

Prevalence and Factors Associated with Metabolic Syndrome Among HIV/AIDS Infected Patients Who Use ARV, Nan Province, 2015-2016

Chantana Teekawong, M.Sc.^{*}, Tawatchai Apidechkul, Dr.P.H. (Epidemiology)^{**}, ^{***}, Mitra Cassely, M.D.^{***}
Korakot Chansareewittaya, Ph.D.^{***}

^{*}Nan Hospital, Nan Province 55000, ^{**}Center of Excellence for the Hill tribe Health Research, Mae Fah Luang University, ^{***}School of Health Science, Mae Fah Luang University, Chiang Rai 57110, Thailand.

ABSTRACT

Objective: A cross-sectional study design was conducted to assess the prevalence and factors associated with the metabolic syndrome among HIV/AIDS infected patients in Nan Province, Thailand.

Methods: The study samples were drawn from antiretroviral clinics (ARV) at 10 district hospitals in Nan Province from 2015-2016, aged ≥ 18 years, who had received antiretroviral therapy for at least six months. The metabolic syndrome was assessed using the criteria of the National Cholesterol Education Program-Adult Treatment Panel III (NCEP ATP III). A validated questionnaire and laboratory analysis were used as research instruments. Logistic regression was used to identify the associations between variables at $\alpha=0.5$.

Results: 252 HIV/AIDS patients who were on ARV were recruited into the study. 53.2% were males, average age was 41.3 years, 55.6% graduated from secondary school, and 51.9% had income $\leq 5,000$ per month. 65.1% had received ARV ≥ 25 months, and 87.7% had a CD4 level ≤ 200 cell/cm³, 23.4% had a high systolic blood pressure, and 29.4% had a high diastolic blood pressure. 4.0% had high fasting blood glucose, 40.1% had a high triglyceride, 50.4% of males had a low high density lipoprotein-cholesterol (HDL-cholesterol), and 78.6% of females had a low HDL-cholesterol. The overall prevalence of metabolic syndrome was 52.8%. After control for all confounding variables, HIV/AIDS patients aged 41-50 years had a 1.89 times greater chance (95%CI=1.07-3.33) to develop metabolic syndrome compared to those aged <30 years old, and those aged ≥ 51 years old had a greater chance 2.14 times (95%CI=1.12-4.53) to develop metabolic syndrome than those aged <30 years old. Those who had no history of taking food more than three times a day had a 1.96 times greater opportunity to develop metabolic syndrome (95%CI=1.19-3.24).

Conclusion: Thailand needs to set up a surveillance system on metabolic syndrome among HIV/AIDS infected patients who use ARV to monitor prolonged side effects. Essential health information including personal healthy dietary behavior should be provided for all ARV receiving patients.

Keywords: Metabolic syndrome; HIV/AIDS; ARV; prevalence (Siriraj Med J 2017;69: 319-329)

INTRODUCTION

HIV/AIDS has been defined as a serious public health and medical problem for almost 30 years.¹ It has been spreading out of all populations and sectors in all societies in the world. Even though we have advancements in medical and public health research regarding HIV infection and therapy, many aspects of its problems

have not been completely dealt with. World Health Organization (WHO) estimated that 36.9 million people were infected with HIV worldwide in 2015.¹ However, only 15.8 million people (40.7%) had access to antiretroviral drugs (ARV).¹

In Thailand, the first HIV/AIDS case was reported in 1984. Currently, all age categories of Thailand have been

Correspondence to: Tawatchai Apidechkul

E-mail: tawatchai.api@mfu.ac.th

Received 24 May 2017 Revised 27 June 2017 Accepted 28 June 2017

doi:10.14456/smj.2017.62

impacted by the disease.² In 2015, the Thai Ministry of Public Health reported that the cumulative number of HIV/AIDS cases in Thailand was 1,526,028.³ In 2015, 481,241 cases of HIV/AIDS were still alive, and among those 355,123 cases, 73.5% were on ARV.⁴

Thailand has provided antiretroviral drugs to people infected with HIV/AIDS since 1991.⁵ All HIV infected persons who meet the criteria can start ARV drugs in any stage of infection.⁶ This is from the latest version on the guideline under the Thailand National Guideline on AIDS Treatment and Prevention 2014 which is in use in all health care sectors in Thailand. Generally, ARV in Thailand can be classified into five groups; i) nucleoside reverse transcriptase inhibitors (NRTIs), ii) non-nucleoside reverse transcriptase inhibitors (NNRTIs), iii) protease inhibitors (PIs), iv) fusion inhibitors (FIs), and v) chemokine coreceptor-5 (CCR5) antagonists.⁵ There are numbers of regimens used in Thailand health care system, although only a few monitoring systems on its side effect for the users are working through out the country.

