



**UNIVERSITI PUTRA MALAYSIA**

***NUTRITIONAL STATUS AMONG PEOPLE LIVING WITH HIV  
RECEIVING ANTIRETROVIRAL MEDICATION  
AT HOSPITAL SUNGAI BULOH, MALAYSIA***

**NAZISA HEJAZI**

**FPSK(m) 2009 22**

**NUTRITIONAL STATUS AMONG PEOPLE LIVING WITH HIV  
RECEIVING ANTIRETROVIRAL MEDICATION  
AT HOSPITAL SUNGAI BULOH, MALAYSIA**

By

**NAZISA HEJAZI**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,  
in Fulfilment of the Requirements for the Degree of Master of Science**

**October 2009**

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of  
the requirement for the degree of Master of Science

## *Dedications*

MULTIETHNICAL STATUS AMONG PEOPLE LIVING WITH HIV  
RECEIVING ANTIRETROVIRAL MEDICATION  
AT HOSPITAL PUNJAI BULOIL, MALAYSIA

By

HAZISA BEJAZI

*To my Father,*

*The best support in my life*

*To my mother,*

*The Kindest one*

*To my Sister,*

*My best friend*

Abstract of thesis presented to the senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

**NUTRITIONAL STATUS AMONG PEOPLE LIVING WITH HIV  
RECEIVING ANTIRETROVIRAL MEDICATION  
AT HOSPITAL SUNGAI BULOH, MALAYSIA**

By

**NAZISA HEJAZI**

**October 2009**

**Chairman: Mary Huang Soo Lee, PhD**

**Faculty: Medicine and Health Sciences**

Lack of information on the nutritional status of PLHIV in Malaysia prompted this cross-sectional study of 340 HIV-positive adults receiving antiretroviral medication at Hospital Sungai Buloh in order to determine their nutritional status as well as identify those factors associated with it.

Respondents were selected based on two-stage proportional stratified sampling among all patients receiving HIV treatment at the Infectious Disease Clinic of the Sungai Buloh Hospital. A pretested questionnaire was used to collect information on socioeconomics, and dietary intake using face to face interview. Medical history, health status and antiretroviral (ARV) regimen were obtained from respondents' computerized medical records. Biochemical parameters including lipid profile,

hematological and immunological parameters were measured using fasting blood samples. Physical measurements included weight, height waist and hip circumference, body composition and blood pressure. Descriptive statistics, comparative statistical procedures and multiple logistic regression were performed using SPSS version 16.0

Most respondents were men (78.8%), Chinese (63.8%), aged between 20 to 50 years (82.1%), had less than ten years of formal education (61.8%) and were employed (63.5%). All subjects were in the first stage of AIDS. The majority (94.6%) had been taking ARV medications for more than six months.

The prevalence of elevated total cholesterol level (65.8%), LDL-C level (78.4%), low HDL-C level (39.8%), elevated triglycerides level (62.2%), fasting plasma glucose (22.0%) metabolic syndrome (27.9%) according to National Cholesterol Education Program (NCEP), diabetes mellitus (10.9%) and hypertension (44.7%) were considerable. Megaloblastic anemia was very high (13.5%) as compared to the prevalence at the start of medication (2.5%). On the other hand, underweight was more prevalent at start of medication. While 36.5% of the respondents had unhealthy waist-hip ratio, 85.1% had optimal body composition based on fat and fat free mass. The majority of respondents had insufficient dietary intakes although males had higher mean food intakes. Rice, green leafy vegetables and fresh sea fish were the most frequently consumed food items.

Education attainment was higher among Indians while Chinese respondents had higher monthly household incomes and had been on treatment for a longer period. More than half of all ethnic groups had abnormal lipid levels. Wasting, abdominal obesity, metabolic syndrome and diabetes mellitus were more common among Indians. Malays as compared to other ethnic groups were more prone to megaloblastic anemia and anemia in the form of reduced HCT. Ethnicity and gender had little influence on pattern of food consumption.

Generally, males had higher socioeconomic status, prevalence of hypertension, metabolic syndrome and diabetes mellitus as compared to females. Apart from HDL-C level, more females had elevated lipid level than males. All types of anemia were more commonly observed in females than males. The female subjects had more weight loss, wasting, underweight as well as overweight/obesity, abdominal obesity and higher percentage of body fat.

Based on the results of multiple logistic regression, high waist circumference and waist hip ratio were the major risk factors for low HDL-C level and high triglycerides (components of metabolic syndrome) while age was a considerable risk factor in the occurrence of hypertension, anemia characterized by low hemoglobin level and also megaloblastic anemia. Body mass index (BMI) at start of ARV medication, energy intake, % energy from carbohydrate and % energy from fat were the risk factors for metabolic syndrome in this study.

The present study demonstrated that PLHIV receiving ARV medication experience some nutritional abnormalities. Thus, the setting up of supportive and intervention programs should be introduced to prevent and reduce these health and nutritional complications that result both from of the infection as well as the ARV that they are on.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Sarjana Sains

**TARAF PEMAKANAN DI KALANGAN ORANG YANG HIDUP DENGAN HIV YANG SEDANG MENERIMA RAWATAN ANTIRETROVIRAL DI HOSPITAL SUNGAI BULOH, MALAYSIA**

Oleh

**NAZISA HEJAZI**

**Oktober 2009**

**Pengerusi : Mary Huang Soo Lee, PhD**

**Fakulti : Perubatan dan Sains Kesihatan**

**ABSTRAK**

Pengetahuan yang terhad tentang taraf pemakanan orang yang hidup dengan HIV di Malaysia membawa kepada kajian keratan rentas ini yang mengkaji 340 orang yang hidup dengan HIV yang menerima rawatan antiretroviral di Hospital Sungai Buloh untuk menentukan taraf pemakanan dan juga faktor-faktor yang berkaitan.

Responden kajian ini dipilih melalui dua tahap pensampelan terstratum berkadar daripada semua orang yang hidup dengan HIV yang menerima rawatan HIV di Klinik Penyakit Berjangkit, Hospital Sungai Buloh. Satu borang soal selidik yang telah dipra-uji digunakan untuk mengumpul maklumat tentang sosioekonomi dan pengambilan diet melalui cara temuramah semuka. Maklumat tentang rekod



perubatan yang lampau, taraf kesihatan dan regimen ARV yang digunakan diperoleh melalui sistem rekod perubatan berkomputer. Parameter biokimia merangkumi profil lipid, parameter hematologi dan imunologi diuji dengan menggunakan sampel-sampel darah puasa. Penilaian fizikal pula meliputi berat, tinggi, ukuran lilitan pinggang dan pinggul, komposisi badan dan juga tekanan darah. Statistik deskriptif, perbandingan prosedur-prosedur statistik dan regresi logistik berganda diperoleh dengan menggunakan SPSS versi 16.0.

Kebanyakan responden adalah lelaki (78.8%), berbangsa Cina (63.8%), berumur dalam lingkungan 20 hingga 50 tahun (82.1%), menerima pendidikan formal kurang dari sepuluh tahun (61.8%) dan bekerja (63.5%). Semua subjek berada di peringkat pertama AIDS. Majoriti (94.6%) telah menerima rawatan ARV melebihi enam bulan.

Prevalens jumlah kolesterol tinggi (65.8%), tahap LDL-C tinggi (78.4%), tahap HDL-C rendah (39.8%), tahap trigliserida tinggi (62.2%), plasma glukosa puasa tinggi (22.0%), sindrom metabolik (27.9%), diabetes mellitus (10.9%) dan hipertensi (44.7%) adalah banyak. Megaloblastik anemia adalah sangat tinggi (13.5%) jika dibandingkan dengan masa mereka mula-mula menerima rawatan ARV (2.5%). Sebaliknya, kurang berat badan adalah lebih prevalen pada permulaan rawatan ARV. Sementara 36.5% responden mempunyai nisbah pinggang-pinggul yang tidak sihat, sebanyak 85.1% mempunyai komposisi badan yang optimal. Majoriti responden mempunyai kekurangan pengambilan pemakanan walaupun lelaki mempunyai min pengambilan yang lebih tinggi. Nasi, sayuran berdaun hijau dan ikan laut segar merupakan makanan yang diambil paling kerap. Responden India mempunyai tahap

pendidikan yang paling tinggi manakala responden Cina pula mempunyai pendapatan bulanan dan tempoh rawatan yang paling tinggi.

Kebanyakan responden mengikut golongan etnik mempunyai tahap lipid yang tak normal. *Wasting*, obesiti bahagian abdomen, sindrom metabolik dan diabetes mellitus adalah lebih kerap di kalangan etnik India. Selain itu, responden Melayu lebih cenderung kepada megaloblastik anemia dan juga anemia yang mempunyai tahap HCT yang rendah. Kumpulan etnik dan gender didapati mempunyai sedikit pengaruh terhadap pola pengambilan makanan.

Secara amnya, lelaki mempunyai tahap sosioekonomi, prevalens hipertensi, sindrom metabolik dan diabetes mellitus yang lebih tinggi berbanding dengan perempuan. Selain tahap HDL-C, perempuan mempunyai tahap lipid yang lebih tinggi berbanding lelaki. Semua jenis anemia didapati lebih kerap berlaku di kalangan perempuan berbanding lelaki. Golongan perempuan juga mempunyai bilangan yang lebih tinggi mengalami penurunan berat badan, *wasting*, kurang berat badan dan juga berlebihan berat badan/obesiti, obesiti bahagian abdomen, serta peratusan lemak badan yang lebih tinggi.

Berdasarkan keputusan yang diperolehi melalui regresi logistik berganda, ukuran lilitan pinggang dan nisbah lilitan pinggang dan pinggul yang tinggi merupakan faktor risiko utama untuk tahap HDL-C yang rendah dan juga tahap trigliserida yang tinggi (komponen sindrom metabolik) manakala umur merupakan faktor risiko utama

untuk keberlakuan anemia jenis kurang tahap hemoglobin serta megaloblastik anemia.

Kajian ini menunjukkan bahawa orang yang hidup dengan HIV yang menerima rawatan ARV mengalami masalah pemakanan. Oleh yang demikian, program-program yang berbentuk sokongan dan juga intervensi perlu diperkenalkan demi menghalang dan mengurangkan masalah-masalah kesihatan serta pemakanan yang dibawa oleh jangkitan HIV dan rawatan ARV yang digunakan.



## ACKNOWLEDGMENTS

First of all, I would like to express how grateful I am to Associate Professor Dr. Mary Huang Soo Lee, chairperson of my supervisory committee for her guidance, insightful comments and continuous support throughout my Master in nutritional education program in Malaysia. I am grateful for the time and encouragement she offered so generously, and for the doors to understanding she helped open. She has been a true lecturer and friend, and her assistance has shaped my actions and developed my academic knowledge. I couldn't have carried out my research without her.

I would also want to thank my supervisory committee members, Professor Dr. Khor Geok Lin and Dr. Christopher Lee for their encouragement, assistance and support. Much of what I know about basic and advanced nutritional issues has come from Prof. Khor through the courses she taught. Special thanks also to Dr. Christopher Lee who accepted my master research project and provided me with the best research environment and support at Hospital Sungai Buloh.

I am very grateful to Associate Professors Dr. Mirnalini Kandiah and Dr. Zalilah Mohd Sharriff and Dr. Chan Yoke Mun for their excellent and professional advices on nutritional issues during the first semester of my study in the Department of Nutrition and Dietetics, University Putra Malaysia. My appreciation goes to the Department of Nutrition and Dietetics and also Faculty of Medicine and Health Sciences University Putra Malaysia, Hospital Sungai Buloh, Hospital Selayang,

Clinical Research Center (CRC), National Institute of Health (NIH) and Ministry of Health Malaysia for approval to conduct the study.

I was so privileged to work with HIV infected people at Hospital Sungai Buloh who willingly participated in this study. Without their patience and cooperation I would not have been able to conduct this research

Special thanks also to the nursing staff and physicians of the infectious Disease (ID) clinic, Hospital Sungai Buloh, for their invaluable contribution. They have freely shared their knowledge and assisted me in all areas to facilitate data collection. To my assistants, Ms. A.Jayanthi A/P Arumugam and Mr. Tan Bee Poh who helped me gather data throughout the study my heartfelt thanks.

This study was funded by Malaysian AIDS Council (MAC) under the Ministry of Health, Malaysia, year 2006 grant. I wish to thank Dr. Adeeba Kamaruzaman, President of the Malaysian AIDS Council (MAC) who assisted me in getting the funding and members of her staff, especially Miss. Ines Yap, Director, Evaluation & Development Division and Mrs. Sivakami Visvalingam Senior Executive, Programme Development Department for their continuous support throughout research.

I acknowledge my family whose encouragement and support sustained me throughout the duration of my study. To all my friends for your help and support thank you and be assured I will also be here for you.

Member of the Examination committee were as follows:


**Mohd Huzairul Hafid, PhD**  
Associate Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Chairperson)

**Zahrah Mohd, Sharmila**  
Associate Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Internal Examiner)

**Muzaliah Handayani, PhD**  
Associate Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Internal Examiner)

**Zulfitriyati Ahmad, PhD**  
Professor  
School of Medical Sciences  
Universiti Sains Malaysia  
(Internal Examiner)



  
**SUAIKO BIN KIM HUAT, PhD**  
Professor and Deputy Dean  
School of Graduate Studies  
Universiti Putra Malaysia  
Date: 15 January 2010

This thesis submitted to the Senate of Universiti Putra Malaysia and has been approved as fulfillment of the requirement for the degree of Master of Science. The

I certify that a Thesis Examination Committee has met on 27 October 2009 to conduct the final examination of Nazisa Hejazi on her thesis entitled "Nutritional Status among People Living with HIV Receiving Antiretroviral Medication at Hospital Sungai Buloh, Malaysia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

Member of the Examination committee were as follows:

**Mohd Nasir Mohd Taib, PhD**

Associate Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Chairperson)

**Zalilah Mohd. Shariff, PhD**

Associate Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Internal Examiner)

**Mirnalini Kandiah, PhD**

Associate Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Internal Examiner)

**Zulkifli bin Ahmad, PhD**

Professor  
School Of Medical Sciences  
Universiti Sains Malaysia  
(External Examiner)

---

**BUJANG BIN KIM HUAT, PhD**

Professor and Deputy Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date: 15 January 2010

This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

**Mary Huang Soo Lee, PhD**

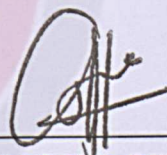
Associated Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Chairman)

**Khor Geok Lin, PhD**

Professor  
Faculty of Medicine and Health Sciences  
Universiti Putra Malaysia  
(Member)

**Christopher Lee Kwok Choong , MD**

Medical Doctor  
Department of Medicine,  
Hospital Sungai Buloh  
(Member)



---

**HASANAH MOHD GHAZALI, PhD**  
Professor and Deputy Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date: 11 FEB 2010





# TABLE OF CONTENTS

	<b>Page</b>
<b>DEDICATION</b>	ii
<b>ABSTRACT</b>	iii
<b>ABSTRAK</b>	vii
<b>ACKNOWLEDGEMENTS</b>	xi
<b>APPROVAL</b>	xiv
<b>DECLARATION</b>	xvi
<b>LIST OF TABLES</b>	xxii
<b>LIST OF FIGURES</b>	xxv
<b>LIST OF ABBREVIATIONS</b>	xxvi
<b>CHAPTER</b>	
<b>1 INTRODUCTION</b>	<b>1</b>
1.1 Background of Study	1
1.2 Statement of Problem	4
1.3 Significance of Study	6
1.4 Objectives of Study	7
1.4.1 General Objective	7
1.4.2 Specific objectives	7
1.5 Conceptual Model of Nutritional Status	8
<b>2 LITRETURE REVIEW</b>	<b>12</b>
2.1 Human Immunodeficiency Virus (HIV)	12
2.1.1 Biology of HIV	12
2.2 AIDS (Acquired Immunodeficiency Syndrome)	13
2.2.1 Classifications of Stage of AIDS	14
2.3 HIV/AIDS and the MDGs	14
2.3.1 Epidemiology of HIV/AIDS in the World	15
2.3.2 Epidemiology of HIV/AIDS in Asia	16
2.3.3 Epidemiology of HIV/AIDS in Malaysia	17
2.4 Nutrition and HIV/AIDS	19
2.4.1 Inadequate Intake of Nutrients	20
2.4.2 Poor Absorption of Nutrients	21
2.4.3 Altered Metabolism of Nutrients	21
2.5 HIV and Nutritional Problems	22
2.5.1 Definition of Wasting Syndrome	22
2.5.2 HIV/AIDS and Changes in Body Composition	25
2.5.3 HIV/AIDS and Micronutrient Deficiencies	26
2.5.4 HIV/AIDS and Anemia	29
2.6 Nutrition at Different Stages in the Development of AIDS	31
2.6.1 Asymptomatic Phase and Macronutrient Requirements	31
2.6.2 Symptomatic Phase and Macronutrient Requirements	31
2.6.3 HIV/AIDS and Micronutrient Requirements	32
2.6.4 ARV and Nutrient Requirements	34
2.7 HIV/AIDS Medication	35
2.7.1 Definition of Antiretroviral (ARV) Medication	35
2.7.2 Classes of Antiretroviral Drugs	36

