

Health Reform Foundation of Nigeria (HERFON)

**Noncommunicable Diseases
in Nigeria: The Coming Epidemics**

**Nigerian Health
Review
2010**

EDITED BY

Akinkugbe O.O., Lucas A.O., Onyemelukwe G.C., Yahaya H., and Saka M.J.

Non-communicable Diseases in Nigeria: The Coming Epidemics

Nigerian Health Review 2010

Edited by
**Akinkugbe O.O., Lucas A.O., Onyemelukwe G.C., Yahaya H.,
and Saka M.J.**

Health Reform Foundation of Nigeria (HERFON)



HEALTH REFORM FOUNDATION OF NIGERIA

60, Lobito Crescent, (Opp. Visafone),
Off Adetokunbo Ademola Crescent, Wuse II, Abuja.
Tel: +234-9-5240433, 4618496, 803 347 2900, 803 306 7883, Fax: +234-9-52040433
Email: info@herfon.org. Website: www.herfon.org, www.ngnhc.org

November 18, 2011

Dr. Aishat S. Oluwatoyin
Gastroenterology/Nutritional Unit
Department of Paediatrics and Child Health
University of Ilorin Teaching Hospital
Ilorin, Kwara State.

Dear Ma,

NIGERIA HEALTH REVIEW (NHR) 2010: FORWARDING OF COMPLIMENTARY COPY AND APPRECIATION

On behalf of the Board of Trustees, Management and Members of Health Reform Foundation of Nigeria (HERFON), we write to thank you immensely for your contribution towards the publication of the Nigeria Health Review 2010.

The public presentation of the Nigeria Health Review (NHR) 2010 titled; **Non-Communicable Diseases in Nigeria: "The Emerging Epidemics"** was held on Thursday, October 13, 2011 at NICON Luxury Hotel, Abuja under the Chairmanship of Mr. Foluso Philips, Chairman of Nigeria Economic Summit Group (NESG).

As a contributing author, we hereby forward to you a **complimentary copy**.

Please accept the assurances of our highest regards.

Mr. John C. Igboka
Ag. Executive Secretary

...Better Health for All Nigerians

BOT Members: Dr. Benjamin Anyene (Chairman), Prof. Joseph Oluwasanmi, Dr. Daniel Gana, Dr. Shehu Sule,
Dr. Ede Idia, Dr. Chidi Maruma, Dr. Halima Yalwa Adamu, Hajia Maimuna M. Bala, Sam Nda

HERFON Board Of Trustees

1. HRH Dr. Haliru Yahaya (Chairman)
2. Dr. Oladipo Ladi Awosika
3. Ambassador Mustafa Sam
4. Hajia Bilkisu Yusuf
5. Dr. Loal Dare
6. Dr Sheu Sule
7. Dr. Sani Wali Sulieman
8. Prof. (Mrs) Dora Akunyili
9. Prof. Joseph Oluwasanmi
10. Dr. Ben Anyene
11. Dr. Daniel Gana
12. Chief Dr. (Mrs.) Monica Iyomobe Okun (JP)
13. Mr. John Igboka (Ag. Secretary)

Review Advisory Committee

1. Prof. Adetokunbo Lucas
Chairman (RAC)
Adjunct Professor
Harvard School of Public Health
2. Prof. Akinkugbe O.O.
Co-Chairman (RAC)
Ibadan Hypertension Centre
Iyaganku Reservation Area, GRA
Ibadan, Nigeria
3. Dr. A. G. Abdulrahman
Technical Editor
Dept. of Surgery
University of Ilorin Teaching Hospital
Ilorin, Kwara State
4. Prof. A.F. Biola Mabadeje
c/o Dept. of Pharmacology & Medicine
College of Medicine University of Lagos
Idiaraba, Lagos
5. Prof. C.U. Abengowe
National Hospital
Central Area, Abuja
6. Prof. G.C. Oyemelukwe
Dept. of Medicine Immunology
Ahmadu Bello University
Teaching Hospital, Zaria
Kaduna State
7. Dr. Aderonke Olumide
Dept. of Community Medicine,
College of Medicine,
University of Ibadan
8. Prof. O.K. Alausa
Deputy Vice Chancellor Academic
Olabisi Onabanjo University,
Ago Iwoye, Ogun State
9. Prof. Christopher N. Obionu
Dept. of Community Medicine,
University of Nigeria Teaching Hospital, Enugu
10. Dr. Ibrahim Taofeeq
Department of Community Medicine,
Usman Danfodiyo University, Sokoto
11. Dr. Nnebe Agumadu (Nee Omaliu)
Department of Pediatric
University of Abuja, Nigeria
12. Dr. Ibrahim Oloriegbe
Former Executive Secretary (HERFON)
Abuja, Nigeria
13. Dr. Issa Baba
Department of Behavioral Science
University of Ilorin
14. Jane Miller
Senior Health Advisor
DfID Nigeria
15. Dr Anibuze
Director of Public Health
Federal Ministry of Health
16. Dr Francis T. Aminu
Country Coordinator/National Program Manager
Micronutrient Initiative
Abuja, Nigeria
17. Dr Saka Mohammed Jimoh
Editorial Adviser & Secretary to the RAC
Health Reform Foundation of Nigeria

