



PUBLIC HEALTH-NUTRITION INTERVENTION PROGRAMME TO ATTENUATE THE PROGRESSION OF HIV TO AIDS AMONG PEOPLE LIVING WITH HIV (PLWH) IN ABUJA, NIGERIA: A CONCEPTUAL FRAMEWORK

**Abraham Mainaji Amlogu^{*1, 2},
Kate Godden¹ and Ihab Tewfik¹**

University of Westminster, UK

Sundus Tewfik³,

London Metropolitan University, UK

Charles Wambebe⁴

Ahmadu Bello University, Nigeria



Abstract

Purpose: This presented pilot intervention provides evidence that suggests the use of local resources as therapeutic nutrition. The latter can act as a fundamental part of the comprehensive package of care at the country level.

Background: HIV/AIDS is a pandemic disease and its scourge has had a devastating impact on health, nutrition, food security and overall socio-

¹ (corresponding author*): Dr Abraham Mainaji Amlogu, School of Life Sciences, University of Westminster, 115 New Cavendish Street, London W1W 6UW, UK, Email: amloguab@yahoo.com and abraham.amlogu@my.westminster.ac.uk

² State House Medical Centre, P.M.B 316, Aso Rock, Abuja, NIGERIA

³ School of Human Sciences, Faculty of Life Sciences, London Metropolitan University, 8 Moorgate, London EC2M 6SQ, UK

economic development in affected countries. Since 2007, sub-Saharan Africa (SSA) has remained the region most heavily affected by HIV/AIDS across the world, accounting for 67% of all people living with HIV and for 75% of AIDS deaths. HIV infection increases energy requirements through increases in resting energy expenditure (12% higher), while reduced food intake, nutrient mal-absorption, negative nitrogen balance and metabolic alterations exacerbate weight loss and wasting, perpetuating the cycle. Moreover, intervention programmes, which simply employ antiretroviral drugs, have been found to lack effectiveness, particularly when the patient is undernourished.

Design/methodology/approach: Local ingredients, which were known for their availability, accessibility and micro- and macronutrient strengths were selected and optimised into a nutritional functional meal (*Amtewa*). Daily consumption was ascertained to assess its effects on nutritional intake and biomedical indices of the study participants (N=100) who were/were not taking anti-retroviral drug therapy (ART).

Findings: Mean CD4 count for ART-Test group at baseline and sixth months increased by 40.8cells/mm³ while the ART-Control group decreased by 18.12cells/mm³. These positive outcomes would qualify the *Amtewa* meal for the next phase of intervention (400 participants) to ascertain its effectiveness on the health status of HIV infected subjects and appraise its position within the National Health Services framework as an innovative approach to attenuate the progression of HIV to AIDS in Nigeria.

Originality/value: The *Amtewa*-based approach in HIV management is innovative, culturally relevant, reliable and requires low technology in order to assure compliance, sustainability and cost effectiveness.

Key words: HIV, AIDS, Public Health Nutrition Intervention, CD4, Micro/macronutrients, ART, Nutritional Functional Meal

Paper type: Research paper

INTRODUCTION

Background to the study

HIV/AIDS is a pandemic disease and its impact is worsened by the presence of other conditions such as under-nutrition and opportunistic infections (Anabwani and Nazario, 2005). Sub-Saharan Africa (SSA) remains the region most heavily affected by HIV/AIDS, accounting for

67% of all people living with HIV and for 75% of AIDS deaths in 2007 (USAID, 2004; UNAIDS, 2008).

HIV/AIDS and under-nutrition form a symbiotic relationship and one increases the prevalence and severity of the other (Bijlsma, 2000; Yale University, 2007). Moreover, intervention programmes, which simply employ antiretroviral drugs, have been found to lack effectiveness, particularly when the patient is undernourished (FAO/WHO, 2002; Yale University, 2007).

Micronutrient deficiencies significantly contribute to HIV progression to AIDS; deficiencies of essential vitamins (A, B-complex, C and E) and minerals (selenium and zinc), are common in People Living with HIV (PLWH) and these micronutrients are required by the immune system to combat infection (WHO, 2005; Barry, *et al.*, 2007). Furthermore, deficiencies of antioxidants (vitamins and minerals) contribute to oxidative stress, a condition that may accelerate immune cell damage and increase the rate of HIV replication (USAIDS, 2004; Piwoz *et al.*, 2004; Paul *et al.*, 2007).