2.7.3	Highly Active Antiretroviral Therapy (HAART)	36
2.7.4	Line of HAART Regimen	37
2.7.5	Antiretroviral Treatment (ART) in Malaysia	38
2.7.6	Antiretroviral Drug Toxicities	38
2.7.7	Morphological and Metabolic Abnormalities	39
2.7.8	Morphological Changes	41
2.7.9	Metabolic Complications	43
2.7.10	Weight Changes	46
2.7.11	Hematological Toxicity	47
2.7.12	Anemia	47
2.8	Dietary Intake and HIV	48
2.9	Risk Factors of Selected Nutritional Complications	50
2.9.1	Risk Factors of Metabolic Syndrome and its Components	50
2.9.2	Risk Factors of low Hemoglobin Anemia and Megaloblastic Anemia	52
<b>3</b>	<b>MATERIALS AND METHODS</b>	<b>54</b>
3.1	Study Location	54
3.2	Study Design	56
3.3	Study Duration	56
3.4	Sample Population	56
3.5	Subjects	56
3.6	Inclusion Criteria	57
3.7	Exclusion Criteria	57
3.8	Sample Size Estimation	57
3.9	Sampling Method	58
3.10	Study Variable	62
3.10.1	Dependent Variable	62
3.10.2	Independent Variable	62
3.11	Research Instruments and Measurements	63
3.12	Anthropometric Measurements	66
3.12.1	Weight	66
3.12.2	Height	66
3.12.3	BMI	67
3.12.4	Body Composition	68
3.12.5	Waist, Hip Circumference and Waist Hip Ratio	70
3.13	Biochemical Measurements	71
3.13.1	Blood Collection Procedure	72
3.13.2	Lipid Profile and Fasting Plasma Glucose Level	73
3.13.3	Hematological Indicators Levels	74
3.13.4	CD4 cell Count	77
3.13.5	HIV RNA Load	78
3.14	Blood Pressure	78
3.15	Assessment of Dietary Intake	79
3.15.1	24-Hour Dietary Recall	79
3.15.2	Food Frequency Questionnaire (FFQ)	81
3.16	Metabolic Syndrome	82
3.17	Ethical Issue, Approvals and Consent Form	82
3.18	Pre Testing	83
3.19	Data collection	84

3.20	Analysis of Data	85
4	<b>RESULTS AND DISCUSSION</b>	88
4.1	Socio-economic Characteristics	90
4.1.1	Gender	90
4.1.2	Ethnicity	90
4.1.3	Age Group	90
4.1.4	Education Level	92
4.1.5	Employment Status	92
4.1.6	Monthly Household Income	92
4.2	Medical History	93
4.2.1	Duration of HIV Infection	93
4.2.2	Immunological Status at Start of Medication	96
4.2.3	Hematological Status at Start of Medication	97
4.2.4	Anthropometric status Start of Medication	97
4.2.5	Drug Abuse Status	98
4.3	Health Status	99
4.3.1	Stage of AIDS	99
4.3.2	Dietary Supplementation Status	99
4.3.3	Immunological Status	102
4.3.4	Blood Pressure (BP)	103
4.4	ARV Regimen Status	104
4.4.1	Length of Time on ARV	104
4.4.2	Current ARV Regimen Line	104
4.4.3	ARV Regimen Agent	104
4.4.4	Agents Used in ARV Regimen Line	107
4.5	Anthropometric Status	109
4.5.1	Weight Change, Wasting Status and BMI	109
4.5.2	Waist Circumference and Waist-Hip Ratio	112
4.5.3	Fat and Lean Mass Percentage	113
4.6	Blood Lipids and Glucose Level	114
4.7	Hematological Status	119
4.8	Anemia Status	122
4.9	Energy, Macronutrients and Micronutrients	126
4.10	Food Consumption Pattern	131
4.11	Prevalence of Metabolic Syndrome and Clinical Determinants of Metabolic Syndrome	134
4.12	Comparison of Socio-economic Characteristics by Ethnicity and Gender	136
4.12.1	Comparison of Socio-economic Characteristics by Ethnicity	138
4.12.2	Comparison of Socio-economic Characteristics by Gender	139
4.13	Comparison of Medical History by Ethnicity and Gender	140
4.13.1	Comparison of Medical History by Ethnicity	140
4.13.2	Comparison of Medical History by Gender	143
4.14	Comparison of Health Status by Ethnicity and Gender	146
4.14.1	Comparison of Health Status by Ethnicity	146
4.14.2	Comparison of Health Status by Gender	148
4.15	Comparison of ARV Regimen Status by Ethnicity and Gender	149
4.15.1	Comparison of ARV Regimen Status by Ethnicity	149
4.15.2	Comparison of ARV Regimen Status by Gender	152

4.16	Comparison of Blood Lipids and Glucose Level by ethnicity and Gender	152
4.16.1	Comparison of Blood Lipids and Glucose Level by Ethnicity	153
4.16.2	Comparison of Blood Lipids and Glucose Level by Gender	155
4.17	Comparison of Hematological Status by Ethnicity and Gender	156
4.17.1	Comparison of Hematological Status by Ethnicity	158
4.17.2	Comparison of Hematological Status by Gender	159
4.18	Comparison of Anemia Status by Ethnicity and Gender	162
4.18.1	Comparison of Anemia Status by Ethnicity	162
4.18.2	Comparison of Anemia Status by Gender	165
4.19	Comparison of Anthropometric Status by Ethnicity and Gender	167
4.19.1	Comparison of Anthropometric Status by Ethnicity	167
4.19.2	Comparison of Anthropometric Status by Gender	171
4.20	Comparison of Nutrient Intake by Ethnicity and Gender	174
4.20.1	Comparison of Nutrient Intake by Ethnicity	175
4.20.2	Comparison of Nutrient Intake by Gender	180
4.21	Comparison of Food Intake Frequency Score by Ethnicity and Gender	182
4.22	Comparison of Metabolic Syndrome Components by Ethnicity and Gender	187
4.23	Risk Factors for Metabolic Syndrome and its Components	189
4.23.1	Risk Factors of Low HDL-C Level	189
4.23.2	Risk Factors of High Triglycerides Level	191
4.23.3	Risk Factors of High Fasting Plasma Glucose Level	194
4.23.4	Risk Factors of High Blood Pressure Level	196
4.23.5	Risk Factors of Abdominal Obesity	198
4.23.6	Risk Factors of Metabolic Syndrome	201
4.24	Risk Factors for Low Hemoglobin Anemia	205
4.25	Risk Factors for Low Megaloblastic Anemia	207
4.26	Summary of Risk and Protective Factors of Metabolic Syndrome and Anemia	210
<b>5</b>	<b>CONCLUSION AND RECOMMENDATION</b>	<b>212</b>
5.1	Summary and Conclusion	212
5.2	Recommendation	216
5.2.1	Population-based Strategies	216
5.2.2	Diet Plans	217
5.2.3	Future Research	218
5.3	Limitations of the Study	219
	<b>BIBLIOGRAPHY</b>	<b>223</b>
	<b>APPENDICES</b>	<b>257</b>
A	Approval Sheet from the Ethical Committee of Faculty of Medicine Universiti Putra Malaysia	258
B	Investigator's Agreement and Head of Department's Approval Department of Nutrition and Dietetic, Universiti PUTRA Malaysia	260
C	Permission/Approval Letter from the Director, Hospital Sungai Buloh	262
D	Permission/Approval Letter from the Director, Hospital Selayang	264
E	Permission/Approval Letter from National Institute of Health (NIH) Malaysia	266

F	Permission/Approval Letter from Ministry of Health Malaysia	268
G1	Patient's Consent Form	270
G2	Surat Persetujuan Responden	272
H1	Subject's Information Letter	274
H2	Surat Makluman Respond	278
I	Research Study Questionnaire	282
<b>BIODATA OF STUDENT</b>		<b>300</b>



## LIST OF TABLES

Table		Page
3.1	Materials and Indicators of the Study	64
3.2	Classification of BMI for Adults	67
3.3	Classification of Body Fat for Adults	69
3.4	Classification of Sex-Specific Waist Circumference for Adults	71
3.5	Classification of Sex-Specific Ratio for Healthy Waist-Hip Ratio	71
3.6	Classification of Lipid Profile Levels	73
3.7	Diagnostic Criteria for Blood Glucose Abnormalities	74
3.8	Classification of Sex-Specific Hematological Indicators Levels for Adults	75
3.9	Criteria for Classification of Anemia for Adults	77
3.10	Classification of CD4 Cell Counts (Immunosuppression) for Adults	77
3.11	Classification of HIV RNA Load (Immunosuppression) for Adults	78
3.12	Classification of Blood Pressure Levels for Adults	79
3.13	ATP III Clinical Identification of the Metabolic Syndrome	82
4.1	Socio-economic Characteristics	91
4.2	Medical History	95
4.3	Health Status	100
4.4	Antiretroviral Regimen Status	105
4.5	Anthropometric Status	110
4.6	Lipid and Glucose Profiles	116
4.7	Hematological Status	120
4.8	Anemia Status	123
4.9	Energy and Macronutrients Intakes	127

4.10	Micronutrients (Vitamins) Intakes	128
4.11	Minerals and Trace Elements Intakes	128
4.12	Food Intake Frequency Score	132
4.13	Prevalence of Metabolic Syndrome and its Components	135
4.14	Socio-economic Characteristic by Ethnicity and Gender	137
4.15	Comparison of Medical History by Ethnicity and Gender	141
4.16	Comparison of Health Status by Ethnicity and Gender	147
4.17	Comparison of ARV Regimen Status by Ethnicity and Gender	150
4.18	Comparison of Blood Lipids and Glucose Level by Ethnicity and Gender	154
4.19	Comparison of Hematological Status by Ethnicity and Gender	157
4.20	Comparison of Anemia Status by Ethnicity and Gender	163
4.21	Comparison of Anthropometric Status by Ethnicity and Gender	168
4.22	Comparison of Energy and Macronutrients Intakes by Ethnicity and Gender	176
4.23	Comparison of Micronutrients (Vitamins) Intakes by Ethnicity and Gender	177
4.24	Comparison of Minerals and Trace Elements Intakes by Ethnicity and Gender	178
4.25	Comparison of Food Intake Frequency Score by Ethnicity	183
4.26	Comparison of Food Intake Frequency Score by Gender	185
4.27	Comparison of Metabolic Syndrome components by Ethnicity and Gender	188
4.28	Crude and Adjusted Odds and 95% Confidence Intervals for the Respondents with Low HDL-C Level	190
4.29	Crude and Adjusted Odds and 95% Confidence Intervals for the Respondents with High Triglycerides Level	192



4.30	Crude and Adjusted Odds and 95% Confidence Intervals for the Respondents with High Fasting Plasma Glucose Level	195
4.31	Crude and Adjusted Odds and 95% Confidence Intervals for the Respondents with High Blood Pressure Level	197
4.32	Crude and Adjusted Odds and 95% Confidence Intervals for the Respondents with Abdominal Obesity	199
4.33	Crude and Adjusted Odds and 95% Confidence Intervals for the Respondents with Metabolic Syndrome	202
4.34	Crude and Adjusted Odds and 95% Confidence Intervals for the Respondents with Anemia with Low Hemoglobin Level	206
4.35	Crude and Adjusted Odds and 95% Confidence Intervals for the Respondents with Megaloblastic Anemia	208
4.36	Risk and Protective Factors of Metabolic Syndrome and Anemia	211

## LIST OF FIGURES

<b>Figure</b>		<b>Page</b>
1.1	Conceptual Model of Nutritional Status and Associated Factors	10
3.1	Location of Sungai Buloh Hospital in Selangor State	55
3.2	Sampling Procedures of the Study	61



## LIST OF ABBREVIATIONS

3TC	Lamivudine
ABC	Abacavir
AHOD	Australian HIV Observational Database
AI	Adequate Intake
AIDS	Acquired Immune Deficiency Syndrome
APRCCN	Asia-Pacific Regional Centre of the Culturelink Network
ARC	AIDS-Related Complex
ART	Antiretroviral Therapy
ARV	Antiretroviral
ATP III	Adult Treatment Panel III
ATV	Atazanavir
AWS	AIDS Wasting Syndrome
AZT/ZDV	Zidovudine
BCM	Body Cell Mass
BIA	Bioelectrical Impedance Analyzer
BMI	Body Mass Index
BP	Blood Pressure
CD4 cell	CD4 Receptor positive T Lymphocyte Cell
CDC	Centers for Disease Control and Prevention
CHOD-PAP	Cholesterol Oxidase-Peroxidase Amino Phenazone Phenol
CRC	Clinical Research Center
CT	Computed Tomography
CVD	Cardiovascular Disease

d4T	Stavudine
DBP	Diastolic Blood Pressure
ddI	Didanosine
D:A:D	Data Collection on Adverse Events of Anti-HIV Drugs
DEXA	Dual-Energy X-Ray Absorptiometry
DFE	Dietary Folate Equivalent
DNA	Deoxyribonucleic Acid
DRI	Dietary Reference Intake
EC	Enteric Coated
EDTA	Ethylenediamine Tetraacetic Acid
EFV	Efavirenz
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization
FBC	Full Blood Cell
FFM	Fat Free Mass
FFQ	Food Frequency Questionnaire
FPG	Fasting Plasma Glucose
FPV	Fos-amprenavir
FTC	Emtricitabine
gp	Glycoprotein
GPO-PAP	Glycerol-3-Phosphate Oxidase-Peroxidase Amino Phenazone Phenol
HAART	Highly Active Antiretroviral Therapy
Hb	Hemoglobin
HBP	Hyper Blood Pressure
HCT	Hematocrit

HDL-C	High Density Lipoproteins Cholesterol
HEI	Healthy Eating Index
HIV	Human Immunodeficiency Virus
HPLC	High Performance Liquid Chromatography
HR	Hazard Ratio
ID	Infectious Disease
IDUs	Injecting Drug Users
IDV	Indinavir
IOM	Institute of Medicine
ISH	International Society of Hypertension
LAS	Lymphadenopathy Syndrome
LDL-C	Low Density Lipoproteins Cholesterol
LPV/r	Lopinavir + low dose Ritonavir
MANS	Malaysian Adult Nutrition Survey
MCH	Mean Corpuscular Hemoglobin
MCHC	Mean Corpuscular Hemoglobin Concentration
MCV	Mean Corpuscular Hemoglobin volume
MDGs	Millennium Development Goals
MetS	Metabolic Syndrome
MLTs	Medical Laboratory Technologists
MOH	Ministry of Health
MRI	Magnetic Resonance Imaging
MTCT	Mother-To-Child Transmission
NCCFN	National Coordinating Committee on Food and Nutrition
NCEP	National Cholesterol Education Program

NE	Niacin Equivalent
NFV	Nelfinavir mesylate
NGO	Non Government Organization
NHMS	National Health and Morbidity Survey
NIH	National Institute of Health
NKF	National Kidney Foundation
NO	Nitric Oxide
NNRTI	Non-Nucleoside Reverse Transcriptase Inhibitor
NRTI	Nucleoside Reverse Transcriptase Inhibitor
NtRTI	Nucleotide Reverse Transcriptase Inhibitor
NVP	Nevirapine
OIs	Opportunistic Infections
OR	Odds Ratio
PEM	Protein-Energy Malnutrition
PI	Protease Inhibitor
PLHIV	People Living with HIV
PR	Prevalance Ratio
RBC	Red Blood Cell
RDA	Recommended Dietary Allowance
RE	Retinol Equivalent
REE	Resting Energy Expenditure
RNA	Ribonucleic Acid
RNI	Recommended Nutrient Intake
RR	Relative Risk
RTV, r	Ritonavir

SBP	Systolic Blood Pressure
SD	Standard Deviation
SF	Serum Ferritin
SGA	Subjective Global Assessment
SPSS	Statistical Packages For Social Science
SQV	Saquinavir
SST	Serum Separator Tube
START	Selection of Thymidine Analog Regimen Therapy
TAHOD	TREAT Asia HIV Observational Database
TC	Total Cholesterol
TDF	Tenofovir
TEE	Total Energy Expenditure
TG	Triglyceride
TREAT	Therapeutics Research, Education, and AIDS Training
TS	Transferin Saturation
TSC	Technical Subcommittee
UK	United Kingdom
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNGASS	United Nations General Assembly Special Session
UNICEF	United Nations Children's Fund
US	United State
USA	United State of America
USAID	United States Agency for International Development
USDA	United States Department of Agriculture

VLDL	Very Low Density Lipoprotein
WC	Waist Circumference
WHO	World Health Organization
WHR	Waist-Hip Circumference Ratio

### 1.1 Background of Study

Acquired Immune Deficiency Syndrome (AIDS or Aids) is a rapidly growing global health problem that is accompanied by high morbidity and mortality. It affects all ages, both men and women, and has a significant impact on the quality of life of individuals affected.

The World Health Organization (WHO) and UNAIDS (Joint United Nations Programme on HIV/AIDS) have estimated that approximately 33 million people who have died from this disease since its first identification in 1981.