Nan province is located in northern region of Thailand with a total population of 497,955.⁷ In 2016, a total of 2,930 HIV/AIDS cases were registered in health care systems under 10 hospitals and were still alive, but only 2,145 cases (73.2%) met the criteria and were on ARV.⁸ Furthermore, no prolonged surveillance system on the side effect of ARV has been available. In 2017, there were 16 different regimens available for the patients under Nan health care system.⁶ All Thai people who hold Thai national identification card and meet the criteria can get access to ARV without charge in a public hospital. This has led to an increase in the number of HIV/AIDS patients who received ARV in Thailand including Nan province.

Since people who are living with HIV/AIDS are predominantly concerned with their surviving survival, many of drugs present side effects in short and long term, but only a few people are concerned about the side effects particularly in mental health impact. This is a common phenomenon among HIV/AIDS patients' in developing countries including Thailand where they have limited choice in their medication.

Therefore, this study aimed to assess the prevalence and factors associated with the metabolic syndrome among HIV/AIDS infected persons who were on ARV treatment at least 6 months at the start of the study.

MATERIALS AND METHODS

Study design

A cross-sectional study was conducted to find the

prevalence and to assess the factors associated with metabolic syndrome among HIV/AIDS infected patients who used ARV in Nan province.

Study site

The samples were drawn from HIV/AIDS clinics from 10 district hospitals in Nan Province from 2015–2016; Nan, Chiang Kran, Pua, Wiang Sa, Na Naoi, Tha Wang Pha, Bau Krea, Tong Chang, Pup Paing, and Cha Lerm Pra Kient hospitals.

Study population

The study population was 2,596 cases of people diagnosed as infected with HIV and receiving antiretroviral therapy on the date of data collection.⁸

Eligible population

HIV/AIDS patients who were receiving any regimen of ARV for at least 6 months before starting the project were eligible for the study.

Sample size

Sample size was calculated by using formula.⁹

$$n = \frac{p(1-p)}{Z^2 \cdot e^2} \cdot N$$

n = The sample size

N = Population size - the total population of 2,596 people

e = Acceptable level of sampling error at 0.05

Z = 1.96

p = Prevalence of metabolic syndrome in previous study = 0.2¹⁰

After calculating, at least 229 cases were needed in the study, and 10.0% was added for any errors from the study, so finally 252 cases were required.

Sample selection

The lists of HIV/AIDS patients who were receiving any regimen of ARV for at least 6 months were asked from 10 ARV clinics in Nan provinces. After getting the lists, a simple random sampling method was used to get 252 subjects. After getting the lists, the chief of ARV clinic was contacted for making appointment. Explanation and specific requirements regarding the project were delivered to relevant staff. Appointment was made for each selected participant on the day they had to come to meet the doctor in a hospital.

Research instruments

A validated questionnaire and laboratory analysis were used as research instruments. The questionnaire was developed from the literature review and evaluated by experts in the field. It consisted of six parts: general information, ARV drugs use information, health behaviors and daily dietary information, laboratory information, mental health and quality of life assessments, and KAP. The questionnaire had been tested for validity by three external experts (Index of Item-Objective Congruence; IOC).¹¹ In the step of IOC testing, only questions with a score of score > 0.5 were kept, and the remaining were deleted or improved before use. Knowledge and practice questions were tested for reliability by testing 10 selected samples who had similar characteristics with the participants. Cronbach's alpha was 0.78, 0.73 in the attitude and practice parts, respectively. In the part of knowledge, only Kuder's score (KR) > 0.5 was kept for use.¹²

Five mL of blood specimens were collected and tested for lipid profiles and fasting blood sugar at Nan hospital. All information from both questionnaire and laboratory were pooled into the same file before analysis. The outcome of the study was metabolic syndrome.

The measurement for assessing the metabolic syndrome was the (National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP-III)).¹³ The definition according to the NCEP ATP-III consisted of 5 criteria; i) waist for male greater than 90 cm, or greater than 80 cm for female, ii) triglyceride ≥ 150 mg/dL, iii) HDL Cholesterol < 40 mg/dL in male, and < 50 mg/dL in female, iv) blood pressure > 130/85 mmHg, and v) fasting blood sugar ≥ 110 mg/dL. Those subjects who met 3 of 5 criteria were defined as having metabolic syndrome.¹⁴

Data collection procedure

Before data collection, all the 10 hospital directors and chiefs of ARV clinic were contacted to get their approval for gathering the data. All HIV/AIDS infected persons who received ARV were identified based on inclusion and exclusion criteria of the study. All subjects who met the criteria were contacted and asked for their cooperation to participate in the project. Once the subjects presented their interested in joining project, then, they were explained all essential information regarding the research project before signing the consent form. The physical health of all the subjects was examined by a physician and a 5 mL blood specimen was collected. After that, subjects were asked the information in the questionnaires in a private and confidential room. The process of obtaining the information lasted for 40 minutes.