The effects of under-nutrition on the immune system are well documented and include decreases in CD4 T cells (*cells that produce a specific immunity to a particular antigen*), suppression of delayed hypersensitivity, and abnormal B-cell responses (USAIDS, 2004; Paul *et al.*, 2007). Interestingly, the immune suppression caused by protein-energy malnutrition mechanisms is similar in many ways to the effects of HIV infection (FANTA, 2004; USAIDS, 2004).

An earlier review by Piwoz and Preble (2000; WHO, 2009) examined preliminary evidence that improving nutrition status may improve some HIV-related outcomes. HIV infection increases energy requirements through increases in resting energy expenditure (FAO/WHO, 2002; Piwoz, 2004), reduced food intake, nutrient mal-absorption, negative nitrogen balance and metabolic alterations that lead to weight loss and wasting. Asymptomatic HIV-positive individuals need 10% more energy (per day) than HIV-negative individuals of the same age and sex. The energy needs of symptomatic individuals are 20 to 30% (per day) above normal (Piwoz, 2004; FANTA, 2004). Few published reliable studies highlight the use of macro and specific micronutrients in the intervention and management of HIV/AIDS in Nigeria (Piwoz, 2004; Amuna *et al.*, 2004; Zotor and Amuna, 2008).

SCALE OF THE PROBLEM AND EPIDEMIOLOGY OF THE DISEASE

The HIV epidemic has repeatedly defied predictions derived from epidemiological modelling (UNAIDS, 2008). The dimensions of the epidemic remain staggering. UNAIDS reported that in 2007 alone, worldwide, an average of 33 million [30–36 million] people were living with HIV, 2.7 million [2.2–3.2 million] people became infected with the virus, and 2 million [1.8–2.3 million] people died of HIV-related causes. In addition, in 2007, the estimated number of new HIV infections was 2.5 times higher than the increase in the number of people on antiretroviral drugs in that year, underscoring the need for substantially greater success in preventing new HIV infections (UNAIDS, 2008).

Public health-
nutrition
intervention
programme to
attenuate the
progression

86

PREVALENCE AND INCIDENCE AT NATIONAL LEVEL IN NIGERIA

The first case of HIV/AIDS in Nigeria was reported in 1986. Since then the number of people living with HIV or AIDS (PLWHA) steadily increased and the epidemic moved into a “generalized” state with an increase in seroprevalence from 1.8% in 1991 to 5.8% in 2001 (FMOH, 2007). A slight drop to 5.0% was recorded in 2003, which was sustained in 2005 with a seroprevalence rate of 4.4%. According to a UNAIDS Report in 2009, the HIV prevalence in Nigeria was 3.1% in 2007. Nigeria ranks third most affected by HIV/AIDS globally after South Africa and India. Nigeria is among the 15 focus countries, which collectively represent 50% of HIV infections worldwide. Although the HIV prevalence of approximately 3.1% (UNAIDS, 2004, 2008 and 2010) appears relatively low compared with other countries in sub-Saharan Africa, it nevertheless translates into about 2.6 million people infected with HIV in Nigeria. Out of these, approximately 750,000 require antiretroviral treatment and this number is expected to double in the next 5 years. In 2007, it was estimated that 200,000 people were receiving antiretroviral therapy (ART) from various providers in the country, representing about 27% of all the people who need the treatment. Between 2005 and 2009, the AIDS-related deaths fell from 220,000 to 170,000 while those orphaned as a result rose from 930,000 in 2005 to 1.2 million orphans in 2009. Estimates also show a cumulative death of 1.45 million people (FMOH, 2007).

HIV/AIDS, malaria and tuberculosis, along with other infectious diseases, still predominate in Nigeria and will do so for the foreseeable future (Tewfik *et al.*, 2010).

The high burden of the disease with its associated morbidity and mortality despite the concerted efforts of the Federal Government of Nigeria and its international and local partners to combat it, continues to constitute a major public health concern for the country (FMOH, 2007).