Table of Contents

Foreword.....	vii
Acknowledgments.....	viii
HERFON Board Of Trustees.....	ix
Review Advisory Committee.....	ix
Reviewers.....	x
Contributing Authors.....	x
Chapter 1	Overview: Review of Chronic, Non-Communicable Diseases in Nigeria..... 1
Chapter 2	Life Expectancy and Economic Perspectives of Non-Communicable Diseases..... 15
Chapter 3	Life Style: Alcohol and Drug Abuse, Smoking, Stress and Unhealthy Dietary Habits..... 19
Chapter 4	Cardiovascular Disease In Nigeria: Hypertension, Ischaemia, Heart Disease..... 37
Chapter 5	Cerebrovascular Diseases (Stroke): Causes, Consequences, Prevention and Management..... 55
Chapter 6	Diabetes Mellitus: Epidemiology and Risk Factors in Nigeria..... 69
Chapter 7	Review of Cancer and Cancer Registration..... 87
Chapter 8	Prostate Cancer..... 105
Chapter 9	Female Breast Cancer..... 121
Chapter 10	Cancer of the Male Breast..... 127
Chapter 11	Sickle Cell Disorder..... 131
Chapter 12	Albinism..... 155
Chapter 13	Bronchial Asthma in Nigerian Children: Burden, Prevention and Treatment Options..... 175
Chapter 14	Chronic Kidney Disease: The Burden and Challenges of Management..... 187
Chapter 15	Mental Health Disorders: Dementia..... 197
Chapter 16	Mental Health Disorder: Suicide and Deliberate Self Harm..... 209
Chapter 17	Epilepsy..... 219
Chapter 18	Gender Based Violence: Violence Against Women..... 239
Chapter 19	Violence Against Men..... 249
Chapter 20	Malnutrition, Micronutrient Deficiencies And Non-communicable Diseases (NCD) In Nigeria..... 253
Chapter 21	Snake Bite in Nigeria..... 275
Chapter 22	Occupational Health Disorders: Economic Benefit of Prevention of Occupational Disorders in Nigeria 287
Chapter 23	Injuries, Trauma, and Road Traffic Crash..... 299

Reviewers

1. Prof. J.D Mabadeje
2. Prof. Lateef Salako
3. Dr. Aishat Abdulkareem
4. Dr A.B. Mankajuola
5. Dr S.B. Isiaka
6. Prof Anezi Okoro

Contributing Authors

1. Prof Adetokunbo Lucas
Chairman (RAC)
Adjunct Professor
Harvard School of Public Health
2. Prof. Akinkugbe O. O.
Co-Chairman (RAC)
Ibadan Hypertension Centre
Iyaganku Reservation Area GRA
Ibadan, Nigeria
3. Prof. Adewale Akinsola
Obafemi Awolowo University
O.A.U Ile-Ife, Osun State Nigeria
4. Prof. F.B. Abdul Kareem
Department of Morbid Anatomy
Lagos University Teaching Hospital
Idi-Araba, Surulere, Lagos, Nigeria
5. Prof. A.G. Falade
Department of Paediatric
University of Ibadan
6. Dr. A.Z. Aminu
Dept. of Pathology
Aminu Kano Teaching Hospital
Kano State, Nigeria
7. Prof. (Mrs) Y.M. Olumide
Dermatology Unit of the Department of Medicine
Lagos University Teaching Hospital
Idi-Araba, Lagos State
8. Prof. J.D. Adeniyi
Dept. of Preventive & Social Medicine
College of Medicine
University of Ibadan
9. Prof. E.O. Ojofehintimi
Dept. of Community Health
College of Health Sciences
Obafemi Awolowo University
Ile-Ife Osun State
10. Dr. Folasahde O. Omokhodion
Occupational Health Unit
Dept. of Community Health
University College Hospital, Ibadan
Oyo State, Nigeria
11. Prof. Margaret O. Araoye
College of Health Sciences
Benue State University, Markudi
12. Dr. Abdul G. Habib
Dept. of Medicine Bayero University, Kano
Aminu Kano Teaching Hospital
Kano State, Nigeria
13. Prof. Olufemi Akinyanju
Sickle Cell Foundation of Nigeria
National Sickle Cell Centre
Opp. Lagos University Teaching Hospital
Ishaga Road, Idi-Araba
14. Dr. Aishat S. Oluwatoyin
Gastroenterology/Nutritional Unit
Department of Paediatrics and Child Health
University of Ilorin Teaching Hospital
Ilorin Kwara State
15. Prof. E. O. Olapade-Olaopa
Dept. of Surgery (Urology Division)
College of Medicine
University of Ibadan Nigeria
16. Prof. Ayo O. Ombebe
Dept. of Psychiatry
Usman Danfodiyo University Teaching Hospital
Sokoto State
17. Prof. Adesola Oguniyi
Neurology Unit Dept. of Medicine
University College Hospital, Ibadan
Ibadan, Oyo State

-
18. Prof. M.A. Danesi
Neurology Unit Department of Medicine
Lagos University Teaching Hospital
Idi-Araba, Lagos State
19. Dr. G. T. Adebule
Consultant Special Grade 1,
Department of Orthopaedics-Spine Unit,
National Orthopaedic Hospital,
W HO Collaborating Centre,
Igbobi, Lagos, Nigeria.
20. Prof. A.F. Biola Mabadeje
Dept. of Pharmacology & Medicine
College of Medicine University of Lagos
Idiaraba, Lagos
21. Prof. C.U. Abengowe
National Hospital
Central Area, Abuja
22. Prof. G.C. Oyemelukwe
Dept. of Medicine Immunology
Ahmadu Bello University Teaching Hospital, Zaria
Kaduna State
23. Dr. Aderonke Olumide
Dept. of Community Medicine,
College of Medicine, University of Ibadan
24. Prof. O.K Alausa
Deputy Vice Chancellor Academic
Olabisi Onabanjo University,
Ago Iwoye, Ogun State
25. Prof. Christopher N. Obionu
Dept. of Community Medicine,
University of Nigeria Teaching Hospital,
Enugu
26. Dr. Ibrahim Taofeeq
Department of Community Medicine,
Usman Danfodiyo University Sokoto
27. Dr. Nnebe Agumadu (Nee Omaliu)
Department of Pediatric
University of Abuja, Nigeria
28. Dr. Ibrahim Oloriegbe
Former Executive Secretary (HERFON)
Abuja, Nigeria
29. Jane Miller
Senior Health Advisor
DfID Nigeria
30. Dr Anibuze
Director of Public Health
Federal Ministry of Health
31. Dr. Francis T. Aminu
Country Coordinator/National Program Manager
Micronutrient Initiative
Abuja, Nigeria
32. Dr. Saka Mohammed Jimoh
Research and Technical Assistance Unit
Health Reform Foundation of Nigeria
No 60, Lobito Crescent,
Off Adetokunbo Ademola
Wuse II, Abuja