All subjects were given a small gift to appreciate their participation.

Data management and data analysis

Data were double entered and validated using Microsoft Excel. Data analyses were performed using SPSS (version 11.5; 2006 SPSS, Chicago, Illinois), and Stata (version 8.2; Stata Corp, College Station, TX). All the data were secured with a specific password accessible only by the researchers. Descriptive statistics; frequency, percentage, mean, and standard deviation were used to explain the characteristics of the subjects. Logistic regression was used to identify the associations between variables. Variables that were found to be significant in simple logistic regression model, were kept into the multiple logistic regression. A p-value <0.05 was considered as statistically significant.

Ethical considerations

All research procedures and instruments had been approved by the human research ethic committee of Mae Fah Laung University, Chiang Rai, Thailand, with No. REH-59024, and the Committee for the Protection of Human Subjects of Nan Public Health Office, Thailand, No. REC 59-004. All participants were given a small gift to appreciate their participation after finishing the interview.

RESULTS

Totally, 252 participants were recruited into the study. 53.2% were males, average age was 41.3 years old (SD = 9.49, min=18, max=68). 55.6% graduated from secondary school, and 51.9% had income $\leq 5,000$ per month (Table 1).

65.1% had received ARV ≥ 25 months, and 87.7% had a CD4 level ≤ 200 cell/cm³. 23.4% had a high systolic blood pressure and 29.4% had a high diastolic blood pressure. 4.0% had fasting blood glucose higher than the standard level, 40.1% had a triglyceride higher than the stand level, 50.4% of males had a HDL-cholesterol lower than the standard level, and 78.6% of females had a HDL-cholesterol lower than the standard level (Table 2).

29.8% smoked, 44.4% drank alcohol, 62.3% ate sweet food often, 66.3% had high fat diets often, 68.7% drank soft drink often, and 50.0% were taking food more than 3 times a day. Regarding exercise, 27.8% did not engage in exercise, and 78.9% often did housework. 26.9% had a low level of knowledge related to ARV, and 11.1% had a high level of stress (Table 3).

63.9% had an overall quality of life at low to moderate

TABLE 1. Univariate analysis on the associations between general characteristic and metabolic syndromes.

Factor	Total (n=252)	Metabolic syndromes		OR (95% CI)	p-value
		Yes (n=133)	NO (n=119)	NA	NA
Total	252 (100.0)	133 (52.8)	119 (47.2)		
Sex					
Male	134 (53.2)	67 (50.0)	67 (50.0)	1.00	
Female	118 (46.8)	66 (55.9)	52 (44.1)	1.27 (0.77- 2.09)	0.347
Age (years)					
<30	35 (13.9)	13 (33.1)	22 (62.9)	1.00	
31-40	74 (29.4)	39 (52.7)	35 (47.3)	1.89 (0.83-4.29)	0.131
41-50	108 (42.9)	60 (55.6)	48 (44.4)	2.12 (0.97-4.63)	0.061*
≥51	35 (13.8)	21 (60.0)	16 (40.0)	2.54 (0.93-6.91)	0.068*
Mean=41.27, SD=9.49					
Education					
Illiterate	12 (4.8)	5 (41.7)	7 (58.3)	0.69 (0.21-2.29)	0.549
Primary school	100 (39.7)	57 (57.0)	43 (43.0)	1.29 (0.77-2.16)	0.336
Secondary school	140 (55.6)	71 (50.7)	69 (49.3)	1.00	
Income (baht)					
≤ 5,000	131 (51.9)	70 (53.4)	61 (46.6)	1.00	
5,001-10,000	74 (29.4)	37 (50.0)	37 (50.0)	0.87 (0.49- 1.54)	0.636
≥10,001	47 (18.7)	26 (55.3)	21 (44.7)	1.08 (0.55-2.10)	0.824

*Significant level of alpha=0.05

levels. 67.1% had low to moderate levels of quality of life in the physical aspect, 25.4% had low to moderate level of quality of life in the psychological aspect, 80.9% had low to moderate level of quality of life in the social aspect, and 74.6% had low to moderate level of quality of life in the environmental aspect (Table 3).

In the univariate analysis, age had a slightly significant association with the development of metabolic syndrome among the HIV infected using ARV, and those aged 41-50 years, and ≥ 51 years were 2.12 times (95%CI= 0.97-4.63) and 2.54 times more likely (95%CI=0.93-6.91) to develop metabolic syndrome than those aged <30 years, respectively (Table 1).