The epidemic has further weakened and threatened to overwhelm the Nigerian health care system, increased the number of orphans and increased the cost of achieving set developmental goals by decreasing the size of the workforce, affecting as it does, mainly adults in their most productive years of life (15–60 years). The high manpower-intensive sectors of the economy are most affected; in Nigeria this includes the agricultural, educational and health sectors as well as the rural economy. In summary, the impact of HIV/AIDS on Nigeria's social fabric and on its economic development and well-being is pervasive and, unless controlled, will continue to undermine the quality of life of Nigerians (FMOH, 2007).

CURRENT INTERVENTION PROGRAMMES AT INTERNATIONAL LEVEL

The 2009 epidemic update revealed slow but steady progress on averting HIV-related deaths, disease progression and new HIV infections—progress that resulted from expanded access to antiretroviral therapy, antiretroviral prophylaxis, and safe infant-feeding interventions (WHO, 2010).

The revised recommendation for antiretroviral therapy (ART) will include an earlier start to treatment for all HIV-infected individuals with a CD4-cell count of 350/mm³ or less and those with advanced HIV clinical disease, active tuberculosis, or active chronic hepatitis B irrespective of CD4-cell count. They are based on evidence of both the individual and public health benefits of starting treatment earlier (WHO, 2010). However, WHO recommends that nutritional care and support with macro/micronutrients must be started at the early stages of the infection in order to prevent weight loss and malnutrition (Piwoz and Preble, 2000; WHO, 2009).

CURRENT INTERVENTION PROGRAMMES IN NIGERIA

In response to the challenge of reversal in the gains in development and life expectancy and the fact that approximately 750,000 PLWHA were estimated to be in need of ARV treatment (FMOH, 2007), the Federal Government of Nigeria, as part of its care and support strategies, initiated the National Antiretroviral Drug Access Programme in 2002 in 25 sites across the country. The goal was to provide access to affordable antiretroviral (ARV) drugs thereby improving the health and quality of life of PLWHA in Nigeria in order for them to meaningfully contribute to the sustainable development of the Nation.

Furthermore, the Nigerian government, fully committed to increasing access to treatment, developed a scale-up plan targeting treatment for 1 million PLWHAs by 2009 and universal access by 2010. Appreciable progress has been made and there are over 200 ART sites nationwide, supported by funds provided by the Global Fund to fight AIDS, Tuberculosis and Malaria (GFATM), the World Bank and the US President's Emergency Plan for AIDS Relief (PEPFAR). In addition, faith-based and private organizations are also providing services.

JUSTIFICATION AND RATIONALE OF THE NEED FOR A PUBLIC HEALTH NUTRITION INTERVENTION PROGRAMME IN NIGERIA

The HIV/AIDS scourge has had a devastating impact on health, nutrition, food security and overall socioeconomic development in countries that have been greatly affected by the disease. There is an urgent need for renewed focus on and use of resources for nutrition as a fundamental part of the comprehensive package of care at the country level.

Action and investment to improve the nutrition of PLWHA should be based on sound scientific evidence, local resources, and programmatic and clinical experience with the prevention, treatment, and management of the disease and related infections. Although there are gaps in scientific knowledge, much can and should be done to improve the health, nutrition and quality of care for PLWHA and their families and communities.

In West Africa, there are many macronutrients in commonly available food sources which may contain antioxidants and

Public health-
nutrition
intervention
programme to
attenuate the
progression

88

relevant essential vitamins and minerals. Such food sources need to be appropriately analyzed *vis-à-vis* their potential for use in the management of HIV/AIDS.

ARVs have been shown to reverse under-nutrition in HIV/AIDS but are usually used at the later stages of the disease when the patients are moribund (Boon *et al.*, 2006; Kumar and Clark, 2005). Thus, presently, 75% of Nigerians infected with HIV do not require ART, but nutritional assistance to maintain the immune system, sustain healthy levels of physical activity and for optimal quality of life. Incidentally, virtually all the HIV/AIDS programmes and interventions at the moment focus on the remaining 25% of HIV-infected subjects in Nigeria. The implication of the reality on the ground is that all the interventions at the moment are grossly unable to cope with the treatment of those who require ARVs urgently.