*"The emerging global epidemic of NCDs is closely associated with
changing dietary habits*

*We can see trends in reduced intake of fruit and vegetables, and
increased intake of fats (especially saturated fats) sugar and alcohol".*

Pekka Pusce, Director, Non-communicable Disease
Prevention and Health Promotion, WHO, Geneva (2002)

ABSTRACT

In the low-income societies like Nigeria, two facts of public health are becoming overwhelmingly apparent. The first is the incidence and prevalence of non-communicable diseases (NCDs), which has been accelerating rapidly throughout the world (not just in affluent, industrialised nations), with deaths from heart disease and cancer surpassing those from infections and under-nutrition. The second is the persistence of conditions of food insecurity, underweight, and micronutrient deficiency ('hidden hunger'). Consequently, the number of overweight people now rivals the numbers who are underweight such that an equal number of individuals in any settings suffer from under-nutrition and over-nutrition. There is a double burden of obesity on the one hand, and underweight on the other hand in developing countries including Nigeria. There is generally segregation in age and geographical demography, with the under-nutrition occurring among the young of the poor settings and over-nutrition among adults in affluent ones.

However, this traditional separation is by no means hermetic, as overweight rates continue to rise in developing societies in the face of widespread under-nutrition. These apparently paradoxical situations have been termed 'nutrition transition', a phase in societal development during which chronic diseases emerge and coexist with nutritional deficiency states. However, virtually all of the hungry, many of the overweight, and others of normal weight are debilitated by a deficiency of essential vitamins and minerals with important consequences for their health. A potential emerging public health issue may be the increasing incidence of obesity in developing countries and the resulting socioeconomic and public health burden faced by these countries. Therefore, resolving the apparent paradox invokes the multifaceted adversity of poverty, which influences one's capacity to access both the *quantity* and the *quality* of diet for optimal nutrition and health. The aforementioned formed the basis for the contribution of this chapter to the 2008 Nigeria Health Review.

INTRODUCTION

Globally, in the low-income societies like Nigeria, two facts of public health are becoming overwhelmingly apparent. The first is the incidence and prevalence of non-communicable diseases (NCDs), which has been accelerating rapidly throughout the world (not just in affluent, industrialized nations), with deaths from heart disease and cancer surpassing those from infections and under-nutrition. The second is the persistence of conditions of food insecurity, underweight, and micronutrient deficiency ('hidden hunger'). Consequently, the earth's population has moved into an interesting and historically unprecedented situation; an equal number of individuals (at least 1.1 billion) across the world suffered from under-nutrition (defined as a 2 standard deviation deficit in weight-for-age) and over-nutrition (defined as a body mass index (BMI) in excess of 25 kg/m²).¹ In other words, a double burden of obesity (suggesting over-nutrition) on the one hand, and underweight (suggesting under-nutrition) on the other hand is not uncommon in developing countries).²

The aforementioned have been attributed to the major technological and economic innovations in the last century, which have deeply influenced what and how people eat, with

important consequences for their health. While some of these impacts were positive, societies have largely failed to guard against the harm that some innovations in food production, distribution, and preparation have done to the nutrition and health of many people. Despite unprecedented wealth and surplus food stocks at all levels, malnutrition hunger, micronutrient deficiencies, or overeating spread more widely than at perhaps any time in history.

The potential emerging public health issue may be the increasing incidence of obesity and the resulting socioeconomic and public health burden faced by many people. Therefore, resolving the apparent paradox invokes the multifaceted adversity of poverty, which influences one's capacity to access both the *quantity* and the quality of diet for optimal nutrition and health. This chapter provides a systematic review of data from surveys on the prevalence, epidemiology and magnitude of the disease burden associated with under-nutrition (underweight/hunger), over-nutrition (overweight/obesity), and micronutrient deficiencies (with particular focus on iodine deficiency disorder-IDD) in Nigeria. The chapter also reviews the policy and programmatic options of addressing the problems while considering the health system and public health implications that form the basis for the recommendations at policy, research and institutional levels.

MALNUTRITION IN NIGERIA: PREVALENCE AND ASSOCIATED DISEASE BURDEN

Major technological and economic innovations in the last century have deeply influenced what and how people eat, with important consequences for their health. While some of these impacts were positive, societies have largely failed to guard against the harm that some innovations in food production, distribution, and preparation have done to the nutrition and health of many people. Despite unprecedented wealth and surplus food stocks at the global level, malnutrition hunger, micronutrient deficiencies, or overeating spread more widely than at perhaps any time in history. Worldwide, the number of overweight people now rivals the numbers who are underweight (Table 1).

Table 1: Types and Effects of Malnutrition, and Number Affected Globally

Type of Malnutrition ¹	Nutritional Effect	Number Affected Globally (billion)
Hunger (Under-nutrition)	Deficiency of protein and energy	~ 1.1
Micronutrient Deficiency	Deficiency of vitamins and minerals	2.0-3.5
Over-consumption (Over nutrition)	Excess of energy often accompanied by deficiency of vitamins and minerals	~ 1.1

Source: Gardner G. and Halwell B (2000)

¹Hunger and over-consumption correspond to underweight or overweight populations. There is considerable overlap between micronutrient deficiency and other forms of malnutrition

These three faces of malnutrition are taking different directions globally as trends in nutrition, and in the way the food system operates, are headed down troubling paths (Table 2).

It is recognised that there is generally segregation in age and geographical demography, with the under-nutrition occurring among the young of the low-socioeconomic populations and over-nutrition among adults in affluent societies. This traditional separation, however, is by no means hermetic, as overweight rates continue to rise in developing societies in the face of widespread under-nutrition. These apparently paradoxical situations have been termed 'nutrition transition', a phase in societal development during which chronic diseases emerge and coexist with nutritional deficiency states. However, virtually all of the hungry, many of the overweight, and others of normal weight are debilitated by a deficiency of essential vitamins and minerals with important

Table 2: Share of Children Who Are Underweight and Adults Who Are Overweight, Selected Countries, Mid-1990s

Country	Share Underweight (%)	Country	Share Overweight (%)
Bangladesh	56	United States	55
India	53	Russian Federation	54
Ethiopia	48	United Kingdom	51
Viet Nam	40	Germany	50
Nigeria	39	Colombia	41
Indonesia	34	Brazil	36

consequences for their health. However, virtually all of the hungry, many of the overweight, and others of normal weight are debilitated by a deficiency of essential vitamins and minerals.