In the laboratory characteristics, five variables had a significant association with the development of metabolic syndrome; systolic blood pressure, diastolic blood pressure, triglycerides level, male HDL cholesterol, and female HDL

cholesterol. Subjects who had a high systolic blood pressure had a greater chance to develop metabolic syndrome than those who did not with OR=15.58 (95%CI = 5.97-40.71). Subjects who had a high diastolic blood pressure had a greater chance to develop metabolic syndrome than those who did not with OR=13.97 (95%CI=6.06-32.24). Subjects who had high triglyceride level had a greater chance to develop metabolic syndrome than who had a standard level with OR=2.54 (95%CI=1.50-4.28). Among the male, those who had a high level of cholesterol had a greater chance to develop metabolic syndrome than those who had a standard level with OR=4.64 times (95%CI=2.73-7.89). Among female, those who had a high level of cholesterol had a greater chance to develop metabolic syndrome than those who had a standard level with OR=9.85 (95%CI=4.40-22.00) (Table 2).

Table 3 shows that those who had a history of

TABLE 2. Univariate analysis the associations between laboratory characteristics and metabolic syndrome

		Metabolic syndromes			
Factor	Total	Yes	NO	OR	p-value
	n (%)	n (%)	n (%)	(95% CI)	
Length of ARV use (months)					
≤ 6	10 (3.9)	5 (50.0)	5 (50.0)	1.00	
7-12	40 (15.9)	24 (60.0)	16 (40.0)	1.50 (0.37-6.03)	0.568
13-24	38 (15.1)	18 (47.4)	20 (52.6)	0.90 (0.22-3.63)	0.882
≥ 25	164 (65.1)	86 (52.4)	78 (47.6)	1.10 (0.31-3.95)	0.881
CD4 (cell/cm³)					
> 200	31(12.3)	17 (54.8)	14 (45.2)	1.00	
≤ 200	221(87.7)	116 (52.5)	105 (47.5)	0.91(0.43-1.94)	0.806
Systolic blood pressure (mmHg)					
Normal (<130)	193 (76.6)	114 (59.1)	79 (40.9)	1.00	
High (≥130)	59 (23.4)	5 (8.5)	54 (91.5)	15.58 (5.97-40.71)	<0.001*
Diastolic blood pressure (mmHg)					
Normal (<85)	183 (72.6)	112 (61.2)	71 (38.8)	1.00	
High (≥85)	69 (29.4)	7 (10.1)	62 (89.9)	13.97 (6.06-32.24)	<0.001*
FBS (mg/dl)					
Normal (< 110)	242 (96.0)	119 (49.2)	123 (50.8)	1.00	
High (≥ 110)	10 (4.0)	0 (0.0)	10 (100.0)	NA	NA
Triglycerides (mg/dl)					
Normal (< 150)	151 (59.9)	85 (56.3)	66 (43.7)	1.00	
High (≥ 150)	101 (40.1)	34 (33.7)	67 (66.3)	2.54 (1.50-4.28)	<0.001*
Male HDL Cholesterol (mg/dl)					
Normal (≥50)	60 (44.8)	40 (66.6)	20 (33.3)	1.00	
Low (<50)	74 (55.2)	22 (29.7)	52 (70.3)	4.64 (2.73-7.89)	<0.001*
Female HDL cholesterol					
Normal (≥40)	108 (91.5)	91 (84.3)	17 (15.7)	1.00	
Low (<40)	10 (8.5)	4 (40.0)	6 (60.0)	9.85 (4.40-22.00)	<0.001*

*Significant level at alpha=0.05

TABLE 3. Univariate analysis on the associations between participants behaviors and quality of life and metabolic syndrome