UNAIDS (2008) reported that the number of people living with HIV/AIDS in the world totalled 33 million in 2007, of whom 5 million were women. Since the epidemic first started, more than 2 million people in the world have died from AIDS.

In Malaysia, the first case of AIDS was reported in 1984 (MOH Malaysia, 2007) and by 1992, 100 cases were reported. In 2007, there were 10,000 people living with HIV in Malaysia.

UNAIDS, WHO, UNAIDS and WHO (2006) also described the epidemic in Malaysia as a localized epidemic based on a relatively low prevalence of HIV infection and a high proportion of infection in injecting drug use.

These individuals having an abnormal pattern and blood counts in conventional studies.



## CHAPTER 1

### INTRODUCTION

#### 1.1 Background of Study

Acquired Immune Deficiency Syndrome (AIDS or Aids) is a rapidly growing global problem that is accompanied by high morbidity and mortality. It affects all aspects of life at the physical, emotional, psychological, social, economic levels. In general the quality of life of infected persons is compromised. Due to the number of people who have died from this infectious disease, WHO (World Health Organization) and UNAIDS (Joint United Nations Programme on HIV/AIDS) put out data regularly on the number of people infected worldwide. According to their latest report (UNAIDS, 2008a) the number of people living with the human immunodeficiency virus (HIV) in the world totaled 33 million people as of December 2007 of whom 5 million were in Asia. Since the epidemic began, AIDS has killed more than 25 million people in the world.

HIV, like most infectious diseases, transcends all countries. In Malaysia, the first case of HIV infection was reported in 1986 (MOH Malaysia, 2007) and by December 2007, there were more than 80,000 people living with HIV in Malaysia (UNAIDS, 2008a). UNAIDS and WHO (2006) also described the epidemic in Malaysia as a country with a concentrated epidemic based on a relatively low rate of infection in the general population as measured by a prevalence of less than 0.1% from mandatory testing of antenatal mothers and blood donors in government clinics

in 2005. However, of late the increase in the number of women infected by their spouse/partners has been a cause of concern to the Government.

This infectious disease affects patients' health status including nutritional status through different ways at all stages of the development of AIDS and visa versa (Seumo-Fosso et al., 2004). The HIV damages the immune system, which can then expose an individual to a range of opportunistic infections and some malignancies. These factors can cause infected individuals to experience fever, diarrhea, nausea, vomiting, loss of appetite and general feelings of weakness. Weight loss, wasting syndrome and protein-energy malnutrition (PEM), micronutrient deficiency as well as a weakened immune system results from a reduction in nutrients absorption, increase in nutrients excretion, additional demand for nutrients and changes in metabolism. Diminished nutritional status of people living with HIV (PLHIV) leads to the inability to fight off other diseases that further exacerbates malnutrition. In short any immune impairment as a result of HIV and AIDS leads to malnutrition and at the same time malnutrition can also lead to immune impairment, whereby it worsens the effects of the HIV and contributes to more rapid progression to AIDS. Therefore malnutrition can both contribute to and can be a result of the progression of HIV. On the other hand, optimal nutrition can slow down this process.

Antiretroviral (ARV) drugs are the only medication available to inhibit viral replication and reduce morbidity and mortality due to AIDS in the absence of vaccination (WHO, 2000b). Unfortunately access to antiretroviral drugs medication is not available in all countries and therefore nutritional status of HIV infected patients becomes an even more important factor in slowing down the progression of

HIV/AIDS. On the other hand, ART (Antiretroviral Therapy) can cause a variety of side effects and some of them adversely affect the nutritional status of PLHIV (WHO, 2007b). Anemia (Berhane et al., 2004; Moyle et al., 2004; Matsushita et al., 2005), changes in body composition and metabolic complications such as elevated blood lipid level, insulin resistance (Richter et al., 2004; Miller et al., 2004; Hansen et al., 2009) and increased rate of cardiovascular disease (CVD) (Depairon et al., 2001; Sankatsing et al., 2009) are the most commonly quoted adverse nutritional effects on patient receiving highly active antiretroviral therapy (HAART).

In Malaysia, significant progresses have been made in the area of prevention and clinical treatment in recent years. The number of people on highly active antiretroviral therapy (HAART) has increased considerably by 35% in 2007 alone (UNAIDS & WHO, 2008) when the Government began to provide ARV drugs free or at reduced charges. The government subsidizes two drugs while patients pay for one (Malaysia UNGASS Report, 2008). Currently all drugs are free for patients on first line regimen, pregnant women, children, government staff, and those infected by blood products. Treatment for opportunistic infections is available and free in all government hospitals.

Due to limitation of information on the nutritional status of PLHIV in Malaysia, a study such as this is needed. Thus, this study aims to determine the nutritional status of PLHIV receiving antiretroviral therapy (ART) and therefore provide information for public health programs and policies that can improve patients' general well-being and quality of life.

## 1.2 Statement of Problem

The HIV/AIDS pandemic is a universal crisis which affects the general well-being of people. AIDS is incurable and therefore fatal. It affects all people in the world irrespective of race, age, sex and socio-economic status. It mainly affects men in their productive years; because of their exposure to high risks activities and they in turn can infect their spouses/partners who can then pass it on to children. In order to address this problem, Governments are confronted with many problems. Preventive work is expensive and the results difficult to assess and at the same time treatment places a high financial burden on the health budget.

The situation is also becoming increasingly alarming in other parts of the world, notably South Asia. UNAIDS (2008a) reported that an estimated 80,000 [52,000-120,000] people were living with HIV with 0.5 percent adult prevalence in 2007 in Malaysia, where the most common risk factor for HIV infection was exposure to contaminated drug injecting equipment. In addition, majority of HIV infected cases between 1986-2006 were adults as 35.7% of total percentage of reported HIV cases were in the age groups of 20 to 29, 42.8% in 30 to 39 years old and 15.0% in 40 to 49 years old (MOH Malaysia, 2007).

Because of the importance of nutrition to the progress of AIDS, this area has been investigated by many researchers. Paton and colleagues (2006) suggested that nutritional status may be a major determinant of survival in patients with HIV receiving ARV medication. Malnutrition, various forms of tissue wasting, fat

accumulation, increased lipid levels, and risk of additional chronic disease have become central issues in health and nutritional care plans of PLHIV.

Good nutrition improves patients' health but does not treat the HIV in them. Medication with antiretroviral treatment is the only means of retarding the progression to AIDS through the suppression of the multiplication of the virus thus enabling the PLHIV to live longer. At the same time medications can also indirectly lead to changes in the nutritional status. WHO (2006a) reported that the major ART-related metabolic abnormalities are lactic acidosis, dyslipidaemia, morphological changes (fat accumulation and lipoatrophy), dysregulation of glucose metabolism, and reduced bone mineral density. As the number of individuals on medication increase (now that it is free or highly subsidized by the Malaysian Government), investigation into the nutritional status of these individuals is of urgent need. In fact UNAIDS and WHO (2008) pointed out that with more and more PLHIV going on medication there is an urgent need to explore the side effects of medication and this includes their nutritional status.

With medication as the only available alternative (to early death) to PLHIV, steps must be taken to reduce the side-effects. This therefore must include treating the complications of AIDS as a chronic disease that needs long-term medication therapies. Taking care of the nutritional complications like medication-induced anemia, metabolic abnormalities and CVD events can improve their nutritional status and therefore quality of life. Improved quality of life enables PLHIV to continue working and contribute to the sustenance of their families' directly and the country

indirectly benefit from the continued economic contribution of a group of young infected people who otherwise could be sick with the side-effects of medication.

This research sought to answer the following question:

1. What is the nutritional status (anthropometry, blood profiles etc.) of Malaysians receiving antiretroviral therapy at Hospital Sungai Buloh?
2. What are their socio-economic and medical history, health and hematological status?
3. What is the ARV regimen they are on?
4. Is there any difference in socio-economic, medical history, health status, antiretroviral regimen and nutritional status by genders and ethnic groups?
5. What are the health risk factors for metabolic syndrome (MetS) and its components as well as anemia?

### **1.3 Significance of Study**

HIV and nutrition are intimately linked. AIDS is well known for causing severe weight loss known as wasting. On the other hand, poor diet can in turn speed the disease's progress. In addition, some antiretroviral drugs have been linked to abdominal obesity, lipid abnormalities by raising LDL cholesterol, lowering HDL cholesterol, and raising triglyceride levels in the blood. This may result in higher risks of heart disease, stroke and diabetes.

Although the impact of nutrition on PLHIV has been well established in many countries, it has not been reported yet in Malaysia. This study looks at the

relationships between HIV and nutrition and can provide baseline information on nutritional status as well nutritional disorders of people living with HIV (PLHIV) receiving ARV so that asymptomatic PLHIV and their caregivers such as physicians, dieticians, nurses and family members can provide suitable nutritional interventions to reduce morbidity and mortality due to AIDS and side effects of Antiretroviral Therapy (ART). Nutrition interventions including education and therapeutic interventions can help PLHIV manage symptoms, reduce susceptibility to opportunistic infections, improve nutritional status, promote response to medical treatment, and improve overall quality of life. Briefly, significance of this study includes the ability to alert the health community on the nutritional status of people living with HIV (PLHIV) receives ART and also to make recommendations that can be put into practice so that complications can be reduced.

The most significant contribution of this study is to the improvement of the quality of life of PLHIV. Knowing their own nutritional status and taking the appropriate action will extend the productive life of PLHIV benefiting both families and country.

## **1.4 Objectives of Study**

### **1.4.1 General objective**

To determine the nutritional status and associated factors among PLHIV receiving antiretroviral medication at Hospital Sungai Buloh, Malaysia.

## 1.4.2 Specific objectives

- 1- To determine the nutritional status (anthropometry, lipid and fasting plasma glucose level, diabetes mellitus and metabolic syndrome, hematologic indices and anemia, dietary intake).
- 2- To determine the socioeconomic status (age, gender, ethnicity, educational level, employment status, monthly household income).
- 3- To determine the medical history {duration of HIV infection, and those measurements at start of medication including immunological status (CD4 cell count and HIV RNA load), hematological status including red blood cells (RBC), hemoglobin (Hb), hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC), anthropometric status (weight, BMI) and drug abuse status at start of medication}.
- 4- To determine the health status (stage of AIDS, CD4 cell count and viral RNA load, supplement status and blood pressure) at the time of study.
- 5- To determine the ARV regimen status (type, line and length of time).
- 6- To compare health and nutritional status of PLHIV by ethnicity and sex.
- 7- To determine factors associated with metabolic syndrome and its components.
- 8- To determine factors associated with anemia (low hemoglobin and megaloblastic).

## 1.5 Conceptual Model of Nutritional Status

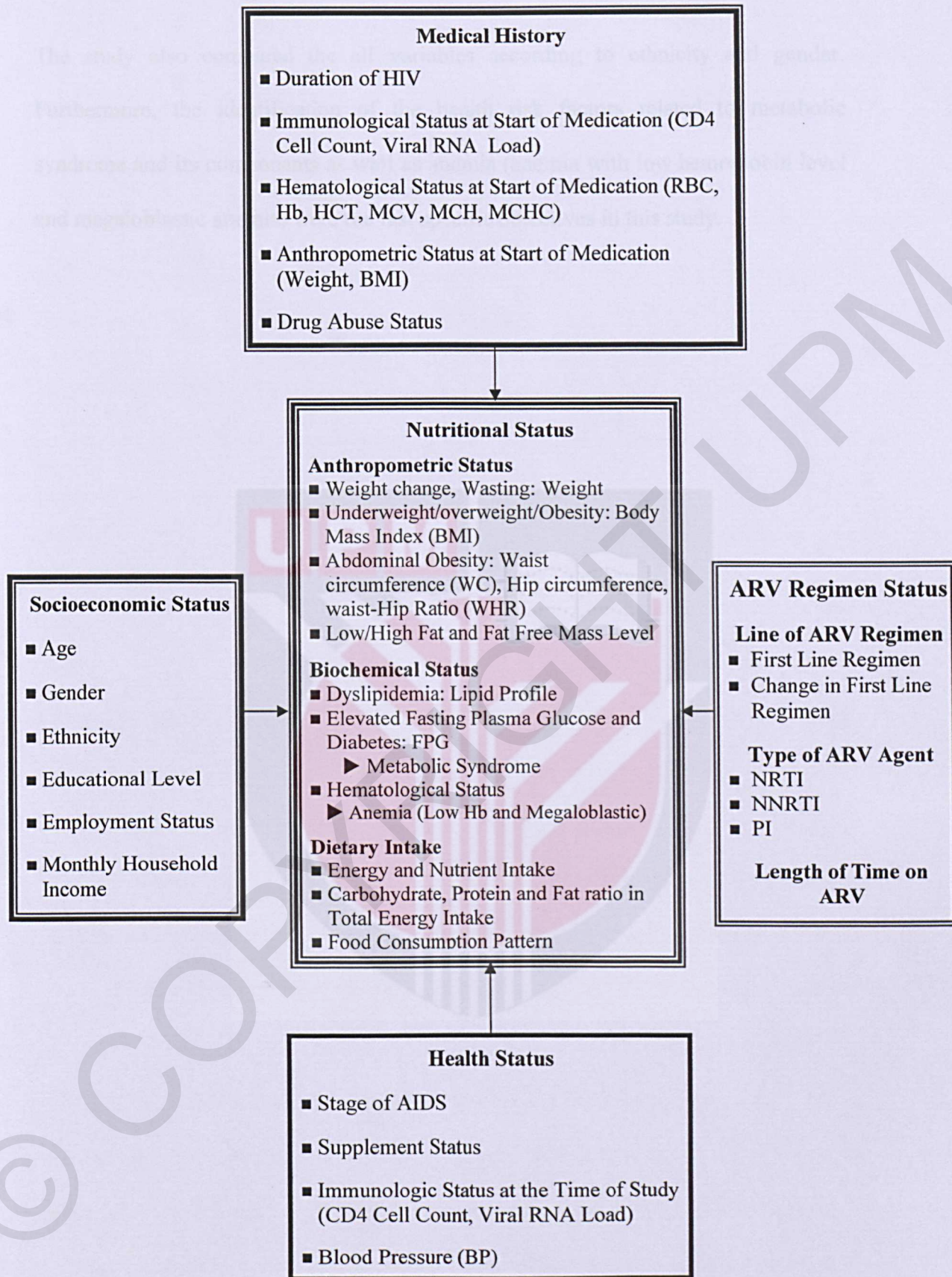
This study aims to determine the nutritional status of people living with HIV (PLHIV) receiving antiretroviral medication at Hospital Sungai Buloh, Malaysia as



main outcome that was influenced by socioeconomic status, medical history, health status and ARV regimen status. Under conceptual model, Figure 1.1 shows the conceptual framework for this study. In this model, the nutritional status of PLHIV (anthropometric status, biochemical status and dietary intake) as dependent variable is influenced by the independent variables related to socioeconomic status (age, gender, ethnicity, educational level, employment status and monthly household income), and medical history (duration of HIV, immunological status at start of medication, hematological status and anthropometric status at start of medication, drug abuse status), health status (stage of AIDS, supplement status, immunological status at the time of study, blood pressure) and ARV regimen (type, line and length of time on ARV).



Figure 1.1. Conceptual Model of Nutritional Status and Associated Factors



**Figure 1.1. Conceptual Model of Nutritional Status and Associated Factors**

The study also compared the all variables according to ethnicity and gender. Furthermore, the identification of the health risk factors related to metabolic syndrome and its components as well as anemia (anemia with low hemoglobin level and megaloblastic anemia) were the last specific objectives in this study.

## 2.2. Human Immunodeficiency Virus (HIV)

HIV stands for human immunodeficiency virus. This agent causes AIDS or acquired immunodeficiency syndrome by infecting, weakening and damaging cells of the

human immune system (World Health Organization, 2017).

