. Montessori V, Press N, Harris M, Akagi L, Montaner J. Adverse effects of antiretroviral therapy for HIV infection. CMAJ. 2004;170:229-38.
2. Bonnet F, Bonarek M, Witte S, Beylot J, Morlat P. Efavirenz-associated severe hyperlipidemia. Clin Infect Dis. 2002;35:776-7.
3. Sax PE. Strategies for management and treatment of dyslipidemia in HIV/AIDS. AIDS Care. 2006;18(2):149-57.
4. Sharrett AR, Ballantyne CM, Coady SA, Heiss G, Sorlie PD, Catellier D, Patsch W. Atherosclerosis Risk in Communities Study Group. Coronary heart disease prediction from lipoprotein cholesterol levels, triglycerides, lipoprotein(a), apolipoproteins A-I and B, and HDL density subfractions: The Atherosclerosis Risk in Communities (ARIC) Study. Circulation. 2001;104:1108-13.
5. Fichtenbaum CJ, Gerber JG. Interactions between antiretroviral drugs and drugs used for the therapy of the metabolic complications encountered during HIV Infection. Clin Pharmacokinet. 2002;41(14):1195-211.
6. Dube MP, Stein JH, Aberg JA, et al. Guidelines for the evaluation and management of dyslipidemia in human immunodeficiency virus (HIV)-infected adults receiving antiretroviral therapy: recommendations of the HIV Medical Association of the Infectious Disease Society of America and the Adult AIDS Clinical Trials Group. Clin Infect Dis. 2003;37:613-27.
7. Lundgren JD, Battegay M, Behrens G, et al. European AIDS Clinical Society (EACS) guidelines on the prevention

and management of metabolic disease in HIV. HIV Med. 2008;9:72-81.
8. Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults. Executive summary of the third report of the national cholesterol education program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III). JAMA. 2001;285:2486-97.
9. Lazzaretti RK, Kuhmmer R, Sprinz E, Polanczyk CA, Ribeiro JP. Dietary intervention prevents dyslipidemia associated with highly active antiretroviral therapy in human immunodeficiency virus type 1-infected individuals: a randomized trial. J Am Coll Cardiol. 2012;59:979-88.
10. Fitch KV, Anderson EJ, Hubbard JL, et al. Effects of a lifestyle modification program in HIV-infected patients with the metabolic syndrome. AIDS. 2006;20:1843-50.
11. Figueiredo SM, Penido MG, Guimaraes MM, et al. Effects of dietary intervention on lipids profile of hiv infected patients on antiretroviral treatment (ART). ESJ. 2013;9(12):32-49.
12. Barrios A, Blanco F, García-Benayas T, et al. Effect of dietary intervention on highly active antiretroviral therapy-related dyslipidemia. AIDS. 2002;16:2079-81.
13. Batterham MJ, Garsia R, Greenop PA. Dietary intake, serum lipids, insulin resistance and body composition in the era of highly active antiretroviral therapy 'Diet FRS Study'. AIDS. 2000;14:1839-43.
14. Duran AC, Almeida LB, Segurado AA, Jaime PC. Diet quality of persons living with HIV/AIDS on highly active antiretroviral therapy. J Hum Nutr Diet. 2008;21:346-50.
15. Chotivichien S, Arab L, Prasithsirikul W, Manosuthi W, Sinawat S, Detels R. Effect of nutritional counseling on low-density lipoprotein cholesterol among Thai HIV-infected adults receiving antiretroviral therapy. AIDS Care. 2016;28(2):257-65.