ORIGINALITY OF THE PROPOSED CONCEPTUAL FRAMEWORK TO INTERVENE TO ATTENUATE HIV PROGRESSION TO AIDS

Development of “HIVmeal”

Under-nutrition and micronutrient deficiency remain significant contributors to morbidity and mortality in developing countries (Amuna *et al.*, 2004; FAO/WHO, 2002) and in economic terms, remain a major challenge. Food-based approaches need to be innovative, culturally relevant, reliable and requiring low-tech approaches in order to assure compliance, sustainability and cost-effectiveness. It is possible to improve the nutritive value of local foods through simple but scientific combinations of food ingredients in the form of food multimixes (FMM). A FMM may be defined as a blend of locally available, affordable, culturally acceptable and commonly consumed foodstuffs mixed proportionately, drawing on the “nutrient strengths” of each component of the mix in order to optimize the nutritive value of the end product without the need for fortification (Amuna *et al.*, 2004).

HYPOTHESIS OF THE CONCEPTUAL FRAMEWORK

Selected micro and macronutrients can delay the progression of HIV to AIDS by improving the CD4 counts and reducing the viral load in People Living with HIV with a CD4 count above 200/mm³.

STUDY DESIGN AND METHODOLOGY

Description of study setting

The setting of the study will be the State House Medical Centre (SHMC), Abuja, Nigeria. The SHMC is a secondary health institution recognized by the Federal Government of Nigeria for the care and management of PLWH. Presently, the institution is involved in intervention programmes such as Voluntary Counselling and Testing (VCT), Prevention of Mother to Child Transmission of HIV (PMTCT), Paediatric Antiretroviral Treatment and Adult Antiretroviral Treatment.

Laboratory analysis of macronutrients will be carried out in London at the University of Westminster and micronutrient analysis will take place at London Metropolitan University. CD4 count, viral load assessments and clinical trials will be undertaken at the Department of Laboratory Medicine, State House Medical Centre Abuja (SHMCA) Nigeria, one of the centres in Nigeria recognized for the care and management of HIV/AIDS patients.

Target population

Recruitment of study participants will be done by the researcher while the sample collection, CD4 count, viral load assessment and other laboratory investigations will be performed by a trained laboratory scientist in SHMCA. The analysis of micro and macronutrients as well as optimization of the HIVmeal will be carried out by the researcher in London.

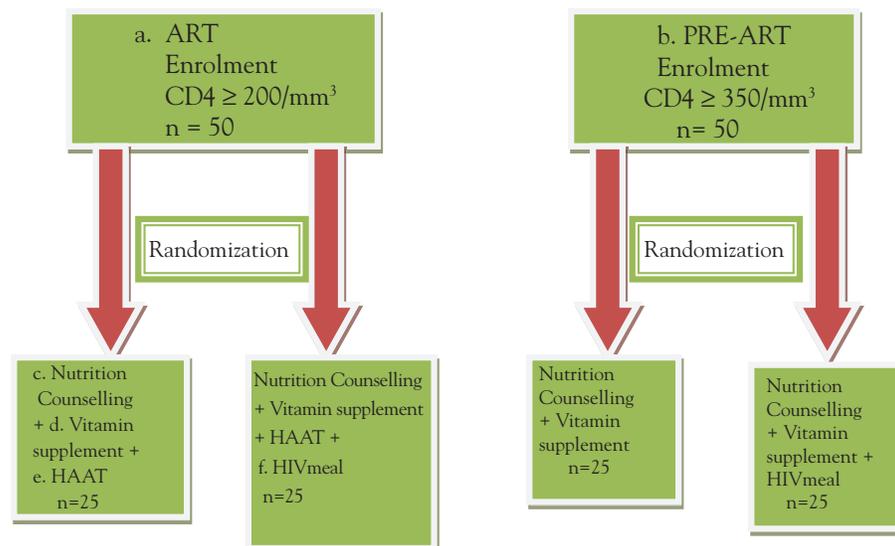
Eligible PLWH will be recruited and given the right to decline participation without jeopardizing their receipt of care at the State House Medical Centre, Abuja. Before intervention, a consent form will be signed and a project information sheet will be given and explained to all participants.

Once enrolled, participants will be subjected to an interview questionnaire, which includes the following variables: *demographic information, specific questions on lifestyle, health habits and nutritional practices*. Furthermore, participants shall be grouped into four groups according to the study design. Nutrition counselling, Highly Active Antiretroviral Therapy (*provided as standard mode of treatment for PLWH by the State House Medical Centre*), vitamin supplements and specific

micro- and macronutrient combinations will be administered to the groups' accordingly.