### 2.2.1 Biology of HIV

HIV, including HIV-1 and HIV-2, are members of the Retroviridae family (Nesher et al., 2017). HIV-1, the most common of these viruses, attack cells of the immunity system, particularly the CD4+ T-helper cells and of white

blood cell that generally have a high concentration of the CD4 receptors on their surface. HIV-1 is a single-stranded RNA virus (HIV-1) normally the main cause of AIDS (World Health Organization, 2017). These viruses can be

transmitted through sexual intercourse with blood. A protein on the virus's surface called gp120 binds to a receptor called CD4 (Nesher, 2017). RNA is the genetic

material of HIV species and codes for DNA, which is then inserted into the host cell nucleus. DNA performs the host cell's tasks, carrying out its normal functions and

creating a new HIV. During this process, HIV is using the cell's particles such

## BIBLIOGRAPHY

- Adeyemi, O., Rezai, K., Bahk, M., Badri, S., & Thomas-Gossain, N. (2008). Metabolic syndrome in older HIV-infected patients: Data from the CORE50 cohort. *AIDS Patient Care and STDs*, 22 (12), 941-945.
- Ahmad, S., & Sukthakar, A. (1997). Stavudine induced macrocytosis. *Genitourin Med*, 73, 421-423.
- Allard, J. P., Arendt, B. M., Aghdassi, E., Mohammed, S. S., Fung, L. Y., Jalali, P., et al. (2008). Dietary intake and physical activity in a Canadian population sample of male patients with HIV infection and metabolic abnormalities. *Current HIV Research*, 6 (1), 82-99.
- Anderson, P. J., Critchley, J. A. J. H., Chan, J. C. N., Cockram, C. S., Lee, Z. S. K., Thomas, G. N., et al. (2001). Factor analysis of the metabolic syndrome: Obesity vs insulin resistance as the central abnormality. *International Journal of Obesity*, 25 (12), 1782-1788.
- Andrès, E., Loukili N. H., Noel, E., Kaltenbach, G., Abdelgheni, M. B., Perrin, A. E., et al. (2004). Vitamin B12 (cobalamin) deficiency in elderly patients. *Canadian Medical Association Journal*, 171 (3), 251-259.
- Anekthananon, T., Ratanasuwan, W., Techasathit, W., Sonjai, A., & Suwanagool, S. (2004). Safety and efficacy of a simplified fixed dose combination of stavudine, lamivudine and nevirapine (GPO-VIR) for the treatment of advanced HIV-infected patients: A 24-week study. *Journal of the Medical Association of Thailand*, 87 (7), 760-767.
- Angastiniotis, M., & Modell, B. (1998). Global epidemiology of haemoglobin disorders. *Annals of the New York Academy of Sciences*, 850, 251-269.
- Ary, D., Jacobs, L. C., & Razavieh, A. (2002). *Introduction to research in education* (5<sup>th</sup> ed.). Belmont, CA: Wadsworth/Thomson.
- Asia-Pacific Regional Centre of the Culturelink Network (APRCCN). (2008). *Cultural policy, Malaysia*. Seoul: Korean National Commission for UNESCO (KNCU). Retrieved June 1, 2009, from <http://www.culturelink.or.kr/ASP/Board/View.asp?BoardCode=7&IDX=286>

- Baekken, M., Os, I., Sandvik, L., & Oektedalen, O. (2008). Hypertension in an urban HIV-positive population compared with the general population: Influence of combination antiretroviral therapy. *Journal of Hypertension*, 26 (11), 2126-2133.
- Baekken, M., Os, I., Stenehjem, A., Sandvik, L., & Oektedalen, O. (2009). Association between HIV infection and attenuated diurnal blood pressure rhythm in untreated hypertensive individuals. *HIV Medicine*, 10 (1), 44-52.
- Barbosa-Silva, M. C. G., & Barros, A. J. D. (2005). Bioelectrical impedance analysis in clinical practice: A new perspective on its use beyond body composition equations. *Current Opinion in Clinical Nutrition & Metabolic Care*, 8 (3), 311-317.
- Barbosa-Silva, M. C. G., Barros, A. J. D., Post, C, A, L., Barros, A. J. D., Waitzberg, D., L., & Heymsfield, S. V. (2003). Can bioelectrical impedance analysis identify malnutrition in preoperative nutrition assessment?. *Nutrition*, 19 (5), 422-426.
- Bassand, J. P. (2006). Results from a region by-region analysis of the IDEA study highlight the differences in anthropometric characteristics between Asian and European populations. World Congress Press Releases 2006. Retrieved November, 2009, from <http://www.escardio.org/vpo/Press+Area/Press+Releases/2006+World+Congress+Press>
- Baum, M. K., Shor-Posner, G., & Campa, A. (2000). Zinc Status in Human Immunodeficiency Virus Infection. *The Journal of Nutrition*, 130 (5), 1421S-1423S.
- Behler, C., Shade, S., Gregory, K., Abrams, D., & Volberding, P. (2005). Anemia and HIV in the antiretroviral era: Potential significance of testosterone. *AIDS research and human retroviruses*, 21 (3), 200-206.
- Behrens, G., Dejam, A., Schmidt, H., Balks, H. J., Brabant, G., Korner, T., et al. (1999). Impaired glucose tolerance, beta cell function and lipid metabolism in HIV patients under treatment with protease inhibitors. *AIDS*, 13 (10), F63-F70.
- Benjamin, P., Brownlee, N., Jain, A., Alwood, K., Dorman, S. E., & Agwu, A. (2007). Prolonged diarrhea, protein losing enteropathy, and intestinal perforation: An illustrative case of HIV-associated kaposi sarcoma [Abstract]. *The Internet Journal of Gastroenterology*, 5 (2). Retrieved 2 February, 2009, from [http://www.ispub.com/journal/the\\_internet\\_journal\\_of\\_gastroenterology/volume\\_7\\_number\\_2\\_13/article/prolonged\\_diarrhea\\_protein\\_losing\\_enteropathy\\_and\\_intestinal\\_perforation\\_an\\_illustrative\\_case\\_of\\_hiv\\_associated\\_kaposi\\_sarcoma.html](http://www.ispub.com/journal/the_internet_journal_of_gastroenterology/volume_7_number_2_13/article/prolonged_diarrhea_protein_losing_enteropathy_and_intestinal_perforation_an_illustrative_case_of_hiv_associated_kaposi_sarcoma.html)

- Berger, N. A., & Skinner, A. M. (1974). Characterization of lymphocyte transformation induced by zinc ions. *The Journal of Cell Biology*, 61 (1), 45-55.
- Bergersen, B. M., Sandvik, L., Dunlop, O., Birkeland, K., & Bruun, J. N. (2003). Prevalence of hypertension in HIV-positive patients on highly active retroviral therapy (HAART) compared with HAART-naïve and HIV-negative Controls: Results from a Norwegian study of 721 patients. *European Journal of Clinical Microbiology & Infectious Diseases*, 22 (12), 731-736.
- Berhane, K., Karim, R., Cohen, M. H., Masri-Lavine, L., Young, M., Anastos, K., et al. (2004). Impact of highly active antiretroviral therapy on anemia and relationship between anemia and survival in a large cohort of HIV-infected women. *Journal of Acquired Immune Deficiency Syndromes*, 37 (2), 1245-1252.
- Berhane, K., Sanchez, L., Masri-Lavine, L., Pearce, L., Cohen, M., Young, M., et al. (2000). Relationship between highly active anti-retroviral therapy (HAART) and anemia in a large cohort of HIV infected women (Women's Interagency HIV Study - WIHS) [Abstract]. *Proc American Society of Clinical Oncology*, 19: 624a. Retrieved 25 March, 2009, from [http://www.asco.org/ASCOv2/Meetings/Abstracts?&vmview=abst\\_detail\\_view&confID=2&abstractID=201719](http://www.asco.org/ASCOv2/Meetings/Abstracts?&vmview=abst_detail_view&confID=2&abstractID=201719)
- Bernasconi, E., Boubaker, K., Junghans, C., Flepp, M., Furrer, H. j., Haensel, A., et al. (2002). Abnormalities of body fat distribution in HIV-infected persons treated with antiretroviral drugs: The Swiss HIV cohort study. *Journal of Acquired Immune Deficiency Syndromes*, 31 (1), 50-55.
- Beutler, E. (2006). Disorder of iron metabolism. In M. A. Lichtman, E. Beutler, T. J. Kipps, U. Seligsohn, K. kaushansky, & J. T. Prchal (Eds.), *Williams hematology* (7<sup>th</sup> ed., pp. 511-553). New York: McGraw-Hill Medical.
- Ble, A., Fink, J. C., Woodman, R. C., Klausner, M. A., Windham, B. G., Guralnik, J. M., et al. (2005). Renal function, erythropoietin, and anemia of older persons. *Archive of Internal Medicine*, 165 (19), 2222-2227.
- Bobat, R., Coovadia, H., Stephen, C., Naidoo, K. L., McKerrow, N., Black, R. E., et al. (2005). Safety and efficacy of zinc supplementation for children with HIV-1 infection in South Africa: A randomized double-blind placebo-controlled trial. *The Lancet*, 366 (9500), 1862-67.

- Bogden, J. D., Kemp, F. W., Han, S., Li, W., Bruening, K., Denny, T., et al. (2000). Status of selected nutrients and progression of human immunodeficiency virus type 1 infection. *American Journal of Clinical Nutrition*, 72 (3), 809-815.
- Bonora, E., Kiechl, S., Willeit, J., Oberhollenzer, F., Egger, G., Targher, G., et al. (1998). Prevalence of insulin resistance in metabolic disorders: the Bruneck Study. *Diabetes*, 47 (10), 1643-1649.
- Brown, T. T., Cole, S. R., Li, X., Kingsley, L. A., Palella, F. J., Riddler, S. A., et al. (2005). Antiretroviral therapy and the prevalence and incidence of diabetes mellitus in the multicenter aids cohort study. *Archives of Internal Medicine*, 165 (10), 1179-1184.
- Ca'rcamo, C., Hooton, T., Weiss, N. S., Gilman, R., Wener, M. H., Chavez, V., et al. (2006). Randomized controlled trial of zinc supplementation for persistent diarrhea in adults with HIV-1 infection. *Journal of Acquired Immune Deficiency Syndromes*, 43 (2), 197-201.
- Capili, B., & Joyce K., A. (2008). Body mass index and nutritional intake in patients with HIV and chronic diarrhea: A secondary analysis. *Journal of the American Academy of Nurse Practitioners*, 20 (90), 463-478.
- Carr, A., Chuah, J., Hudson, J., French, M., Hoy, J., Law, M., et al. (2000). A randomised, openlabel comparison of three highly active antiretroviral therapy regimens including two nucleoside analogues and indinavir for previously untreated HIV- 1 infection: The OzCombo 1 study. *AIDS*, 14 (9), 1171-1180.
- Carr, A., Samaras, K., Thorisdottir, A., Kaufmann, G. R., Chisholm D. J., & Cooper, D. A. (1999). Diagnosis, prediction, and natural course of HIV-1 protease-inhibitor-associated lipodystrophy, hyperlipidaemia, and diabetes mellitus: A cohort study. *The Lancet*, 353 (9170), 2093-2099.
- Castaldo, A., Tarallo, L., Palomba, E., Albano, F., Russo, S., Zuin, G., et al. (1996). Iron deficiency and intestinal malabsorption in HIV disease. *Journal of Pediatric Gastroenterology and Nutrition*, 22 (4), 359-363.
- Castetbon, K., Kadio, A., Bondurand, A., Boka Yao, A., Barouan, C., Coulibaly, Y., et al. (1997). Nutritional status and dietary intakes in human immunodeficiency virus (HIV)-infected outpatients in Abidjan, Cote D'Ivoire, 1995. *European Journal of Clinical Nutrition*, 51, 81-86.

- Castleman, T., Eleonore S. F., & Bruce, C. (2004). *Food and nutrition implications of antiretroviral therapy in resource limited setting*. Washington, DC: Food and Nutrition Technical Assistance Project, Academy for Educational Development.
- Center for Disease Control and Prevention (CDC). (1981). Pneumocystis Pneumonia --- Los Angeles. *Morbidity and Mortality Weekly Report*, 30 (21), 250-252.
- Center for Disease Control and Prevention (CDC). (1987). Revision of the CDC surveillance case definition for acquired immunodeficiency syndrome. *Morbidity and Mortality Weekly Report*, 36, 1S-15S.
- Centre for Disease Control and Prevention (CDC). (1993). 1993 Revised classification system for HIV infection and expanded surveillance case definition for AIDS among adolescents and adults. *Morbidity and Mortality Weekly Report*, 41, (RR-17).
- Centre for Disease Control and Prevention (CDC). (1994). 1994 Revised classification system for human immunodeficiency virus infection in children less than 13 years of age. *Morbidity and Mortality Weekly Report*, 43, (RR-12), 1-10.
- Centre for Disease Control and Prevention (CDC). (2003). *Obesity fastest growing health threat in the U.S. US: United States National Library of Medicine and the National Institutes of Health*. Retrieved November 26, 2008, from [http://www.nlm.nih.gov/medlineplus/print/news/fullstory\\_12951.html](http://www.nlm.nih.gov/medlineplus/print/news/fullstory_12951.html).
- Chan, Y. H. (2003a). Biostatistics 101: Data presentation. *Singapore Medical Journal*, 44 (6), 280-285.
- Chan, Y. H. (2003b). Biostatistics 103: Qualitative data –Tests of Independence. *Singapore Medical Journal*, 44 (10), 498-503.
- Chan, Y. H. (2004). Biostatistics 202: Logistic regression analysis. *Singapore Medical Journal*, 45(4), 149-153.
- Charlton, R. W., & Bothwell, T. H. (1982). Definition, prevalence and prevention of iron deficiency. *Clinical Haematology*, 11, 309-25.
- Chawarski, M. C., Mazlan, M., & Schottenfeld, R. S. (2006). Heroin dependence and HIV infection in Malaysia. *Drug and Alcohol Dependence*, 82 (1), S39-S42.



- Chlebowski, R. T., Grosvenor, M., Lillington, L., Sayre, J., & Beall, G. (1995). Dietary intake and counseling, weight maintenance, and the course of HIV infection. *Journal of the American Dietetic Association*, 95 (4), 428-435.
- Cirelli, A., Ciardi, M., de Simone, C., Sorice, F., Giordano, R., Ciaralli, L., et al. (1991). Serum selenium concentration and disease progress in patients with HIV infection. *Clinical Biochemistry*, 24 (2), 211-214.
- Coban, E., Timuragaoglu, A., & Meric, M. (2003). Iron deficiency anemia in the elderly: Prevalence and endoscopic evaluation of the gastrointestinal tract in outpatients. *Acta Haematologica*, 110, 25-28.
- Commission on AIDS in Asia. (2008). Redefining AIDS in Asia – crafting an effective response. New Delhi: Oxford University Press.
- Constans, J., Peuchant, E., Pellegrin, J. L., Sergeant, C., Hamon, C., Dubourg, L., et al. (1995). Fatty acids and plasma antioxidants in HIV-positive patients: Correlation with nutritional and immunological status. *Clinical Biochemistry*, 28 (4), 421-426.
- Crane, H. M., Van Rompaey, S. E., & Kitahata, M. M. (2006). Antiretroviral medications associated with elevated blood pressure among patients receiving highly active antiretroviral therapy. *AIDS*, 20 (7), 1019-1026.
- Dancheck, B., Tang, A. M., Thomas, A. M., Smit, E., Vlahov, D., & Semba, R. D. (2005). Injection drug use is an independent risk factor for iron deficiency and iron deficiency anemia among HIV-seropositive and HIV-seronegative women. *Journal of Acquired Immune Deficiency Syndromes*, 4 (2), 198-201.
- Daniel, W.W. (1999). *Biostatistics: A foundation for analysis in the health science* (7<sup>th</sup> ed.). New York: John Wiley & Sons.
- de Deckere, E. A. M., Korver, O., Verschuren, P. M., & Katan, M. B. (1998). Health aspects of fish and n-3 polyunsaturated fatty acids from plant and marine origin. *European Journal of Clinical Nutrition*, 52, 749-753.
- de Monyé, C., Karcher, D. S., Boelaert, J. R., & Gordeuk, V. R. (1999). Bone marrow macrophage iron grade and survival of HIV-seropositive patients. *AIDS*, 13 (3), 375-380.

- De Wit, S., Sabin, C. A., Weber, R., Worm, S. W., Reiss, P., Cazavan, C., et al. (2008). Incidence and risk factors for new onset diabetes mellitus in HIV infected patients: The Data Collection on Adverse Events of Anti-HIV Drugs (D:A:D) study. *Diabetes Care*, 31 (6), 1224-1229.
- den Boer, M. A. M., Berbée, J. F. P., Reiss, P., van der Valk, M., Voshol, P. J., et al. (2006). Ritonavir impairs lipoprotein lipase-mediated lipolysis and decreases uptake of fatty acids in adipose tissue. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 26 (1), 124-9.
- Depairon, M., Chessex, S., Sudre, P., Rodondi, N., Doser, N., Chave, J. P., et al. (2001). Premature atherosclerosis in HIV-infected individuals - focus on protease inhibitor therapy. *AIDS*, 15 (3), 329-334.
- Dieterich, D. T., & Spivak, J. L. (2003). Hematologic disorders associated with hepatitis C virus infection and their management. *Clinical Infectious Diseases*, 37 (4), 533-541.
- Doig, k. (2007). Disorder of iron and heme metabolism. In B. F. Rodak, G. A. Fritsma, & k. Doig (Eds.), *Hematology: Clinical principals and applications* (pp. 232-247). St. Louis, Missouri: Saunders/Elsevier.
- Dolan, S. E., Hadigan, C., Killilea, K. M., Sullivan, M. P., Hemphill, L., Lees, R. S., et al. (2005). Increased cardiovascular disease risk indices in HIV-infected women. *Journal of Acquired Immune Deficiency Syndromes*, 39 (1), 44-54.
- Domingo, P., Sambeat, M. A., Perez, A., Ordonez, J., Rodriguez, J., & Vazquez, G. (2003). Fat distribution and metabolic abnormalities in HIV-infected patients on first combination antiretroviral therapy including stavudine or zidovudine: Role of physical activity as a protective factor. *Antiviral Therapy*, 8 (3), 223-231.
- Dudgeon, W. D., Phillips, K. D., Carson, J. A., Brewer, R. B., Durstine, J. L., & Hand, G. A. (2006). Counteracting muscle wasting in HIV-infected individuals. *HIV Medicine*, 7 (5), 299-310.
- Duncan, K. H., Bacon, J. A., & Weinsier, R. L. (1983). The effects of high and low energy density diets on satiety, energy intake, and eating time of obese and nonobese subjects. *American Journal of Clinical Nutrition*, 37 (5), 763-7.