Underweight or Under-nutrition

In Nigeria, the rates of under-nutrition are still unacceptably high: 42% of children under-five are stunted, 9% are wasted, and 35% are underweight (Figure 1). Stunting is associated with recurring or chronic illnesses and results when children fail to receive adequate nutrition over an extended period of time (NFCNS 2001). This unacceptably high protein-energy malnutrition rate is significantly higher, for example, than those of Ghana - 25%, Senegal - 22%, or South Africa - 9%.

On the other hand, malnutrition in all dimensions is common as 14.2% of women of childbearing age are overweight as compared with 11.6% underweight (Table 3) as ascribed to by other authors^{5,6}.

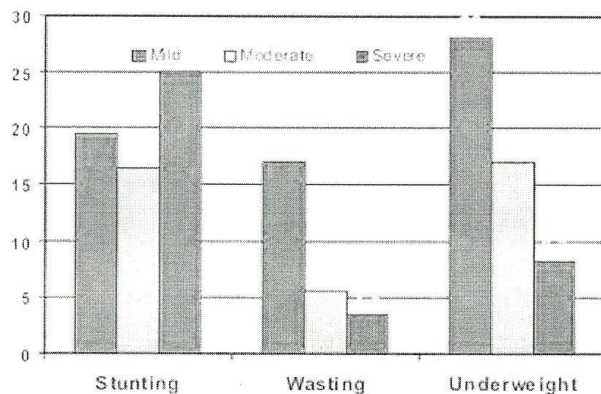
Apart from lack of food, poor breastfeeding and inadequate complementary feeding practices explain the progressive increase of under-nutrition levels in children, as they grow older. It is important therefore to emphasise that in Nigeria, child malnutrition starts very early in life. By the age of 24 to 36 months all the damage is done and there is little chance of recovery (Figure 2), which predispose to diabetes, strokes hypertension and heart attack later in life.

Everywhere, the age-old practice of breast-feeding is being replaced by more "modern" alternatives, even though breast milk is the best source of nutrition for infants and protects babies from some illnesses. From birth, poor breastfeeding practices are a major cause of neonatal and infant mortality. The World Health Organisation, UNICEF, and Nigeria's National Breastfeeding Policy recommend that infants be exclusively breastfed from birth to 6 months. Unfortunately, only 17% of infants under six months of age are exclusively breastfed in Nigeria⁷. This means that 83% of infants are given water, fluids, and/or foods before the age of six months. This harmful practice decreases breast-milk intake and exposes the infant to pathogens, a major cause of diarrhoeal diseases and mortality. The PROFILES analysis shows that 21 % of infant deaths are related to poor breastfeeding practices in Nigeria. This means that if no action is taken to protect, promote and support breastfeeding, over 100,000 Nigerian infants will die annually. This represents 275 infant deaths per day, every day, for the next ten years. According to Sebanjo and Adejuyigbe (2007), although there is no statistically significant relationship between exclusive breastfeeding for 6 months, duration of breastfeeding and the prevalence of overweight ($P = 0.569, 0.669$ respectively), the prevalence of overweight decreases with increase in the duration of breastfeeding.

At about six months of age, infants need to be fed adequate complementary foods. Locally available foods rich in energy, protein, iron, and vitamin A, and prepared in good hygienic conditions should be the base of complementary feeding. In our country most young children are fed complementary foods that are inadequate in quality and quantity. For example, two thirds of infants 6 to 9 months old are currently not fed small quantities of foods of animal origin like meat, fish, crayfish, poultry, or eggs, and therefore lack in their diets essential nutrients for their survival, growth, and development.

⁷PROFILES is a tool/software for nutrition policy analysis and communication that quantifies the magnitude of the consequences of malnutrition on key development sectors: health, education, and economy, developed by AED and adapted for Nigeria.

Fig 1: Under-Nutrition among Children Under 5 Years of Age in Nigeria



Another nutrition problem of public health significance is low birth weight (LBW). More than 20 million infants worldwide, representing 15.5 per cent of all births, are born with low birth weight, 95.6 per cent of them in developing countries (). According to UNICEF (2004), the level of low birth weight in developing countries (16.5 per cent) is more than double the level in developed regions (7 per cent). In Nigeria, the NDHS 2003 revealed that about 14% of children are low birth weight as reported by their mothers. Birth weight is a strong indicator not only of a birth mother's health and nutritional status but also a newborn's chances for survival, growth, long-term health and psychosocial development (). A low birth weight (less than 2,500 grams) raises grave health risks for children. This is based on epidemiological observations that infants weighing less than 2,500 g are approximately 20 times more likely to die than heavier babies. Those who survive have impaired immune function and increased risk of disease; they are likely to remain undernourished, with reduced muscle strength, throughout their lives, and to suffer a higher incidence of diabetes and heart disease.