At the onset of the research, one hundred (100) participants will be recruited for the pilot study. Thereafter, a larger scale intervention that will recruit two hundred (200) participants will follow to determine the impact of the research study on a larger population. The justification of the sample size for the pilot study is based on the 95% confidence interval and a precision limit of 0.05 for the study.

Step 1



Step 2. Assessment of all the groups at month zero (0) i.e. the beginning of the study

Step 3. Re-assessment of all the groups at three (3) months and six (6) months.

Step 4. Comparison of results obtained.

a. ART (Anti-Retroviral Therapy) enrolment: People Living With HIV (PLWH) who are on HAART with a CD4 count value of $\geq 200/\text{mm}^3$ according to WHO classification and HIV treatment guidelines in Nigeria. These patients are HIV patients but not full-blown AIDS patients

b. Pre-ART enrolment: People Living With HIV (PLWH) but not on HAART yet because their CD4 count value is $\geq 350/\text{mm}^3$ according to WHO classification and HIV treatment guidelines in Nigeria

Figure 1. Design (pilot)

-
- c. Nutrition Counselling is provided as a routine service to People Living With HIV/AIDS (PLWH) receiving care at the SHMCA
 - d. Vitamin supplements are provided, prescribed and dispensed at a dose of one capsule daily or one capsule twice daily to PLWH receiving care at the SHMCA. The composition of the vitamin supplement is vitamin A 3333 IU, vitamin B1 4.5mg, vitamin B2 5.1mg, vitamin B6 6mg, vitamin B12 6µg, vitamin C 180mg, vitamin D3 200 IU, vitamin E 10mg, biotin 0.3mg, pantothenic acid 21mg, folic acid 0.2mg, nicotinamide 57mg, calcium 50mg, magnesium 40mg, phosphorus 50mg, copper 0.4mg, iron 3.6mg, manganese 0.5mg, zinc 3mg, chromium 10µg
 - e. HAART (Highly Active Anti-Retroviral Therapy) are HIV medicines provided, prescribed and dispensed (according to the clinical status of the patient) to PLWH receiving treatment at SHMCA
 - f. HIVmeal is a combination of micro- and macro-nutrients, carefully selected from locally available food in Abuja, Nigeria, analyzed and formulated into a 100g pack for daily consumption by study participants. The composition of HIVmeal is soya beans (*Glycine max*), millet (*Pennisetum typhoides*), Guinea corn (*Sorghum*), rice (*Oryza sativa*), carrot (*Daucus carota*), Moringa leaves (*Moringa oleifera*) Efo (*Amaranthus hybridus*) bitter leaf (*Vernonia amygdalina*), ugu leaf (*Telfairia occidentalis*), and ewedu leaf (*Corchorus walcottii*)