- Duran, A. C. F. L., Almeida, L. B., Segurado, A. A. C., & Jaime, P. C. (2008). Diet quality of persons living with HIV/AIDS on highly active antiretroviral therapy. *Journal of Human Nutrition and Dietetics*, 21 (4), 346-350.
- Edwards, M. T., Burkle, W., Cutrell, A., Liao, Q., Brothers, C., & Hernandez, J. E. (2005). *Characterization of anemia in HIV-infected (HIV+) subjects treated with antiretroviral therapy (ART) with and without Zidovudine (+/- ZDV) in 54 clinical trials* [Abstract]. Poster session presented at the Third International AIDS Society Conference on HIV Pathogenesis and Treatment, Rio de Janeiro. Retrieved December 28, 2008, from <http://www.aegis.com/conferences/iashivpt/2005/TuFo0106.pdf>
- Eley, B. S., Sive, A. A., Shuttleworth, M., & Hussey, G. D. (2002). A prospective, cross-sectional study of anemia and peripheral iron status in antiretroviral naïve, HIV-1 infected children in Cape Town, South Africa. *BMC Infectious Diseases*, 2, 3. Retrieved January 23, 2009, from <http://www.biomedcentral.com/content/pdf/1471-2334-2-3.pdf>
- El-Sadr, W. M., Mullin, C. M., Carr, A., Gibert, C., Rappoport, C., Visnegarwala, F., et al. (2005). Effects of HIV disease on lipid, glucose and insulin levels: Results from a large antiretroviral-naïve cohort. *HIV Medicine*, 6 (2), 114-121.
- Engelson, E. S., Agin, D., Kenya, S., Werber-Zion, G., Luty, B., Albu, J. B., et al. (2006). Body composition and metabolic effects of a diet and exercise weight loss regimen on obese, HIV-infected women. *Metabolism Clinical and Experimental*, 55, 1327-1336.
- Eron, J. J., Murphy, R. L., Peterson, D., Pottage, J., Parenti, D. M., Jemsek, J., et al. (2000). A comparison of stavudine, didanosine and indinavir with zidovudine, lamivudine and indinavir for the initial treatment of HIV-1 infected individuals: Selection of Thymidine Analog Regimen Therapy (START II). *AIDS*, 14 (11), 1601-1610.
- Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. (2001). 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). *Journal of the American Medical Association*, 285 (19), 2486-97.
- Faber., M. & Kruger, H. S. (2005). Dietary intake, perceptions regarding body weight, and attitudes toward weight control of normal weight, overweight, and obese black females in a rural village in South Africa. *Ethnicity & Disease*, 15, 238-245.

- Fawzi, W. W., Msamanga, G., Hunter, D., Urassa, E., Renjifo, B., Mwakagile, D., et al. (2000). Randomized trial of vitamin supplements in relation to vertical transmission of hiv-1 in Tanzania. *Journal of Acquired Immune Deficiency Syndromes*, 23 (3), 246-254.
- Fawzi, W. W., Msamanga, G., Renjifo, B., Spiegelman, D., Urassa, E., Hashemi, L., et al. (2001). Predictors of intrauterine and intrapartum transmission of HIV-1 among Tanzanian women. *AIDS*, 15 (9), 1157-1165.
- Fawzi, W. W., Msamanga, G., Hunter, D., Renjifo, B., Antelman, G., Bang, H., et al. (2002). Randomized trial of vitamin supplements in relation to transmission of HIV-1 through breastfeeding and early child mortality. *AIDS*, 16 (14), 1935-1944.
- Fawzi, W. W., Msamanga, G., Antelman, G., Xu, C., Hertzmark, E., Spiegelman, D., et al. (2004a). Effect of prenatal vitamin supplementation on lower-genital levels of HIV type 1 and interleukin type 1 $\beta$  at 36 weeks of gestation. *Clinical Infectious Diseases*, 38 (5), 716-22.
- Fawzi, W. W., Msamanga, G. I., Spiegelman, D., Wei, R., Kapiga, S., & Villamor, E. (2004b). A randomized trial of multivitamin supplements and HIV disease progression and mortality. *New England Journal of Medicine*, 351, 23-32.
- Fawzi, W. W., Villamor, E., Msamanga, G. I., Antelman, G., Aboud, S., Urassa, W., et al. (2005). Trial of zinc supplements in relation to pregnancy outcomes, hematologic indicators, and T cell counts among HIV-1-infected women in Tanzania. *American Journal of Clinical Nutrition*, 81 (1), 161-167.
- Fields, M. (1998). Nutritional factors adversely influencing the glucose/insulin system. *American Journal of Clinical Nutrition*, 17 (4), 317-321.
- Ford, E. S., Giles, W. H., & Dietz, W. H. (2002). Prevalence of the metabolic syndrome among US adults: Findings from the Third National Health and Nutrition Examination Survey. *The Journal of American Medical Association*, 287, 356-359.
- Forrester, J. E., Spiegelman, D., Tchetgen, E., Knox, T. A., & Gorbach, S. L. (2002). Weight loss and body-composition changes in men and women infected with HIV. *American Journal of Clinical Nutrition*, 76 (6), 1428-34.

- Forrester, J. E., Spiegelman, D., Woods, M., Knox, T. A., Fauntleroy, J. M., & Gorbach, S. L. (2001). Weight and body composition in a cohort of HIV-positive men and women. *Public Health Nutrition*, 4 (3), 743-747.
- Forrester, J. E., Tucker K. L., & Gorbach, S. L. (2004). Dietary intake and body mass index in HIV-positive and HIV-negative drug abusers of Hispanic ethnicity. *Public Health Nutrition*, 7 (7), 863-870.
- Foulkes, A. S., Woh, D. A., Frank, I., Puleo, E., Restine, S., Megan, L. W., et al. (2006). Associations among race/ethnicity, ApoC-III genotypes, and lipids in HIV-1-infected individuals on antiretroviral therapy. *PLoS Medicine*, 3 (3), 0337-0347. Retrieved May 12, 2004, from <http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.0030052>
- French, M., Amin, J., Roth, N., Carr, A., Law, M., Emery, S., et al. (2002). Randomized, open-label, comparative trial to evaluate the efficacy and safety of three antiretroviral drug combinations including two nucleoside analogues and Nevirapine for previously untreated HIV-1 infection: The OzCombo 2 Study. *HIV Clinical Trials*, 3 (3), 177-185.
- Friedwald, W. T., Levy, R. I., & Fredrickson, D. S. (1997). Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. *Clinical Chemistry*, 18, 499-502.
- Friis, H., Gomo, E., Kästel, P., Ndhlovu, P., Nyazema, N., Krarup, H., et al. (2001). HIV and other predictors of serum folate, serum ferritin, and hemoglobin in pregnancy: A cross-sectional study in Zimbabwe. *American Journal of Clinical Nutrition*, 73 (6), 1066-73.
- Fultz, S.mL., Duffy, T., Weissman, S., Rodriguez-Barradas, M., Rabeneck, L., & Justice, A.C. (2004). Relationship of anemia type to survival in HIV positive veterans [Abstract]. Poster session presented at the XV International AIDS Conference. Retrived December 12, 2008, from <http://www.aegis.conferences/iac/2004/MoPeB3269.html>
- Garby, L., Irnell, L., & Werner, I. (1969). Iron deficiency in women of fertile age in a Swedish community: III: estimation of prevalence based on response to iron supplementation. *Acta Med Scand*, 185, 113-7.
- Gathe, J., Jr. Badaro, R., Grimwood, A., Abrams, L., Kleszczewski, K., Cross, A., et al. (2002). Antiviral activity of enteric-coated didanosine (EC), stavudine, and nelfinavir

versus zidovudine plus lamivudine and nelfinavir. *Journal of Acquired Immune Deficiency Syndromes*, 31 (4), 399-403.

- Gauthier, S., Reisberg, B., Zaudig, M., Petersen, R. C., Ritchie, K., Broich, K., et al. (2006). Mental mild cognitive impairment. *The Lancet*, 36 (9518), 1262-70.
- Gavrila, A., Tsiodras, S., Doweiko, J., Nagy, G. S., Brodovicz, K., Hsu, W., et al. (2003). Exercise and vitamin E intake are independently associated with metabolic abnormalities in human immunodeficiency virus-positive subjects: A cross-sectional study. *Clinical Infectious Diseases*, 36 (12), 1593-601.
- Gayet-Ageron, A., Baratin, D., Marceillac, E., Allard, R., Pyramid, D., Chidiac, C., et al. (2004). The AIDS epidemic in Lyon: Patient characteristics and defining illnesses between 1985 and 2000. *HIV Medicine*, 5 (3), 163-170.
- Gelmon, K., Montaner, J. S., Fanning, M., Smit, J. R., Faultz, J., Tsoukas, C., et al. (1989). Nature, time course and dose dependence of zidovudine-related side effects: Results from the Multicenter Canadian Azidothymidine Trial. *AIDS*, 3 (9), 555-561.
- Gibert, C. L., Shlay, J. C., Sharma, S., Bartsch, G., Peng, G., & Grunfeld, C. (2009). Racial differences in changes of metabolic parameters and body composition in antiretroviral therapy-naïve persons initiating antiretroviral therapy. *Journal of Acquired Immune Deficiency Syndromes*, 50 (1), 44-53.
- Gibson, R. S. (1990). *Principles of Nutritional Assessment*. New York: Oxford University Press.
- Grandominico, J. M., & Fichtenbaum, C. J. (2008). Short-term effect of HAART on blood pressure in hiv-infected individuals. *HIV clinical trials*, 9 (1), 52-60.
- Grandominico, J. M., & Fichtenbaum, C. J. (2008). Short-Term Effect of HAART on blood pressure in HIV-infected individuals [Abstract]. *HIV Clinical Trials*, 9 (1). Retrieved June 1, 2009 from <http://thomasland.metapress.com/content/g86n34844m076615/>
- Gropper, S., Smith, J. L., & Groff, J. L. (2005). *Advanced nutrition and human metabolism* (4<sup>th</sup> ed.). Belmont, CA: Thomson Wadsworth.
- Grunfeld, C., Pang, M., Shimizu, L., Shigenaga, J. K., Jensen, P., & Feingold, K. R. (1992). Resting energy expenditure, caloric intake, short-term weight change in human

immunodeficiency virus infection and the acquired immunodeficiency syndrome. *American Journal of Clinical Nutrition*, 55 (2), 455-460.

- Gazzaruso, C., Bruno, R., Garzaniti, A., Giordanetti, S., Fratino, P., Sacchi, P., et al. (2003). Hypertension among HIV patients: Prevalence and relationships to insulin resistance and metabolic syndrome. *Journal of Hypertension*, 21 (7), 1377-1382.
- Guralnik, J. M., Eisenstaedt, R. S., Ferrucci, L., Klein, H. G., & Woodman, R. C. (2004). Prevalence of anemia in persons 65 years and older in the United States: Evidence for a high rate of unexplained anemia. *Blood*, 104, 2263-2268.
- Hadigan, C., Jeste, S., Anderson, E. J., Tsay, R., Cyr, H., & Grinspoon, S. (2001). Modifiable dietary habits and their relation to metabolic abnormalities in men and women with human immunodeficiency virus infection and fat redistribution. *Clinical Infectious Diseases*, 33 (5), 710-7.
- Hadigan, C., Miller, K., Corcoran, C., Anderson, E., Basgoz, N., & Grinspoon, S. (1999). Fasting hyperinsulinemia and changes in regional body composition in human immunodeficiency virus-infected women. *The Journal of Clinical Endocrinology & Metabolism*, 84 (6), 1932-1937.
- Hansen, B. R., Petersen, J., Haugaard, S. B., Madsbad, S., Obel, N., Suzuki, Y., et al. (2009). The prevalence of metabolic syndrome in Danish patients with HIV infection: The effect of antiretroviral therapy [Abstract]. *HIV medicine*, 9999, (9999), 1468-1293. Retrieved June 2, 2009 from <http://www3.interscience.wiley.com/journal/122286621/abstract>
- Hattingh, Z., Walsh, C. M., Bester, C. J., & Oguntibeju, O. O. (2008). Evaluation of energy and macronutrient intake of black women in Bloemfontein: A cross-sectional study. *African Journal of Biotechnology*, 7 (22), 4019-4024.
- He, F. J., Markandu, N. D., Coltart, R., Barron, J., & MacGregor, G. A. (2005). Effect of short-term supplementation of potassium chloride and potassium citrate on blood pressure in hypertensives. *Journal of Hypertension*, 45, 571-574.
- Hendricks, K. M., Willis, K., Houser, R., & Jones, C. Y. (2006). Obesity in HIV-Infection: Dietary correlates. *Journal of the American College of Nutrition*, 25 (4), 321-331.

- Hendricks, K., Tang, A., Spiegelman, D., Skinner, S., & Woods, M. (2005). Dietary intake in human immunodeficiency virus-infected adults: A comparison of dietary assessment methods. *Journal of the American Dietetic Association*, 105 (4), 532-540.
- Hepburn, M. J., Dyal, K., Runser, L. A., Barfield, R. L., Hepburn, L. M., & Fraser, S. L. (2004). Low serum vitamin B12 levels in an outpatient HIV-infected population. *International Journal of STD & AIDS*, 15 (2), 127-133.
- Highleyman, L. (2006). Nutrition and HIV. *Bulletin of Experimental Treatments for AIDS (BETA)*, 18 (2), 18-32.
- Hoffmann, C., Rockstroh, J. K., & Kamps, B. S. (Eds.). (2007). *HIV Medicine*. Paris, Cagliari, Wuppertal: Flying Publisher. Retrieved 10 January, 2009, from <http://www.hivmedicine.com/hivmedicine2007.pdf>
- Horne, M. K., III. (2005). Iron deficiency. In G. P. Rodgers, & N. S. Young (Eds.), *Bethesda handbook of clinical hematology* (pp. 1-10). Philadelphia: Lippincott Williams & Wilkins.
- Horsburgh, C. R., Getting, J., Alexander, L. N., & Lennox, J. L. (2001). Disseminated *Mycobacterium avium* complex disease among patients infected with human immunodeficiency virus, 1985–2000. *Clinical Infectious Diseases*, 33, 1938-1943.
- Huang, M. S. L. (2001). HIV/AIDS among fishers: vulnerability of their partners. In M. J. Williams, N. H. Chao, P. S. Choo, K. Matics, M. C. Nandeesh, M. Shariff, et al. (Eds.), *Global Symposium on Women in Fisheries: Sixth Asian Fisheries Forum, 29 November, Kaohsiung, Taiwan* (pp. 49-53). Penang, Malaysia: The World Fish Centre.
- Huang, M. S. L., & Hisham, H. (2004). The HIV/AIDS Epidemic Country Paper: Malaysia. *AIDS Education and Prevention*, 16, (Suppl. A), 1001-1009.
- Humphrey, J. H., Iliff, P. J., Marinda, E. T., Mutasa, K., Moulton, L. H., Chidawanyika, H., et al. (2006). Effects of a single large dose of vitamin A, given during the postpartum period to HIV-positive women and their infants, on child HIV infection, HIV-free survival, and mortality. *The Journal of Infectious Diseases*, 193 (6), 860-871.



- Hurwitz, B. E., Klaus, J. R., Llabre, M. M., Gonzalez, A., Lawrence, P. J., Maher, K. J., et al. (2007). Suppression of human immunodeficiency virus type 1 viral load with selenium supplementation. *Archive of Internal Medicine*, 167 (2), 148-154.
- Insel, P., Turner, R. E., & Ross, D. (2007). *Nutrition* (3<sup>rd</sup> ed.). Sudbury, CA: Jones and Barlett.
- Institute of medicine (IOM). (1997). *Dietary Reference Intakes for Calcium, Phosphorous, Magnesium, Vitamin D, and Fluoride*. Washington, DC: National Academy Press.
- Institute of medicine (IOM). (1998). *Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline*. Washington, DC: National Academy Press.
- Institute of medicine (IOM). (2001). *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc*. Washington, DC: National Academy Press.
- Jacobson, D. L., Bica, I., Knox, T. A., Wanke, C., Tchetgen, E., Spiegelman, D., et al. (2003). Difficulty swallowing and lack of receipt of highly active antiretroviral therapy predict acute weight loss in human immunodeficiency virus disease. *Clinical Infectious Diseases*, 37 (10), 1349-56.
- Jacobson, D. L., Knox, T., Spiegelman, D., Skinner, S., Gorbach, S., & Wanke, C. (2005). Prevalence of, evolution of, and risk factors for fat atrophy and fat deposition in a cohort of hiv-infected men and women. *Clinical Infectious Diseases*, 40 (12), 1837-45.
- Jacobson, D. L., Tang, A. M., Spiegelman, D., Thomas, A. M., Skinner, S., Gorbach, S. L., et al. (2006). Incidence of metabolic syndrome in a cohort of HIV-infected adults and prevalence relative to the US population. *Journal of Acquired Immune Deficiency Syndromes*, 43 (4), 458-466.
- Jaime, P. C., Florindo, A. A., Latorre, M. R. D. O., & Segurado, A. A. C. (2006). Central obesity and dietary intake in HIV/AIDS patients. *Rev Saúde Pública*, 40 (4), 634-40.
- Jericó, C., Knobel, H., Montero, M., Ordoñez-Llanos, J., Guelar, A., Gimeno, J. L., et al. (2005). Metabolic syndrome among HIV-infected patients. *Diabetes Care*, 28 (1), 132-137.