Overweight or Over-nutrition

While hunger or under-nutrition has receded modestly, its opposite overeating is more prevalent today than ever. Indeed, WHO calls the swift spread of the condition of overweight and its extreme form, obesity, "one of the greatest neglected public health problems of our time" (). Weight gain in adulthood is now common in many populations, ranging from modest gains in developing countries

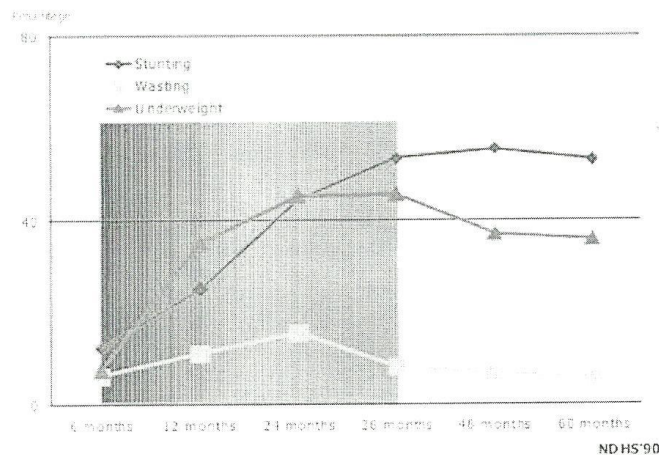
Table 3: Percentage Distribution of BMI of Women at National, Agro-ecological zone (AEZ) and Sector levels in Nigeria

Category/Level	BMI Classification (kg/m ²)			
	<18.5 (Underweight)	18.5-24.99 (Normal)	25.0-29.99 (Overweight)	>30.0 (Obese)
National	11.6	68.5	14.2	5.7
AEZ:				
Dry Savanna	16.4	67.7	11.6	4.3
Moist Savanna	9.9	67.1	16.4	6.6
Humid Forest	9.0	70.0	14.8	6.1
Sector:				
Rural	12.7	70.1	12.6	4.6
Medium	10.3	71.5	13.4	4.8
Urban	11.5	60.9	18.6	9.0

to a substantial percentage of body weight in some Western societies.

It seems natural to assume that being overweight or obese is strictly a developed-country or affluent problem, but this is not true. A 1999 United Nations study found obesity at measurable levels in all developing regions, and growing rapidly, even in countries where hunger persists (). In this regard, a potential emerging public health issue for developing countries may be the increasing incidence of childhood obesity () and, as a result, new cases of metabolic syndrome among children, which in turn is likely to create an enormous socioeconomic and public health burden for poorer nations in the near future ().

A large standardized study across the African Diaspora, called the International Comparative Study of Hypertension in Blacks found a dramatic increase in obesity with the westernisation of the cultures (). Prevalence increased from a very low figure in rural Nigeria to a high one in an urban black population sample in the city of Chicago, in the United States, but it was almost as high in Barbados, where there have been dramatic changes in lifestyle and socioeconomic status since the achievement of independence in 1966. The gradient in obesity in women (Nigeria



5%, urban Cameroon 13%, Jamaica 18%, Barbados 30%, Chicago 36%) was closely correlated with economic development and with the prevalence of hypertension ().

Among the adult in Nigeria, 14.2% of women of childbearing age are overweight while 5.7% are obese, although obesity is more prevalent in the urban (9%) than in the medium/semi-urban (4.8%) and rural sector (4.6%). Overall, the total percentage of women who are overweight is higher (19.9%) than that of women suffering from under-nutrition (). This condition has equally serious implications for the health of women and their newborns. While accurate economic data are difficult to obtain, it is also unlikely that average Nigerians have seen any substantial increase in their material standard of living over the last 2 decades. Thus, the lifestyle changes required to fuel weight gain do not require general economic development, and instead may reflect the penetration of market-based consumption patterns into stagnating or declining economies. These observations suggest that it is the character of social development, not necessarily the level of economic activity per se that is driving the combined obesity-diabetes epidemic in many poor and middle-income countries. Research on trends in nutrient intake, food preparation patterns, physical activity and other weight-modifying factors may help define the context within which these changes are taking place in Nigeria.

Micronutrient Deficiencies

The third malnourished population those with inadequate intakes of vitamins and minerals partially overlaps with both the hungry and the overfed. People may look healthy and their diets may provide adequate energy and proteins but lack vital nutrients that the body needs to grow and function properly. Low intake of micronutrients of public health significance iodine, vitamin A, and iron is of particular concern globally because it is so widespread. Also known as 'hidden hunger', are determining and aggravating factors for health status and quality of life. Despite their enormous consequences for economic growth and human development, these nutritional problems are often hidden and silent. The warning signs are not always recognised and the victims themselves are often not aware of the problem. Hence they are referred to as a "hidden hunger".

In Nigeria, the NCFNS 2003 showed that 29.5% of children under 5 were vitamin A deficient, with 4.7% suffering from severe vitamin A deficiency; while 13% of mothers and 19.2% of pregnant women were at risk of vitamin A deficiency.

Similarly, approximately 36.3% of children under 5 suffered some level of iron deficiency. While the majority of women of childbearing age had normal iron status, 43.8% of pregnant women in urban areas were iron deficient, compared to slightly more than 30% in both medium and rural areas. Approximately one out of every five children under 5 was zinc deficient, while about 28% of mothers and 43.7% of pregnant women zinc deficient.

Iodine deficiency is another issue of developmental importance. Overall, 13% of children under 5 had some level of iodine deficiency, although it can be as high as 26% in some parts of the country. It is important to note that 16.6% of children under 5 had more than adequate intake of iodine and 29.8% had possible excess. However, 13% of mothers and 10.5% of pregnant women were iodine deficient.

For the purpose of the contribution of iodine to metabolic syndrome associated with NCD, the following subsection will focus on a brief history of IDD and its control in Nigeria.

History of IDD and its Control in Nigeria

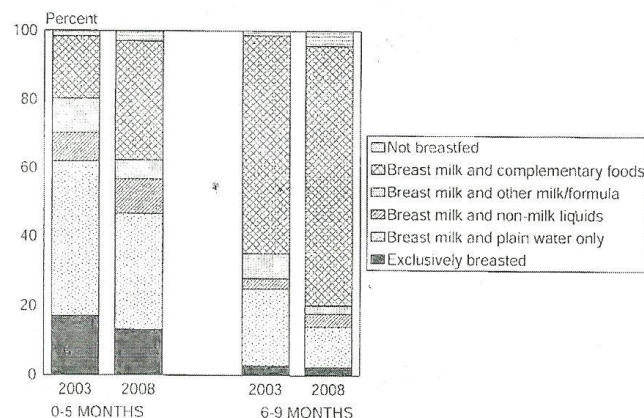
IDD was recognised as a public health problem in Nigeria since late '60s (), however, the Nigeria IDD control programme did not begin until 1993 as a follow-up to a survey which indicated an average total goitre rate (TGR) of 20% (). Although, this was a delayed response to the policy advice given by the Nigerian Medical Research Council from 1975 onwards and other survey reports (), something remarkable has happened since 1993. While total goitre rates in Africa as a whole climbed nearly 30% in the 1990s (), most evidence indicates TGR has cut in half. Surveys found populations affected by goitre prevalence in 10 states dropped from 40 million in 1990 to less than 11 million in 1999. An evaluation by Egbuta and Onyezili in 2002 comparing TGR in 10 identical local government areas (LGAs) indicated lowered prevalence, an average of 75% in most areas (table 4).