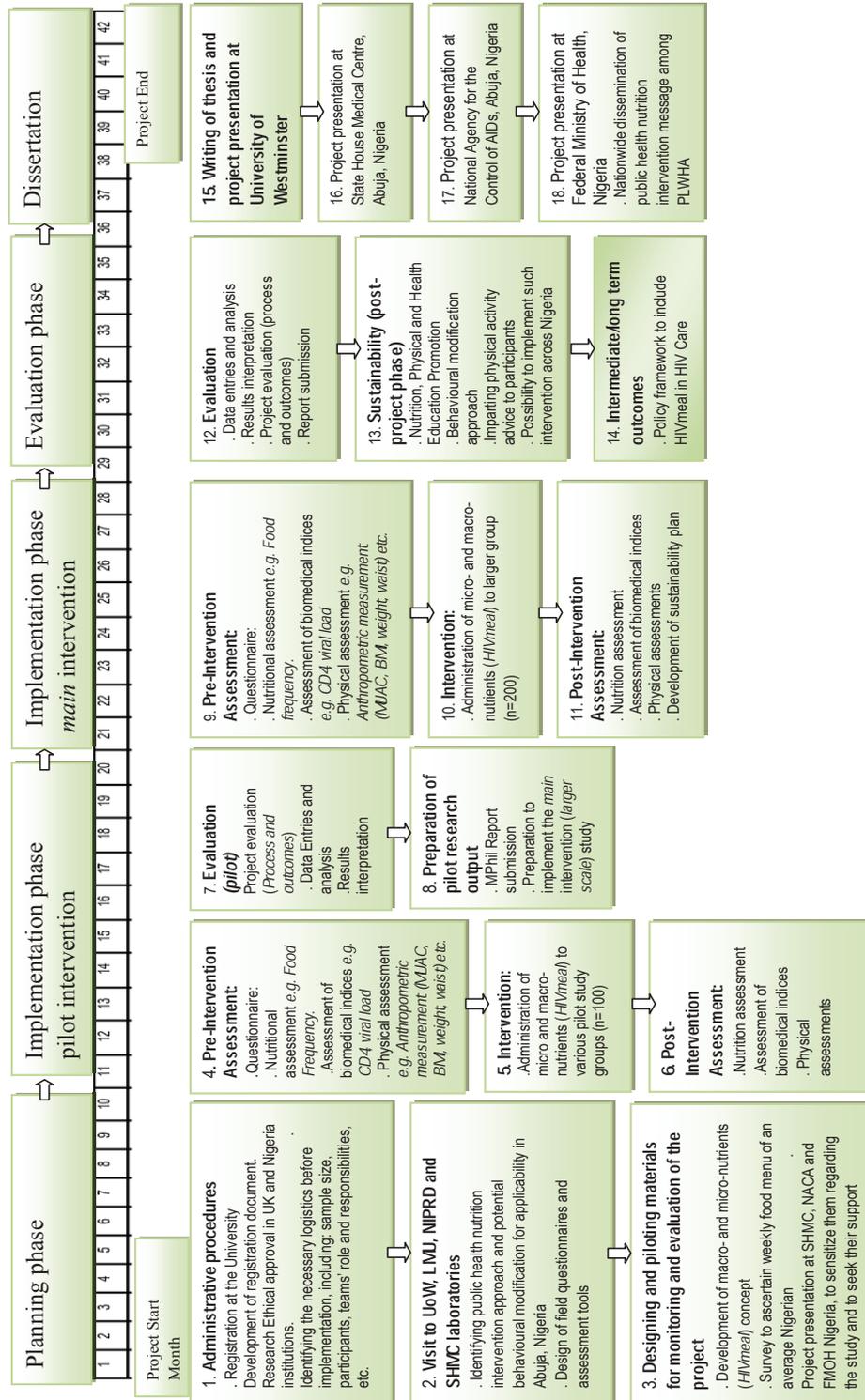
RESEARCH VARIABLES

Anthropometric measurements (*e.g. mid-upper arm circumference (MUAC), body mass index, skin fold measurement, waist circumference*), clinical investigations (*e.g. review of dietary history, dietary intake, blood pressure measurement*) and biomedical indices (*e.g. blood glucose level, lipid profile, CD4 count, viral load*) will be conducted at the commencement of the study, third and sixth months of the pilot and larger scale studies respectively.

EXPECTED OUTCOMES AND OUTPUTS

The outcome of the study will have a direct effect on 90% of HIV infected subjects in West Africa *vis-à-vis* slowing down/eliminating the progression of HIV to AIDS through Nutrition and HIV

Figure 2: Conceptual framework for public health nutrition intervention programme to attenuate the progression of HIV to AIDS among PLWH in Abuja, Nigeria. Total duration 42 months (October 2010– March 2014)



Integration and service delivery. The programme will lead from research to action (products).