- Jiamton, S., Pepin, J., Suttent, R., Filteau, S., Mahakkanukrauh, B., Hanshaoworakul, W., et al. (2003). A randomized trial of the impact of multiple micronutrient supplementation on mortality among HIV-infected individuals living in Bangkok. *AIDS*, 17 (17), 2461-2469.
- Jiménez-Expósito, M. J., Garcia-Lorda, P., Alonso-Villaverde, C., de Virgala, C. M., Solà, R., Masana, L., et al. (1998). Effect of malabsorption on nutritional status and resting energy expenditure in HIV-infected patients. *Journal of Acquired Immune Deficiency Syndromes*, 12 (15), 1965-1972.
- Johnson, C. S., Tegros, C., & Beutler, E. (1982).  $\alpha$  Thalassemia: prevalence and hematologic findings in American Blacks. *Archives of Internal Medicine*, 142, 1280-2.
- Joint United Nations Programme on HIV/AIDS (UNAIDS). (2007). *AIDS epidemic update 2007*, December. Geneva: UNAIDS.
- Joint United Nations Programme on HIV/AIDS (UNAIDS). (2008a). *Report on the global HIV/AIDS epidemic 2008*. Geneva: UNAIDS.
- Joint United Nations Programme on HIV/AIDS (UNAIDS). (2008b). *UNAIDS' terminology guidelines terminology*. Geneva: UNAIDS.
- Joint United Nations Programme on HIV/AIDS (UNAIDS) & World Health Organization (WHO). (2006). *Epidemiological Fact Sheets on HIV/AIDS Sexually Transmitted Infection, 2006 update: Malaysia*. Geneva: UNAIDS/WHO.
- Joint United Nations Programme on HIV/AIDS (UNAIDS) & World Health Organization (WHO). (2008). *Epidemiological fact sheet on HIV and AIDS: Core data on epidemiology and response. Malaysia: 2008 update*. Geneva: UNAIDS/WHO.
- Joy, T., Keogh, H. M., Hadigan, C., Lee, H., Dolan, S. E., Fitch, K., et al. (2007). Dietary fat intake and relationship to serum lipid levels in HIV-infected patients with metabolic abnormalities in the HAART era. *AIDS*, 21 (12), 1591-1600.
- Joy, T., Keogh, H. M., Hadigan, C., Lee, H., Dolan, S. E., Fitch, K., et al. (2008). Relation of body composition to body mass index in HIV-infected patients with metabolic abnormalities. *Journal of Acquired Immune Deficiency Syndromes*, 47 (2), 174-184.

- Jung, O., Bickel, M., Ditting, T., Rickerts, V., Welk, T., Helm, E. B., et al. (2004). Hypertension in HIV-1-infected patients and its impact on renal and cardiovascular integrity. *Nephrol Dial Transplant*, 19 (9), 2250-2258.
- Ibs, K. H., & Rink, L. (2003). Zinc-Altered Immune Function. *The Journal of Nutrition*, 133 (5), 1452S-1456S.
- Hattingh, Z., Walsh, C., Veldman, F. J., & Bester, C. J. (2007). Micronutrient intake of HIV-infected women in Mangaung, Free State. *South African Journal of Clinical Nutrition*, 20, 28-36.
- Kahn B. B., & Flier, J. S. (2000). Obesity and insulin resistance. *The Journal of Clinical Investigation*, 106 (4), 473-481.
- Kandiah, M., Mohd Sharif, Z., Yoke Mun, C., & Abu Saad, H. (2007). *Handbook on nutritional assessment methods*. Malaysia: August Academics.
- Kaplan, R. C., Kingsley, L. A., Sharrett, A. R., Li, X., Lazar, J., Tien, P. C., et al. (2007). Ten-year predicted coronary heart disease risk in HIV-infected men and women. *Clinical Infectious Diseases*, 45 (15 October), 1074-81.
- Karlsson, A., & Nordström, G. (2001). Nutritional status, symptoms experienced and general state of health in HIV-infected patients. *Journal of Clinical Nursing*, 10 (2), 609-617.
- Kee, C. C., Jamaiyah, H., Noor Safiza, M. N., Geeta, A., Khor, G. L., Suzana, S., et al. (2008). Abdominal obesity in Malaysian adults: National Health and Morbidity Survey III (NHMS III, 2006). *Malaysian Journal of Nutrition*, 14 (2), 125-135.
- Keiser, P. H., Sension, M. G., DeJesus, E., Rodriguez, A., Olliffe, J. F., Williams, V. C., et al. (2005). Substituting Abacavir for hyperlipidemia-associated protease inhibitors in HAART regimens improves fasting lipid profiles, maintains virologic suppression, and simplifies treatment. *BMC Infectious Diseases*, 5, 2. Retrieved February 28, 2009, from <http://www.biomedcentral.com/content/pdf/1471-2334-5-2.pdf>
- Khalsa, A., Karim, R., Mack, W., Minkoff, H., Cohen, M., Young, M., et al. (2004). Hypertension in HIV-infected women related to HAART: Women's Interagency HIV Study [Abstract]. Poster session presented at the 11th Conference on Retroviruses Opportunistic Infection. Retrieved 10 February, 2009, from <http://www.retroconference.org/2004/cd/Abstract/741.htm>

- Khor, G. L., & Mohd Sharif, Z. (2003). Dual forms of malnutrition in the same households in Malaysia-a case study among Malay rural households. *Asia Pacific Journal of Clinical Nutrition*, 12 (4), 427-438.
- Khor, G.L. (2008). Impotence of nutrition in achieving the Millennium Development Goal. *Malaysian Journal of Medicine and Health Sciences*, 4 (1), 1-21.
- Kilbourne, A. M., Justice, A. C., Rabeneck, L., Rodriguez-Barradas, M., & Weissman, S. (2001). General medical and psychiatric co-morbidity among HIV infected veterans in the post-HAART era. *Journal of Clinical Epidemiology*, 54 (12), S22-S28.
- Kim, J. H., Spiegelman, D., Rimm, E., & Gorbach, S. L. (2001). The correlates of dietary intake among HIV-positive adults. *American Journal of Clinical Nutrition*, 74 (6), 852-861.
- Knox, T. A., Spiegelman, D., Skinner, S. C., & Gorbach, S. (2004). Diarrhea and abnormalities of gastrointestinal function in a cohort of men and women with HIV infection. *American Journal of Gastroenterology*, 95 (12), 3482-3489.
- Koch, J., Garcia-Shelton, Y. L., Neal, E. A., Chan, M. F., Kristin, E. W., & Cello, J. P. (1996). Steatorrhea: A common manifestation in patients with HIV /AIDS. *The Journal of Nutrition*, 12, 507-510.
- Kotler, D. P., Thea, D. M., Heo, M., Allison, D. B., Engelson, E. S., Wang, J., et al. (1999). Relative influences of sex, race, environment, and HIV infection on body composition in adults. *American Journal of Clinical Nutrition*, 69 (3), 432-439.
- Kotler, D. P., Tierney, A. R., Wang, J., & Pierson, R. N., Jr. (1989). Magnitude of body-cell-mass depletion and the timing of death from wasting in AIDS. *American Journal of Clinical Nutrition*, 50, 444-447.
- Kotler, D. P., Wang, J., & Pierson, R. N., Jr. (1985). Body composition studies in patients with the acquired immunodeficiency syndrome. *American Journal of Clinical Nutrition*, 42, 1255-1265.
- Kruzich, L. A., Marquis, G. S., Carriquiry, A. L., Wilson, C. M., & Stephensen, C. B. (2004). US youths in the early stages of HIV disease have low intakes of some micronutrients important for optimal immune function. *Journal of the American Dietetic Association*, 104 (7), 1095-1101.

- Kumarasamy, N., Solomon, S., Chaguturu, S. K., Mahajan, A. P., Flanigan T. P., Balakrishnan P., et al. (2003). The safety, tolerability and effectiveness of generic antiretroviral drug regimens for HIV-infected patients in South India. *AIDS*, 17 (15), 2265-2271.
- Lee, R. D., & Nieman, D. C. (2003). *Nutritional Assessment* (3<sup>rd</sup> ed.). New York: McGraw-Hill.
- Leite, L. H. M., & Sampaio, A. B. M. M. (2008). Metabolic abnormalities and overweight in HIV/AIDS persons-treated with antiretroviral therapy. *Revista de Nutrição*, 21 (3), 277-283.
- Lenhard, J. M., Croom, D. K., Weiel, J.E., & Winegar, D. A. (2000). HIV protease inhibitors stimulate hepatic triglyceride synthesis. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 20 (12), 2625-2629.
- Levine, A. M., Berhane, K., Masri-Lavine, L., Sanchez, M. L., Young, M., Augenbraun, M., et al. (2001). Prevalence and correlates of anemia in a large cohort of HIV-infected women: Women's interagency HIV study. *Journal of Acquired Immune Deficiency Syndromes*, 26 (1), 28-35.
- Levinson, W. (2008). *Review of medical microbiology and immunology* (10<sup>th</sup> ed.). New York: MacGraw-Hill Medical.
- Lewis, D. K., Whitty, C. J. M., Epino, H., Letsky, E. A., Mukiibi, J. M., & van den Broek, N. R. (2007). Interpreting tests for iron deficiency among adults in a high HIV prevalence African setting: Routine tests may lead to misdiagnosis. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 101 (6), 613-617.
- Lewis, D. K., Whitty, C. J. M., Walsh, A. L., Epino, H., van den Broek, N. R., Letsky, E. A., et al. (2005). Treatable factors associated with severe anaemia in adults admitted to medical wards in Blantyre, Malawi, an area of high HIV seroprevalence. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 99 (8), 561-567.
- Lind, L., Lithell, H., & Pollare, T. (1993). Is it hyperinsulinaemia or insulin resistance that is related to hypertension and other metabolic cardiovascular risk factors? *Journal of Hypertension*, 11 (suppl 4), S11-S16.

- Lipschitz, D. A. (1995). Nutrition-related anemias in the elderly. *Geriatric nutrition*, 12, 133-143.
- Lohman, T. G. (1992). *Advances in body composition assessment* (3<sup>rd</sup> ed.). IL, USA: Human Kinetic Books.
- Lucas, S. B., De Cock, K. M., Hounnou, A., Peacock, C., Diomande, M., Honde, M., et al. (1994). Contribution of tuberculosis to slim disease in Africa. *BMJ*, 308 (6943), 1531. Retrieved June 6, 2009, from <http://www.bmj.com/cgi/content/full/308/6943/1531>
- Luder, E., Godfrey, E., Godbold, J., & Simpson, D. M. (1995). Assessment of nutritional, clinical, and immunologic status of HIV-infected, inner-city patients with multiple risk factors. *Journal of the American Dietetic Association*, 95 (6), 655-660.
- Macallan, D. C., Noble, C., Baldwin, C., Jebb, S. A., Prentice, A. M., Coward, W. A., et al. (1995). Energy expenditure and wasting in human immunodeficiency virus infection. *The New England Journal of medicine*, 333, 83-88.
- Makola, D., Ash, D. M., Tatala, S. R., Latham, M. C., Ndossi, G., & Mehansho, H. (2003). A micronutrient-fortified beverage prevents iron deficiency, reduces anemia and improves the hemoglobin concentration of pregnant Tanzanian women. *Journal of Nutrition*, 133 (5), 1339-1346.
- Mallon, P. W. G., Miller, J., Cooper, D. A., & Carr, A. (2003). Prospective evaluation of the effects of antiretroviral therapy on body composition in HIV-1-infected men starting therapy. *AIDS*, 17 (7), 1797-1804.
- Mangili, A., Murman, D. H., Zampini, A. M., & Wanke, C. A. (2006). Nutrition and HIV infection: Review of weight Loss and wasting in the era of highly active antiretroviral therapy from the Nutrition for Healthy Living Cohort. *Clinical Infectious Diseases*, 42, 836-842.
- Martin, G. J., Blazes, D. L., Mayers, D. L., & Spooner, K. M. (1999). Stavudine-induced macrocytosis during therapy for human immunodeficiency virus infection. *Clinical Infectious Diseases*, 29 (2), 459-460.
- Matsushita, S., Yoshimura, K., Kimura, T., Kamihira, A., Takano, M., Eto, K., et al. (2005). Spontaneous recovery of hemoglobin and neutrophil levels in Japanese patients on a

long-term Combivir<sup>®</sup> containing regimen. *Journal of Clinical Virology*, 33 (3), 188-193.

- Mauss, S., Wolf, E., & Jaeger, H. (1999). Impaired glucose tolerance in HIV-positive patients receiving and those not receiving protease inhibitors [Letter to the editor]. *Annals of Internal Medicine*, 130 (2), 161-162.
- McDermott, A. Y., Shevitz, A., Knox, T., Roubenoff, R., Kehayias, J., & Gorbach, S. (2001). Effect of highly active antiretroviral therapy on fat, lean and bone mass in HIV-seropositive men and women. *American Journal of Clinical Nutrition*, 74 (5), 679-686.
- Mehta, S., & Fawzi, W. (2007). Effects of Vitamins including Vitamin A, on HIV/AIDS patients. *Vitamins and Hormones*, 75, 355-383.
- Meininger, G., Hadigan, C., Rietschel, P., & Grinspoon, S. (2002). Body-composition measurements as predictors of glucose and insulin abnormalities in HIV-positive men. *American Journal of Clinical Nutrition*, 76 (2), 460-465.
- Melchior, J. C., Salmon, D., Rigaud, D., Leport, C., Bouvet, E., Detruchis, P., et al. (1991). Resting energy expenditure is increased in stable, malnourished HIV-infected patients. *American Journal of Clinical Nutrition*, 53, 437-441.
- Merchant, A. T., Msamanga, G., Villamor, E., Saathoff, E., O'Brien, M., Hertzmark, et al. (2005). Multivitamin supplementation of HIV-positive women during pregnancy reduces hypertension. *The Journal of Nutrition*, 135 (7), 1776-1781.
- Mercié, P., Tchamgoue'S., Thie'baut, R., Viallarda, J. F., Faurea, I., Dancourt, V., et al. (2000). Atherogen lipid profile in HIV-1-infected patients with lipodystrophy syndrome. *European Journal of Internal Medicine*, 11 (5), 257-263.
- Meyers, L. D., Habicht, J-P., Johnson, C. L. (1979). Components of the difference in hemoglobin concentrations in blood between black and white women in the United States. *American Journal of Epidemiology*, 109, 539-49.
- Miller, J., Carr, A., Emery, S., Law, M., Mallal, S., Baker, D., et al. (2003). HIV lipodystrophy: Prevalence, severity and correlates of risk in Australia. *HIV Medicine*, 4 (3), 293-301.