Characteristic	Total n (%)	Metabolic syndromes		OR (95% CI)	p-value
		Yes n (%)	No n (%)		
Smoking					
Yes	75 (29.8)	36 (48.0)	39 (52.0)	0.76 (0.44-1.31)	0.323
No	177 (70.2)	97 (54.8)	80 (45.2)	1.00	
Drinking					
Yes	112 (44.4)	60 (53.6)	52 (46.4)	1.06 (0.64-1.74)	0.821
No	140 (55.6)	73 (52.1)	67 (47.9)	1.00	
Having sweetly food					
No	8 (3.2)	4 (50.0)	4 (50.0)	1.00	
Sometimes	87 (34.5)	43 (49.4)	44 (17.5)	0.98 (0.23-4.16)	0.975
Often	157 (62.3)	86 (54.8)	71 (28.2)	1.21 (0.29-5.02)	0.792
Having high fat dietary					
No	13 (5.2)	7 (53.8)	6 (46.2)	1.00	
Sometimes	72 (28.6)	35 (48.6)	37 (51.4)	0.81 (0.25-2.65)	0.729
Often	167 (66.3)	91 (54.5)	76 (45.5)	1.03 (0.33-3.18)	0.964
Drinking soft drink					
No	15 (5.9)	7 (46.7)	8 (53.3)	1.00	
Sometimes	64 (25.4)	36 (56.3)	28 (43.8)	1.47 (0.48-4.54)	0.504
Often	173 (68.7)	90 (52.0)	83 (47.9)	1.24 (0.43-3.57)	0.691
Having desserts after meal					
No	94 (37.3)	49 (52.1)	45 (47.9)	1.00	
Sometimes	85 (33.7)	43 (50.6)	42 (49.1)	0.94 (0.52-1.69)	0.837
Often	73 (28.9)	41 (56.2)	32 (43.8)	1.18 (0.64-2.18)	0.604
Having food > 3 times/day					
No	126 (50.0)	77 (61.1)	49 (38.9)	2.18 (1.01-4.83)	0.049*
Yes	126 (50.0)	56 (44.4)	70 (55.6)	1.00	0.746
Soft and moderated exercise					
No	70 (27.8)	36 (51.4)	34 (48.6)	1.00	
Sometimes	70 (27.8)	37 (52.9)	33 (47.1)	1.06 (0.55-2.06)	0.866
Often	112 (44.4)	60 (53.6)	52 (46.4)	1.09 (0.59-1.98)	0.778
Heavy or vigorous intensity exercise					
No	118 (46.8)	64 (54.2)	54 (45.8)	1.09 (0.60-1.96)	0.777
Sometimes	63 (25.0)	32 (50.8)	31 (49.2)	0.95 (0.48-1.87)	0.879
Often	71 (28.2)	37 (52.1)	34 (47.9)	1.00	
Housework activities					
No	18 (7.1)	12 (66.7)	6 (12.5)	1.72 (0.62-4.76)	0.292
Sometimes	35 (13.9)	14 (40.0)	21 (60.0)	0.57 (0.28-1.19)	0.136
Often	199 (78.9)	107 (53.8)	92 (46.2)	1.00	

TABLE 3. Univariate analysis on the associations between participants behaviors and quality of life and metabolic syndrome

Characteristic	Metabolic syndromes			OR (95% CI)	p-value
	Total n (%)	Yes n (%)	No n (%)		
Aerobic exercise					
No	90 (35.7)	48 (53.3)	42 (46.7)	1.01 (0.57-1.79)	0.970
Sometimes	64 (25.4)	33 (51.6)	31 (48.4)	0.94 (0.50-1.77)	0.852
Often	98 (38.9)	52 (53.1)	46 (46.9)	1.00	
Resistance training exercise					
No	137 (54.4)	68 (49.6)	69 (50.4)	0.58 (0.32-1.06)	0.075
Sometimes	50 (19.8)	24 (48.0)	26 (52.0)	0.54 (0.26-1.14)	0.107
Often	65 (25.8)	41 (63.1)	24 (36.9)	1.00	
Knowledge about ARV					
Low	68 (26.9)	30 (11.9)	38 (15.1)	1.00	
Moderate	180 (71.4)	101 (40.1)	79 (31.3)	1.62 (0.92-2.84)	0.093
High	4 (1.6)	2 (0.8)	2 (0.8)	1.23 (0.17-9.53)	0.818
Stress					
Low	146 (57.9)	74 (50.7)	72 (49.3)	1.00	
Moderate	78 (30.9)	42 (53.8)	36 (46.2)	1.14 (0.65-1.97)	0.625
High	28 (11.1)	17 (60.7)	11 (39.3)	1.50 (0.66-3.43)	0.332
Overall quality of life					
Low-Moderate	161 (63.9)	79 (49.1)	82 (50.9)	1.00	
Good	91 (36.1)	54 (59.3)	37 (40.7)	1.51 (0.90-2.55)	0.117
Physical aspect					
Low-Moderate	169 (67.1)	86 (50.9)	83 (49.1)	1.00	
Good	83 (32.9)	47 (56.6)	36 (43.4)	1.26 (0.74-2.14)	0.391
Psychological aspect					
Low-Moderate	64 (25.4)	33 (51.6)	31 (48.4)	1.00	
Good	188 (74.6)	100 (53.2)	88 (46.8)	1.07 (0.61-1.88)	0.822
Social aspect					
Low-Moderate	204 (80.9)	106 (51.9)	98 (48.0)	1.00	
Good	48 (19.1)	27 (56.3)	21 (43.8)	1.19 (0.63-2.24)	0.593
Environmental aspect					
Low-Moderate	188 (74.6)	98 (52.1)	90 (47.9)	1.00	
Good	64 (25.4)	35 (54.7)	29 (45.3)	1.11 (0.63-1.96)	0.723

*Significant level at alpha=0.05

“no” in having food greater than three times a day had a greater chance to develop metabolic syndrome than those who had more than three times a day with OR=2.18 (95%CI=1.01-4.83).