REFERENCES

- Amuna, P., Zotor, F. and Tewfik, I. (2004), "Human and Economic Development in Africa: A Public Health Dimension employing the food multimix (FMM) concept", *World Review of Science, Technology and Sustainable Development*, WRSTSD, Vol. 1 No. 2, pp. 45-55.
- Anabwani, G. and Nazario, P. (2005), "Nutrition and HIV/AIDS in sub-Saharan Africa; an overview", *International Journal of Applied and Basic Nutritional Sciences*, Vol. 21, pp. 96-99.
- Barry, E., Johanna, R., Maria, M., Alex, G., Peter, J., Kevin, J., Jeffrey, M., Marianna, K., Gail, S., Jay, S., and Neil, S. (2007), "Suppression of Human Immunodeficiency Virus Type 1 Viral Load with Selenium Supplementation; A randomized controlled trial", *Archives of Internal Medicine*, Vol. 167 No. 2, pp. 148-154.
- Boon, N.A. and Walker, B.R. (2006), *Davidson's Principle and Practice of Medicines*, 20th ed., Elsevier, USA.
- Bijlsma, M. (2000), *Nutritional Care and Support for People with HIV, Review of Literature, Initiatives and Educational Materials in Sub-Saharan Africa and Recommendations For Developing National Programmes*, Report to FAO. p. 2.
- DoH, (2005), *Research Governance Framework for Health and Social Care*, Second Department of Health, Copyright holder: Crown 4747, 55.
- FANTA, (2004), *HIV/AIDS: A Guide for Nutritional Care and Support*, 2nd ed., Food and Nutrition Technical Assistance Project, Academy for Educational Development, Washington DC.
- <http://www.fantaproject.org/publications/HIVguide.shtml>
- FAO/WHO. (2002), *Living well with HIV/AIDS – A manual on nutritional care and support for people living with HIV/AIDS*, Food and Agriculture Organization Rome.
- <http://www.fao.org/DOCREP/005/Y4168E/Y4168E00.htm>
- Federal Ministry of Health (FMOH), (2007), *National Action Plan for Delivery of HIV/AIDS Palliative Care Services in Nigeria*, 2008–2009.

Kumar, P. and Clark, M. (2005), *Clinical Medicines*, 6th ed., UK, USA; Elsevier Saunders, USA.

Paul, K.D., Roland, K., Ferdinand, M. and Wafaie, W.F. (2007), "Micronutrients in HIV-positive persons receiving highly active antiretroviral therapy", *The American Journal of Clinical Nutrition*, Vol. 85 No. 2, pp. 333-345.

Piwoz, E. and Preble, E. (2000), *HIV/AIDS and Nutrition: A review of the literature and recommendations for Nutritional care and support in sub-Saharan Africa*, US Agency for International Development.

Piwoz, E. (2004), "Nutrition and HIV/AIDS: Evidence, Gaps and Priority actions. The Support for Analysis and Research in Africa (SARA) project, *Academy for Education Development*, Washington DC, Vol. 49, pp. 190-195.

Tewfik, I., Bener, A. and Tewfik, S. (2010), "Is Africa facing a nutritional transition under the double burden of disease?" *World Association for Sustainable Development (WASD)* Vol. 1, pp. 160-171.

UNAIDS, (2008), *Report on the global Aids epidemic*.

<http://www.unaids.org/globalreport/2008>. (Accessed November, 2009).

UNAIDS, (2010), *Report on the global Aids epidemic*.

<http://www.unaids.org/globalreport/>. (Accessed December, 2010).

USAID, (2004), *Nutrition and HIV/AIDS; Evidence, Gaps and Priority Actions*.

http://www.fantaproject.org/downloads/.../SARA_Nutrition&HIV (Accessed October, 2009).

WHO, (1988), *Complementary feeding of young children in developing countries: a review of current scientific knowledge*, World Health Organization, Geneva.

http://www.who.int/nutrition/publications/infantfeeding/WHO_NUT_98.1/en/

WHO, (2005), *Executive summary of a scientific review. Consultation on nutrition and HIV/AIDS in Africa. Evidence, lessons and recommendations for action*, Durban, South Africa, 10–13 April 2005, World Health Organization, Geneva.

WHO, (2009), *Nutritional care and support for people living with HIV/AIDS: A training course*, World Health Organization, Geneva.

<http://www.who.int/nutrition/publication/hiv aids>. (Accessed December, 2010).

WHO, (2010), "New WHO HIV treatment and prevention guidelines", www.thelancet.com Vol 375 march 13, (Accessed July, 2010).

Yale University, (2007), *A New Approach to Breaking the HIV/AIDS Malnutrition Cycle*, Nutritional Support Community Gardens, Biointensive Agriculture and Solar Technology, Yale University, USA.

Zotor, F.B. and Amuna, P. (2008), "The food multimix concept: new innovative approach to meeting nutritional challenges in sub-Saharan Africa", *Proceedings of the Nutrition Society*, Vol. 67, pp. 98-104.