- Miller, M. F., Humphrey, J. H., Iliff, P.J., Malaba, L. C., Mbuya, N. V., the ZVITAMBO Study Group & Stoltzfus, R. J. (2006). Neonatal erythropoiesis and subsequent anemia in HIV-positive and HIV-negative Zimbabwean babies during the first year of life: A longitudinal study. *BMC Infectious Diseases*, 6, 1. Retrieved July 7, 2008, from <http://www.biomedcentral.com/content/pdf/1471-2334-6-1.pdf>
- Ministry of Health Malaysia (MOH Malaysia) (2003). *Kajian pengam bilan makanan, Malaysia 2002/2003*. Malaysia: Jawatankuasa Teknikal Kajian Diet Kementerian Kesihatan Malaysia.
- Ministry of Health Malaysia (MOH Malaysia). (2001). *Consensus on antiretroviral treatment (2<sup>nd</sup> ed.)*. Kuala Lumpur: Ministry of Health Malaysia.
- Ministry of Health Malaysia (MOH Malaysia). (2006). *Guidelines for the management of adults and adolescents with HIV infection with antiretroviral therapy (Rev. 2<sup>nd</sup> ed.)*. Kuala Lumpur: Department of Public Health (AIDS/STD section), Ministry of Health, Malaysia.
- Ministry of Health Malaysia (MOH Malaysia). (2007). *Summary of HIV/AIDS cases: Reported by year 2006*. Kuala Lumpur: Department of Public Health (AIDS/STD Section), Ministry of Health, Malaysia.
- Ministry of Health Malaysia (MOH Malaysia). (2008). *The Third National Health and Morbidity Survey (NHMS III) 2006, nutritional status*. Kuala Lumpur: Institute for Public Health, Ministry of Health, Malaysia.
- Ministry of Health Malaysia (MOH Malaysia) & World Health Organization (WHO). (2004). *Consensus report on HIV and AIDS—epidemiology in 2004: Malaysia*. Kuala Lumpur, Ministry of Health and WHO.
- Mirnalini, K., Zalilah, M. S., Safiah, M. Y., Tahir, A., Siti Haslinda M. D., Siti Rohana, D., et al. (2008). Energy and nutrient intakes: Findings from the Malaysian Adult Nutrition Survey (MANS). *Malaysian Journal of Nutrition*, 14 (1), 1-24.
- Mlisana, K., Auld, S. C., Grobler, A., van Loggerenberg F., Williamson, C., et al. (2008). Anaemia in acute HIV-1 subtype C infection. *PLoS ONE*, 3 (2), e1626. Retrieved March 4, 2009 from <http://www.plosone.org/article/info:10.1371/journal.pone.0001626>



- Mondy, K., Overton, E. T., Grubb, J., Tong, S., Seyfried, W., Powderly, W., et al. (2007). Metabolic syndrome in HIV-infected patients from an urban, Midwestern US outpatient population. *Clinical Infectious Diseases*, 44 (5), 726-34.
- Moore, R. D., & Forney, D. (2002). Anemia in HIV-infected patients receiving highly active antiretroviral therapy. *Journal of Acquired Immune Deficiency Syndromes*, 29 (1), 54-57.
- Morfeldt-Manson, L., Bottiger, B., Nilsson, B., & von Stedingk, L. V. (1991). Clinical signs and laboratory markers in predicting progression to AIDS in HIV-1 infected patients. *Scandinavian Journal of Infection*, 23 (4), 443-449
- Moyle, G., Sawyer, W., Law, M., Amin, J., & Hill, A. (2004). Changes in hematologic parameters and efficacy of Thymidine analogue-based, highly active antiretroviral therapy: A meta-analysis of six prospective, randomized, comparative studies. *Clinical Therapeutics*, 26 (1), 92-97.
- Mwamburi, D. M., Wilson, I. B., Jacobson, D. L., Spiegelman, D., Gorbach, S. L., Knox, T. A., et al. (2005). Understanding the role of HIV load in determining weight change in the era of highly active antiretroviral therapy. *Clinical Infectious Diseases*, 40 (1), 167-73.
- National Cholesterol Education Program (NCEP). (2001). Executive summary of the third report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adults Treatment Panel III). *Journal of the American Medical Association*, 285 (19), 2486-2497.
- National Coordinating Committee on Food and Nutrition (NCCFN). (2005). *Recommended Nutrient Intakes for Malaysia (RNI): A report of the technical working group on nutritional guidelines*. Kuala Lumpur: Ministry of Health Malaysia.
- National Kidney Foundation (NKF). (2006) Kidney early evaluation program: Anemia & CKD. New York: NKF. Retrieved 12 January, 2009, from <http://www.kidney.org/news/keep/pdf/adr2006/07chapter6anemia&CKD.pdf>
- Nativig, H., & Vellar, O. D. (1967). Studies on hemoglobin values in Norway: VIII. Hemoglobin, hematocrit and MCHC values in adult men and women. *Acta Med Scand*, 182, 193-205.

- Nester, E. W., Anderson, D. G., Evans R. C., & Nester, M. T. (2007). *Microbiology: A human Perspective* (5<sup>th</sup> ed.). New York: Mcgraw-Hill.
- Nesto, R.W. (2003). The relation of insulin resistance syndromes to risk of cardiovascular disease. *Reviews in Cardiovascular Medicine*, 4 (6), S11-S18
- O'Brien, M., Kupka, R., Msamanga, G., Saathoff, E., Hunter, D. J., & Fawzi, W. W. (2005). Anemia is an independent predictor of mortality and immunologic progression of disease among women with HIV in Tanzania. *Journal of Acquired Immune Deficiency Syndromes*, 40 (2), 219-225.
- Oh, R.C., & Brown, D. L. (2003). Vitamin B12 deficiency. *American Family Physician*, 67 (5), 979-986.
- Onat, A., Avc, G. S., Barlan, M. M., Uyarel, H., Uzunlar, B., & Sansoy, V. (2004). Measures of abdominal obesity assessed for visceral adiposity and relation to coronary risk. *International Journal of Obesity*, 28, 1018–1025.
- Opara, D. C., Umoh, I. B., & John, M. (2007). Effects of nutritional counseling and micronutrient supplementation on some biochemical parameters of persons living with HIV and aids in Uyo, Nigeria. *Pakistan Journal of Nutrition*, 6 (3), 220-227.
- Palacios, R., Santos, J., Camino, X., Arazo, P., Torres Perea, R. Echevarria, S., et al. (2005). Treatment-limiting toxicities associated with nucleoside analogue reverse transcriptase inhibitor therapy: A prospective, observational study. *Current Therapeutic Research*, 66 (2), 117-129.
- Palacios, R., Santos, J., Garcia, A., Castells, E., Gonzalez, M., Ruiz, J., et al. (2006). Impact of highly active antiretroviral therapy on blood pressure in HIV-infected patients. A prospective study in a cohort of naive patients. *HIV Medicine*, 7 (1), 10-15.
- Papathakis, P. C., Rollins, N. C., Chantry, C. J., Bennish, M. L., & Brown, K. H.(2007). Micronutrient status during lactation in HIV-infected and HIV-uninfected South African women during the first 6 mo after delivery. *American Journal of Clinical Nutrition*, 85, 182-192.
- Paton, N. I. J., Elia, M., Jennings, G., Ward, L. C., & Griffin, G. E. (1998). Bioelectrical impedance analysis in human immunodeficiency virus-infected patients: Comparison of single frequency with multifrequency, spectroscopy and other novel approaches. *Nutrition*, 14 (9), 658-666.

- Paton, N. I., Sangeetha, S., Earnest, A., & Bellamy, R. (2006). The impact of malnutrition on survival and the CD4 count response in HIV-infected patients starting antiretroviral therapy. *HIV Medicine*, 7 (5), 323-330.
- Périard, D., Amalio, T., Sudre, P., Cheseaux, J. J., Halfon, P., Reymond, M. J., et al. (1999). Atherogenic dyslipidemia in HIV-infected individuals treated with protease inhibitors. *Circulation*, 100 (7), 700-705.
- Pernerstorfer-Schoen, H., Jilma, B., Perschler, A., Wichlas, S., Schindler, K., Schindl, A., et al. (2001). Sex differences in HAART-associated dyslipidaemia. *AIDS*, 15 (6), 725-734.
- Petersen, K., Hale, B. R., & Wallace, M. R. (2005). Macrocytosis after nucleoside-containing HIV treatment regimens. *Infectious Diseases in Clinical Practice*, 13 (2), 65-67.
- Poppitt, S. D., Keogh, G. F., Prentice, A. M., Williams, D. E. M., Sonnemans, H. M. W., Valk, E. E. J., et al. (2002). Long-term effects of ad libitum low-fat, high-carbohydrate diets on body weight and serum lipids in overweight subjects with metabolic syndrome. *American Journal of Clinical Nutrition*, 75 (1), 11-20.
- Pujari, S. N., Dravid, A., Naik, E., Bhagat, S., Tash, K., Nadler, J. P., et al. (2005). Lipodystrophy and dyslipidemia among patients taking first-line, World Health Organization-recommended highly active antiretroviral therapy regimens in western India. *Journal of Acquired Immune Deficiency Syndrome*, 39 (2), 199-202.
- Pujari, S.N., Patel, A.K., Naik, E., Patel, K. K., Dravid, A., Patel, J. K., et al. (2004). Effectiveness of generic fixed dose combinations of highly active antiretroviral therapy for treatment of HIV infection in India. *Journal of Acquired Immune Deficiency Syndromes*, 37 (5), 1566-1569.
- Puttawong, S., Prasithsirikul, W., & Vadcharavivad, S. (2004). Prevalence of lipodystrophy in Thai HIV infected patients. *Journal of the Medical Association of Thailand*, 87 (6), 605-611.
- Ramezani, A., Aghakhani, A., Sharif, M. R., Banifazl, M., Eslamifar, A., & Velayati, A. A. (2008). Anemia prevalence and related factors in HIV-infected patients: A cohort study. *Iranian Journal of Pathology*, 3 (3), 125-128.

- Rayman, M. P. (2000). The importance of selenium to human health. *The Lancet*, 356 (9225), 233-241.
- Reaburn, J. A., Kronl, M., & Lau, D. (1979). Social determinants in food selection. *Journal of the American Dietetic Association*, 74 (6), 637-641.
- Reaven, G., Abbasi F., & McLaughlin, T. (2004). Obesity, insulin resistance, and cardiovascular disease. *Recent Progress in Hormone Research*, 59 (1), 207-223.
- Reid, G., Kamarulzaman, A., & Sran, S. K. (2007). Malaysia and harm reduction: The challenges and responses. *International Journal of Drug Policy*, 18 (2), 136-140.
- Remacha, A. F., Cadafalch, J., Sardà, P., Barceló, M., & Fuster, M. (2003). Vitamin B-12 metabolism in HIV-infected patients in the age of highly active antiretroviral therapy: Role of homocysteine in assessing vitamin B-12 status. *American Journal of Clinical Nutrition*, 77 (2), 420-424.
- Richman, D. D., Fischl, M. A., Grieco, M. H., Gottlieb, M. S., Volberding, P. A., Laskin, O. L., et al. (1987). The toxicity of azidothymidine (AZT) in the treatment of patients with AIDS and AIDS-related complex. A double-blind, placebo controlled trial. *New England Journal of Medicine*, 317 (4), 192-197.
- Richter, A., Pladevall, M., Manjunath, R., Lafata, J. E., Xi, H., Simpkins, J., et al. (2005). Patient characteristics and costs associated with dyslipidaemia and related conditions in HIV-infected patients: A retrospective cohort study. *HIV Medicine*, 6 (2), 79-90.
- Rodak, B. F., Fritsma, G. A., & Doig, K. (2007). *Hematology: Clinical principals and applications*. St. Louis, Missouri: Saunders/Elsevier.
- Royal, W., III, Wang, H., Jones, O., Hieu, T., & Bryant, J. L. (2007). A vitamin A deficient diet enhances proinflammatory cytokine, Mu opioid receptor, and HIV-1 expression in the HIV-1 transgenic rat. *Journal of Neuroimmunology*, 185 (1/2), 29-36.
- Saghayam, S., Kumarasamy, N., Cecelia, A. J., Solomon, S., Mayer, K., & Wanke, C. (2007). Weight and body shape changes in a treatment-naive population after 6 months of Nevirapine-based generic highly active antiretroviral therapy in South India. *Clinical Infectious Diseases*, 44 (2), 295-300.

- Sales, S., Campa, A., Rafie, C., Le, K., Entengoff, K., Page, J.B., & Baum, M. K. (2008). Anemia and decline of CD4 cell count in HIV+ drug users in Miami [Abstract]. *The Journal of the Federation of American Societies for Experimental Biology*, 22, 1099.3. Retrieved April 2, 2009, from [http://www.fasebj.org/cgi/content/meeting\\_abstract/22/1\\_MeetingAbstracts/1099.3](http://www.fasebj.org/cgi/content/meeting_abstract/22/1_MeetingAbstracts/1099.3)
- Samaras, K., & Campbell, L.V. (1997). The non-genetic determinants of central adiposity. *International Journal of Obesity & Related Metabolic Disorders*, 21, 839-845.
- Sommadossi, J. P., Carlisle, R., & Zhou, Z. (1989). Cellular pharmacology of 3'-azido-3'-deoxythymidine with evidence of incorporation into DNA of human bone marrow cells. *Molecular Pharmacology*, 36 (1):9-14.
- Sankatsing, R. R., Wit, F. W., Vogel, M., de Groota, E., Brinkmane, K., Rockstrohd, J. K., et al. (2009). Increased carotid intima-media thickness in HIV patients treated with protease inhibitors as compared to non-nucleoside reverse transcriptase inhibitors. *Circulation*, 202 (2), 589-595.
- Sechi, L. A., Bartoli, E. (1997). Mechanisms of insulin resistance leading to hypertension: What can we learn from experimental models? *Journal of investigative medicine*, 45, 238-251.
- Scherzer, R., Shen, W., Bacchetti, P., Kotler, D., Lewis, C. E., Shlipak, M. G., et al. (2008). Simple anthropometric measures correlate with metabolic risk indicators as strongly as magnetic resonance imaging-measured adipose tissue depots in both HIV-infected and control subjects. *The American Journal of Clinical Nutrition*, 87 (6), 1809-1817.
- Schwarz, J. M., Linfoot, P., & Dare, D. (2003). Hepatic de novo lipogenesis in normoinsulinemic and hyperinsulinemic subjects consuming high-fat, low-carbohydrate and low-fat, high-carbohydrate isoenergetic diets. *American Journal of Clinical Nutrition*, 77 (1), 43-50
- Schwenk, A., Beisenherz, A., Kremer, G., Diehl, V., Salzberger, B., & Fätkenheuer, G. (1999). Bioelectrical impedance analysis in HIV-infected patients treated with triple antiretroviral treatment. *American Journal of Clinical Nutrition*, 70 (5), 867-73.
- Schwenk, A., Breuer, P., Kremer, G., & Ward, L. (2001). Clinical assessment of HIV-associated lipodystrophy syndrome: Bioelectrical impedance analysis, anthropometry and clinical scores. *Clinical Nutrition*, 20 (3), 243-249.

- Semba, R. D., Shah, N., & Vlahov, D. (2001). Improvement of anemia among HIV-infected injection drug users receiving highly active antiretroviral therapy. *Journal of Acquired Immune Deficiency Syndromes*, 26 (4), 315-319.
- Semba, R. D., Shah, N., Klein, R. S., Mayer, K. H., Schuman, P., & Vlahov, D. (2002). Prevalence and cumulative incidence of and risk factors for anemia in a multicenter cohort study of human immunodeficiency virus-infected and -uninfected women. *Clinical Infectious Diseases*, 34 (15 January), 260-266.
- Seumo-Fosso, E., Rajabiun, S., Cogill, B., Elder, L., Castleman, T., & Sheckler, A. (2004). *HIV/AIDS: A guide for nutritional care and support* (2<sup>nd</sup> ed.). Washington, DC: Food and Nutrition Technical Assistance Project (FANTA), Academy for Educational Development.
- Shah, M., Tierney, K., Adams-Huet, B., Boonyavarakul, A., Jacob, K., Quittner, C., et al. (2005). The role of diet, exercise and smoking in dyslipidaemia in HIV-infected patients with lipodystrophy. *HIV Medicine*, 6 (4), 291-298.
- Shah, S., Smith, C. J., Lampe, F., Youle, M., Johnson, M. A., Phillips, A. N., et al. (2007). Haemoglobin and albumin as markers of HIV disease progression in the highly active antiretroviral therapy era: Relationships with gender. *HIV Medicine*, 8 (1), 38-45.
- Shiyi, O., Kin-chor, K., Yan, L., & Liang, F. (2001). In vitro study of possible role of dietary fiber in lowering postprandial serum glucose. *Journal of Agriculture and Food Chemistry*, 49 (2), 1026-1029.
- Shor-Posner, G., Lecusay, R., Morales, G., Campa, A., & Miguez-Burbano, M. J. (2002). Neuroprotection in HIV-positive drug users: implications for antioxidant therapy. *Journal of Acquired Immune Deficiency Syndromes*, 31, S84-S88.
- Siani, A., Strazzullo, A., Gaicco, A., Pacioni, D., Celletano, E., & Mancini, M. (1991). Increasing dietary potassium intake reduces the need for antihypertensive medication. *Annals of Internal Medicine*, 115 (10), 753-759.
- Simmons, A. (1997). *Hematology: A combined theoretical and technical approach*. Boston: Butterworth-Heinemann.
- Singh, D. (1993). Body shape and women's attractiveness: The critical role of waist-to-hip ratio. *Human Nature*, 4 (3), 297-321.