Table 4 shows that the majority of ARV used was Lamivudine & Zidovudine & Nevirapine group with the prevalence of metabolic syndrome at 53.5%, followed by Lamivudine & Zidovudine & Efavirens group with the prevalence of metabolic syndrome at 55.9%, and Tenofovir & Lamivudine & Efavirens group with the prevalence of metabolic syndrome at 43.9% (Table 4).

Table 5 shows that there was no statistical significance in metabolic syndrome development among those HIV infected persons who used different ARV regimens.

In the multivariate analysis, after control for all possible confounding factors, two variables were found to have significant association with metabolic syndrome,

age and having food more than three times a day. HIV/AIDS patients aged 41-50 years old and ≥ 51 years old had a greater chance to develop the metabolic syndrome than those aged <30 years old with OR=1.89 (95%CI=1.07-3.33), and OR=1.96 (95%CI=1.19-3.24) respectively.

DISCUSSION

The prevalence of metabolic syndrome was different according to age and income of the patients. More than half HIV/AIDS patients using ARV in Nan province had metabolic syndrome (52.8%). The prevalence of metabolic syndrome was not proportionally different in different ARV regimens, and it was not the risk factor of metabolic syndrome development. Age and having food more than three times are statistically significantly associated with metabolic syndrome among the HIV/AIDS patients.

TABLE 4. Prevalence of metabolic syndromes in different types of ARV users

Antiretroviral regimens	Total n (%)	Metabolic syndromes	
		Yes n (%)	No n (%)
Total	252 (100.0)	133 (52.8)	119 (47.2)
Lamivudine & Zidovudine & Nevirapine	127 (50.4)	68 (53.5)	59 (46.5)
Lamivudine & Zidovudine & Efavirens	34 (13.5)	19 (55.9)	15 (44.1)
Tenofovir & Lamivudine & Efavirens	35 (13.9)	15 (42.9)	20 (57.1)
Tenofovir & Lamivudine & Nevirapine	4 (1.6)	2 (50.0)	2 (50.0)
Lamivudine & Nevirapine & Stavudine	15 (5.9)	11 (73.3)	4 (26.7)
Lopinavir & Ritronavir & Lamivudine & Zidovudine	4 (1.6)	1 (25.0)	3 (75.0)
Lamivudine & Stavudine & Efavirens	9 (3.6)	4 (44.4)	5 (55.6)
Lopinavir & Ritronavir & Tenofovir & Stavudine	1 (0.40)	1 (100.0)	0 (0.0)
Lopinavir & Ritronavir & Tenofovir & dovudine	6 (2.4)	3 (50.0)	3 (50.0)
Lopinavir & Ritronavir & Tenofovir & Lamivudine	4 (1.6)	1 (25.0)	3 (75.0)
Lamivudine & Zidovudine & Lopinavir & Ritronavir	7 (2.8)	5 (71.4)	2 (28.6)
Zidovudine & Lopinavir & Ritronavir & Dinanosine	1 (0.4)	1 (100.0)	0 (0.0)
Stavudine & Lopinavir & Ritronavir & Dinanosine	1 (0.4)	0 (0.0)	1 (100.0)
Tenofovir & Lopinavir & Ritronavir	2 (0.8)	1 (50.0)	1 (50.0)
Lopinavir & Ritronavir & Dinanosine	1 (0.4)	1 (100.0)	0 (0.0)
Lopinavir & Ritronavir & Lamivudine	1 (0.4)	0 (0.0)	1 (100.0)

TABLE 5. Univariate analysis of characteristics associated with metabolic syndromes

Antiretroviral formulations	Metabolic syndromes			OR (95% CI)	p-value
	Total n (%)	Yes n (%)	No n (%)		
ARV	28 (11.1)	14 (50.0)	14 (50.0)	1.00	
NRTIs & NRTIs & PIs					
NRTIs & NRTIs & NNRTIs	224 (88.9)	119 (53.1)	105 (46.9)	1.13 (0.52-2.49)	0.755

*Significant level at alpha=0.05

TABLE 6. Multivariate analysis on factors associated with metabolic syndrome

Factor	OR _{adj}	95%CI	p-value
Age (years)			
<30	1.00		
31-40	1.57	0.83-3.16	0.074
41-50	1.89	1.07-3.33	0.042*
≥51	2.14	1.12-4.53	0.006*
Having food > 3 times/day			
No	1.96	1.19-3.24	0.008*
Yes	1.00		

*Significant level at alpha=0.05

The prevalence of metabolic syndrome, in our study was higher than the results of Signorini et al.,¹⁵ which was at 20.6% among the HIV/AIDS patients who were taking ARV, and 15.6% in the study of Alvarez et al.,¹⁶ which reported that the prevalence was high in females (92.6%) when compared with males (7.4%). Sittikorn et al.,¹⁷ conducted a study on metabolic syndrome in seven countries in Latin America. He reported that prevalence of metabolic syndrome among the HIV/AIDS patients who received ARV was 20.2%. Females had a higher prevalence rate (22.7%) when compared to males (19.4%). Having ARV increased the risk of metabolic syndrome by 7.4%.¹⁸ Chawewan et al.,¹⁹ studied HIV-infected patients among ≥18 year olds in the South Region of Thailand, and it was found that the prevalence of metabolic syndrome was 15.7%. Also Chantarapakde et al.,²⁰ reported in 206 HIV-infected patients receiving ARV in which 47.8% were NNRTI-based regimen, and

it was found that the prevalence of metabolic syndrome was 8.7%.