ABOUT THE AUTHORS

Dr Abraham Amlogu is a Consultant Clinical Pharmacist at the State House Medical Centre, Aso Rock, Abuja, Nigeria and a PhD Public Health Nutrition research student in the Department of Human and Health Sciences, University of Westminster, London. He holds a Bachelor of Pharmacy degree, Master's degree in Public Administration and a Doctor of Pharmacy degree. He is a Fellow of the West African Postgraduate College of Pharmacists, a Fellow of Hachioji Pharmaceutical Centre, Japan and a Fellow of the Royal Society of Tropical Medicine and Hygiene, London. His field of research interest is monitoring the clinical use of pharmaceutical and nutraceutical agents against HIV/AIDS, malaria and other infectious diseases. His current research is "assessing the effectiveness of public health nutrition intervention programme to attenuate the progression of HIV to AIDS among people living with HIV in Abuja, Nigeria".

Kate Godden is a lecturer in the School of Life Sciences, University of Westminster. She is also a food security and nutrition adviser who has specialized in the humanitarian and development sectors since 1990. Her primary focus is on under-nutrition. She has an MSc from the London School of Hygiene & Tropical Medicine, and is registered with the UK Nutrition Society as a Public Health Nutritionist. Her teaching inputs are to the postgraduate programme running modules in Food Security, and Nutrition and Programme Planning for the MSc in International Public Health Nutrition. Additionally, she leads an intensive stand-alone short course, and Nutrition in Emergencies. She has worked in the UK and in many other countries carrying out consultancy work for DfiD,

UN agencies and NGOs, largely conducting needs assessment, reviewing proposals and running independent evaluations.

Dr Ihab Tewfik is the Course Leader for BSc (Hons) Human Nutrition, Department of Human and Health Sciences, University of Westminster. Besides his biochemistry background, Ihab holds Master and Doctorate degrees in Public Health Nutrition from the University of Alexandria in addition to a PhD from London South Bank University. Ihab is a Registered Practitioner in Higher Education UK, as well as a Fellow of the Royal Society of Public Health (FRSPH). Dr Tewfik has carried out 11 research projects for UNICEF-UN in aspects of public health nutrition & food safety and has published a number of publications in refereed journals and international conferences. As a Registered Public Health Nutritionist at the Nutrition Society, Ihab has organized several international conferences, workshops, CPD and short training courses on nutrition-related diseases and Public Health. Ihab is member of the editorial advisory board of various international scientific journals.

Dr Sundus Tewfik is the course leader for herbal medicinal sciences at the Faculty of Life Sciences, School of Human Sciences, London Metropolitan University. As a pharmaceutical scientist, she lectures on conventional and herbal pharmacology. She is qualified as a Biologist. Sundus holds a Master's degree in Applied Microbiology and a PhD in Pharmacognosy from the University of Westminster. She is a registered biomedical scientist at the Health Professional Council (HPC), UK, a fellow of the Institute of Biomedical Science, and a chartered scientist at the Science Council, UK. Sundus has carried out numerous research projects on various aspects of herbal medicine, including biochemical analyses, antimicrobial testing, isolation/identification of biologically active components and quality control of herbal products and botanical supplements. Sundus' current research interests include the use of phytochemicals in the human nutrition domain, focusing on how functional foods and nutraceuticals influence health outcomes and health risks to individuals and communities.

Professor Charles Wambebe is a Professor of Pharmacology and presently the Chair of Product Research and Development for Africa. He is also the President of International Biomedical Research for Africa. Professor Wambebe pioneered the research and development of the first Nigerian HIV-1 candidate vaccine (1999–2002), involving collaboration with the Centers for Disease Control and Prevention, Atlanta and the Institute

of Human Virology, Baltimore. He also pioneered the research and development of the plant extract (CONAVIL) for the management of HIV/AIDS. Pilot clinical trials have been undertaken with promising data (1999–2002). A controlled comparative clinical trial has been planned and is awaiting funding. He developed the Draft Nigerian National HIV Vaccine Plan with support from UNAIDS/ Geneva, 2000. Professor Wambebe is a consultant to the World Health Organization (WHO) and one amongst his numerous awards is the International Directory of Distinguished Leadership, First Edition, 1986, the American Biographical Institute, Raleigh, North Caroline, US.

**Public health-
nutrition
intervention
programme to
attenuate the
progression**

98