Stunting is associated with recurring or chronic illness including measles which precipitates malnutrition. Apart from lack of food, poor breastfeeding and inadequate complementary feeding practices are determinants of progressive increase of undernutrition. It is clear from fig. 2 that child malnutrition starts very early in life as confirmed by the World Health Organisation, UNICEF and Nigeria's Natural Breastfeeding Research Findings.

The policy recommends that infants be exclusively breastfed from birth to 6 months. The first breast milk contains colostrum, highly nutritious with antibodies that protect the newborn from diseases.

In 2003 and 2008 surveys, 32% and 38% respectively of infants were breastfed within one hour of birth and 63% and 68% were breastfed within one day of birth. Proportion of children breastfed within one hour of delivery is higher in urban areas (41%) than rural areas (38%). Zonally, North Central zone states had highest proportion (61%) breastfeeding within one hour of birth, while North East (25%) had the lowest. Prelected feeding (giving other food before initiating breastfeeding after birth) occurs widely in Nigeria with dangers of acquiring infection.

Fig. 4: Trends in Infant Feeding Practices for Children 0-5 Months and 6-9 Months, 2003 NDHS and 2008 NDHS



The proportion of children under the age of six months that are exclusively breastfed decreased from 17% in 2003 NDHS to 13% in 2008 NDHS. Proportion of children less than six months who received complementary foods increased notably from 18% to 35% (2003-2008) and there has been an increase in proportion of children 6-9 months who received timely introduction of complementary food (fig. 4). PROFILES analysis shows that 21% of infant deaths are related to poor breastfeeding practices in Nigeria and persistent action is required to prevent such projected infant death of 100,000 per year or 275 infants deaths per day.

Plasma aminoacidemia has been shown in classical studies with reductions in tyrosine, valine, cystine, ornithine, threonine, taurine, leucine, alanine, phenylalanine and arginine in children with malnutrition.

Low Birth Weight and Thrifty phenotype hypothesis

More than 20 million infants worldwide are born with low birth weight, 95.8% of them in developing countries. The 2003 NDHS revealed that 14% of Nigerian children had low birth weight (<2500 grams) and with greater chances of death than normal weight babies impaired or immature immune system and later psychosocial development they later suffer from diabetes, heart disease and other non-communicable diseases. The thrifty phenotype hypothesis affirms that reduced and stressful fetal growth is strongly associated with a number of chronic disease conditions later in adult life and this increased susceptibility results from adaptations or programming made by the foetus in an intrauterine environment of stress and limitations of nutrients supply such disease conditions such as coronary heart disease, stroke, type 2 diabetes, hypertension.

Infant and Young child feeding (IYCF) practices

Appropriately, the variety of foods that ensure nutrient requirements should include meat, poultry, fish, eggs eaten daily while vitamin A rich fruits and vegetables should be consumed daily with adequate fat included (FAO/WHO 2003).

Breastfeed children aged 6-23 months should receive animal source foods and vitamin A rich fruits and grain or tuber based staples. Breast fed infants 6-8 months should have complementary foods two or three times daily. Nationally IYCF practices are actively practised from 26% in North West states to 37% in South South zone states of Nigeria.

MICRONUTRIENT DEFICIENCIES

Low intake of micronutrients - vitamins and minerals - is of public health significance particularly iodine, vitamin A and iron which are globally more widespread. Vitamin A is an essential micronutrient for the immune system and plays an important role in maintaining epithelial tissue - thus severe vitamin A deficiency may cause eye damage and increased severity of infections such as measles and diarrhoeal diseases. Vitamin A is found in breast milk, other milks, liver, eggs, fish, butter, red palm oil, mangoes, papayas, carrots, pumpkins, dark green leafy vegetables.

Iron is essential for cognitive development and impaired body temperature regulation, decreased resistance to infection and anaemia result from low iron intake. The greatest requirements are between ages of 6-11 months when growth is rapid. Infection with helminths or intestinal worms has adverse impact on physical development and is associated with high levels of iron deficiency anaemia which regular deworming can prevent. The risk of iron deficiency increases during periods of rapid growth - infancy, adolescence and pregnancy.

Salt is used in households for many purposes and in line with NAFDAC regulation, household salt should be iodised at least 15 parts per million (ppm). Iodised salt prevents goitre in children and adults. Iodine deficiency disorders lead to preventable brain damage in foetus and infant and retarded psychomotor development in young children.

Zinc is also a recognised micronutrient that prevents growth retardation, male hypogonadism, skin changes, mental lethargy, hepatosplenomegaly, iron deficiency and geophagia. Apart from low zinc levels occasioned by rapid growth, pregnancy and lactation can also lead to zinc deficiency if these increased needs are not met.

LABORATORY CUT OFF POINTS

Epidemiologically, it is important to note and understand the laboratory cut off points for declaration of adequacy or inadequacy of important micronutrients. Serum retinol levels of <20ug/dl in children under five years is marginal deficiency of vitamin A, while <10ug/dl is severe (clinical) deficiency. Mothers with serum retinol of <30ug/dl are at risk of vitamin A deficiency while a concentration of <20ug/dl is vitamin A deficiency in mothers including pregnant mothers⁽²⁵⁾.