The findings of this study were similar to the study of Homkam et al.,¹⁸ which found that lipid levels changed after receiving HIV antiretroviral therapy for 24 months, but it did not show the statistical significant association with metabolic syndrome. Age and overweight led to increase in cholesterol level after 24 months, but there was no statistical association with HIV antiretroviral regimens.¹⁰ Three factors contributed to metabolic syndrome development; age, gender and BMI. This coincided with our study which found that age was a risk factor for metabolic syndrome development among HIV/AIDS patients who used ARV. Sittikorn et al.,¹⁷ reported that HIV/AIDS patients who received non-nucleoside reverse-transcriptase inhibitors group of ARV for more than six years had higher risk of myocardial infarction, at 1.2 times more than those who received protease inhibitors

group of ARV.¹⁵ This was consistent with another study of Lyn et al.,²¹ who reported that HIV-infected patients who received ARV were associated with hypodistrophy and insulin resistance, and patients on antiretroviral therapy had higher risk of coronary disease. Van et al.,²² found the metabolic syndrome prevalence in HIV-infected newborns affected quality of life in later times. Van et al.,²² also reported that in long term study among HIV-infected newborns receiving ARV, they had a greater chance to develop metabolic syndrome and different regimens had a different chance in developing metabolic syndrome. Barlow et al.,²³ reported that different ethnics had different chance to develop metabolic syndrome in HIV/AIDS patients who were on six months duration of antiretroviral therapy, especially Stavudine. In a different study, Cade et al.,²⁴ found association between metabolic syndrome and HIV infected patients which affected the structure and dysfunction of the left ventricle after use of ARV. Ramirez et al.,²⁵ reported that those HIV infected patients with ARV usage had opportunity to develop metabolic syndrome in Brazil. Chawewan et al.,¹⁹ found that age, BMI, low HDL cholesterol, high blood sugar, irregular exercise, and sweaty diet were also associated with metabolic syndrome.

However, in our study, we found that only age and dietary behaviors were associated with metabolic syndrome.

CONCLUSION

Patients' age and personal dietary behaviors should be concerned in prescription of ARV to HIV/AIDS patients. Regular monitoring of metabolic syndrome among HIV/AIDS patients who are on ARV is mandatory in ARV clinic. Providing essential information regarding personal health behavior should also be implemented in this group. The high metabolic syndrome prevalence among HIV/AIDS patient who are on ARV reflects the need for the specific surveillance system to closely monitor the change of the metabolic syndrome among the patients on ARV. Otherwise, we will have another health problem in the next few years from the complications of ARV in patients with metabolic syndrome. A better study design such as prospective cohort study design is also needed to confirm the occurrence of metabolic syndrome in this group of people.

ACKNOWLEDGMENTS

The authors would like to thank the chief of all hospital directors for supporting access to information and help in making appointment with the participants. Special thanks to all the participants for providing essential

information. Finally, the author is grateful to Mae Fah Luang University, Thailand, and The Center of Excellence for the Hill Tribe Health Research for supporting grant.