- Sizer, F., & Whitney, E. (2008). *Nutrition: Concept and controversies* (11<sup>th</sup> ed.). Belmont, CA: Wadsworth.
- Skjelbakken, T., Langbakk, B., Dahl, I. M., & Lochen, M. L. (2005). Haemoglobin and anaemia in a gender perspective: the Tromso Study. *European Journal of Haematology*, *74*, 381-388.
- Sluys, T. E., van der Ende, M. E., Swart, G. R., van den Berg, J. W., & Wilson, J. H. Body composition in patients with acquired immunodeficiency syndrome: A validation study of bioelectric impedance analysis. *Journal of Parenteral and Enteral Nutrition*, *17* (5), 404-406.
- Smit, E., Graham, N. M. H., Tang, A., Flynn, C., Solomon, L., & Vlahov, D. (1996). Dietary intake of community-based HIV-1 seropositive and seronegative injecting drug users. *Nutrition*, *12* (7/8), 496-501.
- Sobieszczyk, M. E., Hoover, D. R., Anastos, K., Mulligan, K., Tan, T., Shi, Q., et al. (2008). Prevalence and predictors of metabolic syndrome among HIV-infected and HIV-uninfected women in the women's interagency HIV study. *Journal of Acquired Immune Deficiency Syndromes*, *48* (3), 272-280.
- Solo'rzano Santos, F., Gochicoa Rangel, L. G., Palacios Saucedo, G., Va'zquez Rosales, G., & Miranda Novales, M. G. (2006). Hypertriglyceridemia and hypercholesterolemia in human immunodeficiency virus-1-infected children treated with protease inhibitors. *Archives of Medical Research*, *37*, 129-132.
- SPSS 16.0. (2007). *Statistical package for the social sciences 16.0*. Chicago, Illinois: SPSS Inc.
- Squires, K. E., Gulick, R., Tebas, P., Santana, J., Mulanovich, V., Clark, R., et al. (2000). A comparison of stavudine plus lamivudine versus zidovudine plus lamivudine in combination with indinavir in antiretroviral naive individuals with HIV infection: Selection of Thymidine Analog Regimen Therapy (START I). *AIDS*, *14* (11), 1591-1600.
- Srasuebku, P., Lim, P. L., Lee, M. P., Kumarasamy, N., Zhou, J., & Sirisanthana, T. (2009). Short-term clinical disease progression in HIV-infected patients receiving combination antiretroviral therapy: Results from the TREAT Asia HIV observational database. *Clinical Infectious Diseases*, *48*, 940-950.

- Steele, R. H., Keogh, G. L., Quin, J., Fernando, S. L., & Stojkova, V. (2002). Mean cell volume (MCV) changes in HIV-positive patients taking nucleoside reverse transcriptase inhibitors (NRTIs): A surrogate marker for adherence. *International Journal of STD & AIDS*, 13 (11), 748-754.
- Steinberg, H. O., Brechtel, G., Johnson, A., Fineberg, N., & Baron, A. D. (1994). Insulin-mediated skeletal muscle vasodilation is nitric oxide dependent: A novel action of insulin to increase nitric oxide release. *The Journal of Clinical Investigation*, 94 (3), 1172-1179.
- Stensland, S., & Margolis, S. (1990). Simplifying the calculation of body mass index for quick reference. *Journal of the American Dietetic Association*, 90 (6), 856.
- Stephensen, C. B., Marquis, G. S., Jacob, R. A., Kruzich, L. A., Douglas, S. D., & Wilson, C. M. (2006). Vitamins C and E in adolescents and young adults with HIV infection. *American Journal of Clinical Nutrition*, 83 (4), 870-879.
- Stine G. J. (2005). *AIDS update 2005: An annual overview of acquired immune deficiency syndrome*. San Francisco, CA: Pearson Education/Benjamin Cummings.
- Straznicky, N. E., O'Callaghan, C. J., Barrington, V. E., & Louis W. J. (1999). Hypotensive effect of low-fat, high-carbohydrate diet can be independent of changes in plasma insulin concentrations. *Journal of Hypertension*, 34, 580-585.
- Sullivan, P. S., Hanson, D. L., Chu, S. Y., Jones, J. L., & Ward, J. W. (1998). Epidemiology of anemia in human immunodeficiency virus (HIV)-infected persons: Results from the multistate adult and adolescent spectrum of HIV disease surveillance project. *Blood*, 91 (1), 301-308.
- Sungai Buloh Hospital. (2008). Sungai Buloh Hospital. Jabatan Recod. Available from Sungai Buloh Hospital Database.
- Sutinen, J., & Yki-Järvinen, H. (2007). Increased resting energy expenditure, fat oxidation, and food intake in patients with highly active antiretroviral therapy-associated lipodystrophy. *American Journal of Physiology Endocrinology and Metabolism*, 292 (3), E687-E692. Retrieved April 16, 2009 from <http://ajpendo.physiology.org/cgi/reprint/292/3/E687>.



- Steele, R. H., Keogh, G. L., Quin, J., Fernando, S. L., & Stojkova, V. (2002). Mean cell volume (MCV) changes in HIV-positive patients taking nucleoside reverse transcriptase inhibitors (NRTIs): A surrogate marker for adherence. *International Journal of STD & AIDS*, 13 (11), 748-754.
- Steinberg, H. O., Brechtel, G., Johnson, A., Fineberg, N., & Baron, A. D. (1994). Insulin-mediated skeletal muscle vasodilation is nitric oxide dependent: A novel action of insulin to increase nitric oxide release. *The Journal of Clinical Investigation*, 94 (3), 1172-1179.
- Stensland, S., & Margolis, S. (1990). Simplifying the calculation of body mass index for quick reference. *Journal of the American Dietetic Association*, 90 (6), 856.
- Stephensen, C. B., Marquis, G. S., Jacob, R. A., Kruzich, L. A., Douglas, S. D., & Wilson, C. M. (2006). Vitamins C and E in adolescents and young adults with HIV infection. *American Journal of Clinical Nutrition*, 83 (4), 870-879.
- Stine G. J. (2005). *AIDS update 2005: An annual overview of acquired immune deficiency syndrome*. San Francisco, CA: Pearson Education/Benjamin Cummings.
- Straznicky, N. E., O'Callaghan, C. J., Barrington, V. E., & Louis W. J. (1999). Hypotensive effect of low-fat, high-carbohydrate diet can be independent of changes in plasma insulin concentrations. *Journal of Hypertension*, 34, 580-585.
- Sullivan, P. S., Hanson, D. L., Chu, S. Y., Jones, J. L., & Ward, J. W. (1998). Epidemiology of anemia in human immunodeficiency virus (HIV)-infected persons: Results from the multistate adult and adolescent spectrum of HIV disease surveillance project. *Blood*, 91 (1), 301-308.
- Sungai Buloh Hospital. (2008). Sungai Buloh Hospital. Jabatan Recod. Available from Sungai Buloh Hospital Database.
- Sutinen, J., & Yki-Järvinen, H. (2007). Increased resting energy expenditure, fat oxidation, and food intake in patients with highly active antiretroviral therapy-associated lipodystrophy. *American Journal of Physiology Endocrinology and Metabolism*, 292 (3), E687-E692. Retrieved April 16, 2009 from <http://ajpendo.physiology.org/cgi/reprint/292/3/E687>.

- Swanson, B., Hershov, R. C., Sha, B. E., Benson, C. A., Cohen, M., & Gunfeld, C. (2000). Body composition in HIV-infected women. *The Journal of Nutrition*, 16 (11/12), 1064-1068.
- Tan, B. Y., Kantilal, H. K., & Singh, R. (2008). Prevalence of metabolic syndrome among Malaysians using the International Diabetes Federation, National Cholesterol Education Program and modified World Health Organization definitions. *Malaysian Journal of Nutrition*, 14 (1), 65-77.
- Tan, C. E., Ma, S., Wai, D., Chew, S. K., & Tai, E. S. (2004). Can we apply the National Cholesterol Education Program Adult Treatment Panel definition of the metabolic syndrome to Asians? *Diabetes Care*, 27, 1182-1186.
- Tang, A. M., Forrester, J., Spiegelman, D., Knox, T. A., Tchetgen, E., & Gorbach, S. L. (2002). Weight loss and survival in HIV-positive patients in the era of highly active antiretroviral therapy. *Journal of Acquired Immune Deficiency Syndromes*, 31 (2), 230-236.
- Tang, A. M., Graham, N. M. H., & Saah, A. J. (1996). Effects of micronutrient intake on survival in human immunodeficiency virus type 1 infection. *American Journal of Epidemiology*, 143 (12), 1244-56.
- Tang, A. M., Graham, N. M., Chandra R. K., & Saah, A. J. (1997). Low serum vitamin B-12 concentrations are associated with faster human immunodeficiency virus type 1 (HIV-1) disease progression. *The Journal of Nutrition*, 127 (2), 345-351.
- Tang, A., Jacobson, D. L., Spiegelman, D., Knox, T. A., & Wanke, C. (2005). Increasing risk of 5% or greater unintentional weight loss in a cohort of HIV-infected patients, 1995 to 2003. *Journal of Acquired Immune Deficiency Syndromes*, 40 (1), 70-76.
- Taylor, C. A., Keim, K. S., & Gilmore, A. C. (2005). Impact of core and secondary foods on nutritional composition of diets in native-American women. *Journal of The American Dietetic Association*, 105 (3), 413-419.
- Tedaldi, E. M., Absalon, J., Thomas, A. J., Shlay, J. C., & van den Berg-Wolf, M. (2008). Ethnicity, race, and gender differences in serious adverse events among participants in an antiretroviral initiation trial: Results of CPCRA 058 (First Study). *Journal of Acquired Immune Deficiency Syndromes*, 47 (4), 441-448.

- Tee, E. S., Ismail, M. N., Nasir, M. A., & Khatijah, I. (1997). Nutrient composition of Malaysian food (4<sup>th</sup> ed.). Malaysian Food Composition Database Programme, Institute for Medical Research, Kuala Lumpur.
- Ter Kuile, F. O., Parise, M. E., Verhoeff, F. H., Udhayakumar, V., Newman, R. D., Van Eijk, A. M., et al. (2004). The burden of co-infection with human immunodeficiency virus type 1 and malaria in pregnant women in Sub-Saharan Africa. *The American Journal of Tropical Medicine and Hygiene*, 71 (suppl. 2), 41-54.
- The Australian HIV Observational Database (AHOD). (2002). Rates of combination antiretroviral treatment change in Australia, 1997–2000. *HIV Medicine*, 3 (1), 28-36.
- Tohill, B. C., Heilig, C. M., Klein, R. S., Rompalo, A., Cu-Uvin, S., Piwoz, E. G., et al. (2007). Nutritional biomarkers associated with gynecological conditions among US women with or at risk of HIV infection. *American Journal of Clinician Nutrition*, 85 (5), 1327-34.
- Tooze, J. A., Vitelines, M. Z., Smith, S. L., Arcury, T. A., Davis, C. C., Bell, R. A., et al. (2007). High levels of low energy reporting on 24-hour recalls and three questionnaires in an elderly low-socioeconomic status population. *The Journal of Nutrition*, 137 (5), 1286-1293.
- Tunku Latifah, T. A. (2001). *HIV among fishermen in Mukim Kuala Kedah*. B.Sc. Thesis. Universiti Putra Malaysia, Malaysia.
- UNGASS Country Progress Report 2008: Malaysia. (2008). Malaysia: AIDS/STD Section of the Disease Control Division, Ministry of Health, Malaysia.
- van den Broek, N. R., & Letsky, E. A. (2000). Etiology of anemia in pregnancy in south Malawi. *American Journal of Clinical Nutrition*, 72 (suppl. 1), 247S-256S.
- Van geertruyden, J. P., Mulenga, M., Chalwe, V., Michael, N., Moerman, F., Mukwamataba, D., et al. (2009). Impact of HIV-1 infection on the hematological recovery after clinical malaria. *Journal of Acquired Immune Deficiency Syndromes*, 50 (2), 200-205.
- Van Lettow, M., Harries, A. D., Kumwenda, J. J., Zijlstra, E. E., Clark, T. D., Taha, T. E., et al. (2004). Micronutrient malnutrition and wasting in adults with pulmonary tuberculosis with and without HIV co-infection in Malawi. *BMC Infectious Diseases*, 4, 61. Retrieved December 12, 2008, from <http://www.biomedcentral.com/content/pdf/1471-2334-4-61.pdf>

- Villamor, E., Koulinska, I. N., Furtado, J., Baylin, A., Aboud, S., Manji, K., et al. (2007). Long-chain n-6 polyunsaturated fatty acids in breast milk decrease the risk of HIV transmission through breastfeeding. *American Journal of Clinical Nutrition*, 86 (3), 682-689.
- Villamor, E., Msamanga, G., Spiegelman, D., Antelman, G., Peterson, K. E., & Hunter, D. J. (2002). Effect of multivitamin and vitamin A supplements on weight gain during pregnancy among HIV-1-infected women. *American Journal of Clinical Nutrition*, 76, 1082-1090.
- Villamor, E., Saathoff, E., Bosch, R. J., Hertzmark, E., Baylin, A., & Manji, K. (2005). Vitamin supplementation of HIV-infected women improves postnatal child growth. *American Journal of Clinical Nutrition*, 81 (4), 880-888.
- Wanke, C. A., Silva, M., Knox, T. A., Forrester, J., Spiegelman, D., & Gorbach, S. L. (2000). Weight loss and wasting remain common complications in individuals infected with human immunodeficiency virus in the era of highly active antiretroviral therapy. *Clinical Infectious Diseases*, 31, 803-805.
- Wig, N., Bhatt, S. P., Sakhujia, A., Srivastava, S., & Agarwal, S. (2008). Dietary adequacy in Asian Indians with HIV. *AIDS Care*, 20 (3), 370-375.
- Wiig, K., & Smith, C. (2007). An exploratory investigation of dietary intake and weight in human immunodeficiency virus-seropositive individuals in Accra, Ghana. *Journal of the American Dietetic Association*, 107 (6), 1008-1101.
- Williams, S. B., Bartsch, G., Muurahainen, N., Collins, G., Raghavan, S. S., & Wheeler, D. (2003). Protein intake is positively associated with body cell mass in weight-stable HIV-infected men. *The Journal of Nutrition*, 133, 1143-1146.
- Woods, M. N., Spiegelman, D., Knox, T. A., Forrester, J. E., Connors, J. L., Skinner, S. C., et al. (2002). Nutrient intake and body weight in a large HIV cohort that includes women and minorities. *Journal of the American Dietetic Association*, 102 (2), 203-211.
- World Bank. (2007). *HIV/AIDS, nutrition, and food security: What we can do*. Washington, DC: World Bank.
- World Health Organization (WHO). (1992). *The Prevalence of anaemia in women: A Tabulation of Available Information*. Geneva: WHO.

- World Health Organization (WHO). (1998). *Obesity: Preventing and managing the global epidemic. Report on a WHO Consultation on Obesity, Geneva, 3-5 June 1997*. Geneva: WHO.
- World Health Organization (WHO). (1999). *Definition, diagnosis and classification of diabetes mellitus and its complications: Part 1, diagnosis and classification of diabetes mellitus*. Geneva: WHO.
- World Health Organization (WHO). (2000a). *Obesity: Preventing and managing the global epidemic. Report on a WHO Consultation on Obesity*. Geneva: WHO.
- World Health Organization (WHO). (2000b). *Safe and Effective Use of Antiretroviral Treatments in Adults with particular references to resource limited settings*. Geneva: WHO.
- World Health Organization (WHO). (2001). *Iron deficiency Anemia: Assessment, prevention and control: A guide for programme managers*. Geneva: WHO.
- World Health Organization (WHO). (2002). *HIV/AIDS: Antiretroviral Newsletter (Rev. No. 7)*. Manila: WHO.
- World Health Organization (WHO). (2003). *Nutrient Requirements for People Living with HIV/AIDS: Report of a technical consultation*. Geneva: WHO.
- World Health Organization (WHO). (2005). *Consultation on nutrition and HIV/AIDS in Africa: Evidence, lessons and recommendations for action*. Geneva: WHO.
- World Health Organization (WHO). (2006a). *Antiretroviral therapy for HIV infection in adults and adolescents: Recommendations for a public health approach-(Rev. 2006)*. Geneva: WHO.
- World Health Organization (WHO). (2006b). *Antiretroviral therapy of HIV infection in infants and children in resource-limited settings: Towards universal access*. Geneva: WHO.
- World Health Organization (WHO). (2006c). *Patient monitoring guidelines for HIV care and antiretroviral therapy (ART)*. Geneva: WHO.

World Health Organization (WHO). (2007a). *Laboratory guidelines for enumerating CD4 T lymphocytes in the context of HIV/AIDS*. New Delhi: WHO.

World Health Organization (WHO). (2007b). *Management of HIV infection and antiretroviral therapy in adults and adolescents: A clinical manual* (Technical Publication Series No. 58). New Delhi: WHO.

World Health Organization (WHO) & Food and Agriculture Organization (FAO). (2003). *Diet, Nutrition and the Prevention of Chronic Diseases: Report of a Joint Expert Consultation* (WHO Technical Report Series No. 916). Geneva: WHO.

Zakai, N. A., McClure, L. A., Prineas, R., Howard, G., McClellan, W., Holmes, C. E., Newsome, B. B., et al. (2009). Correlates of anemia in American Blacks and Whites. *American Journal of Epidemiology*, 169 (3), 355-364.

Zhou, J., Kumarasamy, N., Ditangco, R., Kamarulzaman, A., Lee, C. K. C., Li, P. C. K., et al. (2005). The TREAT Asia HIV Observational Database: Baseline and retrospective data. *Journal of Acquired Immune Deficiency Syndromes*, 38 (2), 174-179.

Zhou, J., Paton, N. I., Ditangco, R., Chen, Y-MA., Kamarulzaman, A., Kumarasamy, N., et al. (2007). Experience with the use of a first-line regimen of stavudine, lamivudine and nevirapine in patients in the TREAT Asia HIV Observational Database. *HIV Medicine*, 8 (1), 8-16.

Zulkifli, S. N., Huang, S. L. M., Wah Yun, L., & Yut Lin, W. (2007). *Impact of HIV on people living with HIV, their families and community in Malaysia*. Kuala Lumpur: The United Nation Country Team, Malaysia.