For an individual to be considered of adequate vitamin E status, the cut offs are between 4 and 14ug/dl from 0-6 months, between 4.4 and 13.8ug/dl from age of 12 months and between 5 and 18ug/dl for adults⁽²⁵⁾. In most individuals the concentration of serum ferritin parallels the total amount of storage iron and is the only iron status index reflecting deficient, excessive and normal iron. 1ng per ml of serum ferritin corresponds to 8-10mg of storage iron, hence serum ferritin is used in clinical practice and population screening.

Serum ferritin levels below 12ng/ml are specific for iron deficiency and complete adult iron stores exhaustion. In the Nigeria survey (Nigeria Food Consumption and Nutrition Survey 2001-2003)⁽²⁵⁾ serum ferritin levels used were as follows:

< 10ng/ml (0-15 years) indicates iron deficiency, <12ng/ml (16-74 years) indicates iron deficiency <20ng/ml in the serum indicates iron store depletion, 20-100ng/ml was the normal range while 101-300ng/ml was slightly above normal and > 300ng/ml was regarded as iron overload.

Epidemiological criteria for assessing iodine nutrition are based on ICCIDD/WHO/UNICEF⁽²⁵⁾ median urinary iodine concentration viz: severe iodine deficiency <20ug/L, moderate iodine deficiency (40-49); mild iodine deficiency (50-99); optimal (100-199), than adequate (200-299) and possible excess (>300ug/L). The applications of these cut off points in children, and women in Nigeria surveys are further provided.

Nigerian Children under 5 years research findings Vitamin A status (2001-2003 Survey): At the national level, 24.8% had marginal deficiency, 4.7% had severe deficiency and 71.5% were normal. Rural children had marginal deficiency of 23.4%; urban 22.5% and in medium geographical

area 25.1%; while severe deficiency were 2.2% (rural), 3.4% (urban) and 7.5% (medium).

Vitamin E status. At the national level 22.6% had vitamin E deficiency, and 77.4% were normal. Rural children had 21.5% deficiency, while 17.8% was obtained in urban, and 26.3% in medium area.

Iron Status. At the national level, 27.5% were at different stages of iron deficiency with 8.1% having depleted iron stores. Children with adequate iron nutrition varied widely in the geographical zones of the country. Disaggregation of data showed that 24.4% were rural, 33.1% urban and 27.9% were found in medium geographical area. Children with depleted iron stores were equally distributed in urban, rural and medium areas.

Zinc Status. At the national level, 20% of children were zinc deficient. Deficiency was higher (26.0%) in rural areas while urban and medium areas had 17%.

Iodine Status. Nationally 27.5% of children suffered various degrees of iodine deficiency, while 46.5% had more than adequate levels. The deficiency was severe in 4.2%, moderate in 8.7% and mild in 14.6%. Only 26.0% had optimal levels. 16.6% had more than adequate levels while 29.8% had possible excess intake of iodine and ran risk of adverse health consequences.

Iodine deficiency was reported in 10.6% in medium sector area, 15.5% in rural sector and 10.6% in urban sector. More than adequate and possible excessive intakes of iodine were seen in 51% in medium sector, 42% in rural and 45% in urban sector.

Intake of micronutrients in children - 2008 survey

Rather than measure serum or urine levels of micronutrients, the 2008 NDHS focused on intake of micronutrients based on information obtained on the consumption of foods rich in each micronutrient in the 24 hours preceding the interview; and the 2008 NDHS tested the quality of household salt in 94% of households whose salt is iodised at least 15 parts per million (ppm).

Vitamin A foods intake: 2 out of every 3 young children aged 6-35 months, living with mother, consumed foods rich in vitamin A 36% for children age 6-8 months to 82% for children aged 24-35 months. Non-breastfeeding children consumed more. Urban children (76%), were more than rural children (67%). Zonally southern zones children. (81-88%) consumed more than northern zones children (54-77%), with the mothers increased level of education positively affecting the performance.

Iron rich foods: Intake rose from 29% among children 6-8 months to 70% among children 18-23 months of age. Urban children (70%) were more likely than rural (53%) to consume iron rich foods and the mother's increased level of education positively impacted the outcome.

Household prevalence of iodised salt

Nationally, 3% use salt with no iodine (0ppm); 45% had salt with inadequate iodine content, and 52% used salt with adequate iodine content. Households in North East states were least likely to have salt with adequate iodine (34%) compared with households in North West states (65%). The WHO primary criterion for iodine deficiency disorders (IDD) elimination is >90% households using adequately iodised salt and <50% of the population with urinary iodine excretion (UIE) of <100ug/l. The performance of households in the geopolitical regions is shown in the next table as collated from 2008 NDHS, which shows that Nigerian households are underperforming with regard to WHO criteria.

NUTRITIONAL STATUS OF WOMEN

Nigeria Health, Nutrition and Population Country Status Report (2005) showed some indicators of maternal health which included comparisons among African nations. Fertility rate, desire to limit child bearing, mean number of ideal children and body mass index (BMI % <18.5%) of undernourished or low weight mothers more compared. All these factors affect the low birth weight babies' outcome, and the repeated range of micronutrient deficiencies that may follow. Fertility rate in Nigeria though decreased from 6.3 in 1990 is still higher than Sub-Saharan Africa (SSA) average (5.7 children per Nigerian woman vs 5.2 per woman in 2005 in SSA).

A comparison of indicators across Sub-Saharan African (SSA) countries⁽²⁸⁾ according to the data of AbouZair and Wardlaw (2001) is shown in table below rearranged with BMI as first indicator.