REFERENCES

1. UNAIDS. Factsheet: HIV/AIDS2015 [Internet] Bangkok, Thailand. [cited 2016 July 15]; Available from: http://www.unaids.org/en/resources/presscentre/pressreleaseandstatementarchive/2015/july/20150714_PR_MDG6report
2. Beuro of General Communication Diseases. Strategies to prevent and resolve national AIDS 2014-2016 [Internet] Bangkok, Thailand. [cited 2016 September 7]; Available from: <http://www.silomclinic.in.th/file/ThaiAIDSstrategic.pdf>
3. Department of Disease Control. Situation AIDS and HIV infection in the year 2015 [Internet] Bangkok, Thailand. [cited 2017 February 27]; Available from: http://www.boe.moph.go.th/files/report/20151126_87903337.pdf
4. National Trustworthy and Competent Authority in Epidemiological Surveillance and Investigation [Internet]. 2016 [cited 2017 February 27]; Available from: <http://203.157.15.110/boe/surveillance.php?idx=c2l0#sur-href>
5. Alice T, Michelle F, Christine AH, Deborah K, Shanna C, Natalie D, et al. Role of pharmacist in caring for patients with HIV/AIDS: Clinical practice guidelines. *Can J Hos Pharm*. 2012; 65(2): 125-45.
6. Sankanupup S. Abnormal of lipid profile among HIV/AIDS patients who were on ARV. [Internet]. 2007 [cited 2017 February 27]; Available from: www.doctor.or.th/clinic/detail/7230
7. National Statistical Office. Population statistic and homes at the current database. [Internet]. 2017 [cited 2017 February 27]; Available from: http://stat.dopa.go.th/stat/statnew/upstat_m.php
8. Nan Provincial Health Office. Information Center, Nan Provincial Health Office; 2015.p.12-26.
9. Kasiulevicius V, Sapoka V, Filipaviciute R. Sample size calculation in epidemiological studies. *Gerontologija*. 2006;7(4):225-31.
10. Mbunkah AH, Meriki HD, Kukwah AT, Nfore O, Nkuo-Akenji T. Prevalence of metabolic syndrome in human immunodeficiency virus - infected patients from the South-West region of Cameroon, using the adult treatment panel III criteria. *Diabetol Metab Syndr*. 2014 Aug 25;6(1):92.
11. Kunlong S. IOC: Index of Item-Objective Congruence. [Internet]. 2014 [cited 2017 March 16]; Available from: <http://www.ipernity.com/blog/248956/424224>
12. Patithrow P. Quality inspection of research tools. [Internet]. 2016 [cited 2017 March 16]; Available from: <http://research.bsru.ac.th/space2/doc/25-29/G5/3.pdf>
13. Boonyavarakul A. Disease management. [Internet]. 2015 [cited 2015 August 21]; Available from http://www.healthtoday.net/thailand/disease/disease_120.html
14. Beilby J. Guidelines review definition of metabolic syndrome: report of the national heart, lung, and blood institute/American heart association conference on scientific issues related to definition. *Clin Biochem Rev*. 2014;25(109):433-8.
15. Signorini DJ, Monteiro MC, Andrade MF, Signorini DH, Eyer-Silva WA. What should we know about metabolic syndrome and lipodystrophy in AIDS? *Rev Assoc Med Bras*. 2012;58(1): 70-5.

16. Alvarez C1, Salazar R, Galindez J, Rangel F, Castañeda ML, Lopardo G, et al. Metabolic syndrome in HIV-infected patients receiving antiretroviral therapy in Latin America. *Braz J Infect Dis.* 2010;14(3):256-63.
17. Sittikorn L. Incidence and risk factors of metabolic syndrome in personnel of phrachomklao Hospital. [Internet]. 2011 [cited 2015 October 14]; Available from: <http://www.phrachomklao.go.th/hrd/reseaech/54/22.pdf>
18. Homkam N, Krinboyen V, Bowonwatanubon J. Changes in body fat within two years of patient follow-up in people infected with HIV after receiving antiretroviral therapy, Thailand. Proceeding: National AIDS Seminar, Thailand. [Internet]. 2011 [cited 2015 November 23]; Available from: aids.thai.org/uploads/files/Track%20A.pdf
19. Chawewan P, Supachai R. The prevalence of metabolic syndrome in HIV-infected patients receiving antiretroviral treatment. [Internet]. 2011 [cited 2015 October 23]; Available from: <http://gsbooks.gs.kku.ac.th/54/grc12/files/mmp25.pdf>
20. Chantarapakde J, Chaturavit J, Pingnoonyan S. The prevalence of metabolic syndrome in people infected with HIV, Thailand treated with MTCT-Plus program. Proceeding: National AIDS Seminar, Thailand. [Internet]. 2011 [cited 2015 November 23]; Available from: aids.thai.org/uploads/files/Track%20A.pdf
21. Lyn WS. Lipodystrophy syndrom in HIV. Kluwer Academic: Pulishing; 2013.p.1-4.
22. Van JH, Cabezas MC. Hypertriglyceridemia, metabolic syndrome, and cardiovascular disease in HIV-infected patients: Effects of antiretroviral therapy and adipose tissue distribution. *Int J Vasc Med.* 2012;2012:201027.
23. Linda BM, Allison RE, Grace AM, Philippa MM. Metabolic complications and treatment of prenatally HIV-infected children and adolescents. *JIAS.* 2013;16:1-5.
24. William TC, Edgar TO, Kristin M, Lisa F, Victor GD, Alan DW, et al. Relationships among HIV infection, metabolic risk factors, and left ventricular structure and function. *AIDS Res Hum Retroviruses.* 2013;29(8):1151-60.
25. Farah AR, Jorge LS, Michael JJ, Jorge RZ, Walter F. Metabolic syndrome in relation to cardiorespiratory fitness, active and sedentary behavior in HIV+ hispanics with and without lipodystrophy. *Realth Sci J.* 2014;33(4):163-9.