Table 2: Presence of Iodised Salt in Household (2008 NDHS)

Zone	% None (0ppm)	% Inadequate (<15ppm)	% Adequate (<15ppm)
North Central	3.4	40.4	56.2
North East	5.0	61.3	33.7
North West	3.7	31.5	64.7
South East	4.3	39.0	56.7
South South	3.3	56.8	39.9
South West	1.9	47.0	51.1

Table 3: Indicators of Maternal Health in SSA Countries

Country	BMI% <18.5	Total fertility Rate (15- 49 years)	Desire to limit Child bearing	Mean Ideal No. of children
Benin	10.5	5.6	25.9	5.5
Burkina Faso	13.3	6.4	19.6	5.7
Cameroon	7.9	4.8	19.6	6
CAR	15.3	5.1	12.3	6.4
Chad	21.1	6.4	10	8.3
Cote d'Ivoire	7.4	5.2	20.7	5.4
Ethiopia	26.0	5.5	32	5.3
Gabon	6.6	4.2	23.1	4.9
Ghana	11.3	4.4	35	4.3
Guinea	11.8	5.5	2.9	5.7
Kenya	11.9	4.7	53.3	3.8
Madagascar	20.6	6.0	38.1	5.3
Malawi	6.5	6.3	42.3	5
Mauritania	8.6	4.5	19.1	6.2
Mozambique	10.9	5.2	16.9	5.9
Niger	20.7	7.2	9.6	8.2
Nigeria	15.2	5.7	18.5	5.7
Rwanda	5.9	5.8	33.7	4.9
Togo	10.9	5.2	28.6	4.5
Uganda	9.4	6.9	38.3	4.8
Zambia	13.0	5.9	35.5	4.7
Zimbabwe	4.5	4.0	40.9	3.9

Source: AbouZair and Wardlaw 2001

In 2001, 15.2% of women in Nigeria had BMI less than 18.5; in 2003 NDHS, among the poorest fifth of population as many as 22% of women have low BMI compared to 9% among the rich. In North East zone states, 23% of women were malnourished compared to 8% in South East region. 2003 report showed that 6% of adult women were obese and about 15% were overweight.

The 2008 NDHS showed the distribution of nutritional status by age group of women, BMI and zonal location. The total number of women examined analysed for BMI was 28,200. Two in three women have normal BMI and normal BMI decreases with age, as well as decreases with increasing level of education and wealth status.

Regarding overweight and obese category, nearly one in four women are either overweight or obese (16% overweight and 6% obese). Overweight and obesity increase by age from 7% among women 15-19 years of age to 34% among women 40-49 years of age. More of urban women (31%)

Age	BMI Normal (18.5-24.9)	Thin BMI <18.5	Overweight/ obese > 25 BMI
15-19	73.7	19.3	7.0
20-29	70.0	11.6	18.3
30-39	60.1	9.5	30.4
40-49	57.1	9.2	33.8
RESIDENCE	60.1	9.1	30.8
	69.0	14.0	17.0
Urban			
Rural			
ZONE	70.4	8.5	21.1
	66.6	20.7	12.7
North Central			
North East			
North West			
South East			
South South			
South West			
Education	67.5	12.4	14.4
	66.0	7.6	23.8
	66.6	7.2	23.8
	55.0	3.4	40.5
No education			
Primary			
Secondary			
More than Secondary			

than rural women (17%) were overweight or obese. Overweight and obesity are higher for women in Southern zones of the country than northern zones.

Micronutrients in Women

There are worrisome levels of micronutrient deficiency among women in Nigeria, and especially during pregnancy, which can harm both women and children. Night blindness in pregnant women due to vitamin A deficiency; stillbirths, child brain damage, cretinism and goiter can occur because of iodine deficiency, while iron deficiency among women can result in maternal mortality, iron deficiency anaemia and low birth weight. In 2003 survey of Maziya Dixon and colleagues⁽²³⁾, the vitamin A status of mothers revealed 13.1% were at risk (<30ug/dl) of developing deficiency with prevalences of 10% (urban), 11.2% (rural) and 30.7% (medium) sector areas. 41% were actually deficient (<20ug/dl). Among pregnant women, 19.2% were at risk of being deficient at national level. This was more in pregnant women living in urban (25.2%) and rural areas (24.4%) than those living in medium areas (17.3%). Only 8.8% of pregnant women were deficient.

Vitamin E status results showed 13.0% of mothers were vitamin E deficient with 7.9% (urban); rural (13.0%) and medium areas (16.2%). At the national level, 12% of pregnant women were vitamin E deficient and largest number were from rural areas (14.7%) while urban areas had 5.3%.

Iron Status results in mothers and pregnant women showed 24.3% mothers and 35.3% pregnant women were at different stages of iron deficiency with 12.7% of mothers and 19.9% of pregnant women already with iron stores (serum ferritin <12ng/ml) in iron deficiency. 63.2% of mothers were in the normal serum ferritin range of 20-100ng/ml and 52.4% of pregnant women in normal range. Iron overload occurred in pregnant women (1.5%) and 0.8% of mothers. Prevalence of various degrees of iron deficiency occurred more commonly in urban (26.9%) areas than in medium (24.7%) and rural areas (2.4%) in mothers.

In pregnant women, four out of ten (43.8%) in urban areas were iron deficient, while 33.6% in rural and 34.0% in medium areas were found.

Zinc status studies showed 43.8% pregnant women and 28.1% of mothers were zinc deficient with similar prevalence in rural, medium and urban areas.

Iodine deficiencies were reported among mothers in urban sector (10%), medium sector (13.7%), and rural sector (21%). Adequate intake of iodine was seen in 16.6% of mothers in rural area, 20.6% in medium sector and 20.3% in urban sector, while those with possible excess iodine were observed in rural sector (14.6%) and urban (24.4%).

Pregnant women had range of 27.4 - 34.9% adequate iodine nutrition across the zones while iodine deficiency was reported in rural sector (14%) medium sector (10%) and urban sector (9%). Excess intake was reported 37% in rural sector, 41% in urban sector and 45% in medium sector.

The 2008 NDHS, rather than measure serum or urine levels of micronutrients, assessed intake of vitamin A and iron-rich foods, as well as those who received vitamin A post partum period. 84% of mothers with children under three years eat foods rich in vitamin A and 69% eat iron-rich food. 53% of mothers are found in households with adequately iodised salt. Mothers in urban areas (90%) are more likely to consume vitamin A rich foods than rural mothers (82%) and zonally, North West states had 73%, while South South and South West states had 96% and 95% respectively. Consumption of iron rich foods was more in urban areas (82%) than rural areas (63%) while mothers in North West states (44%) were less likely to consume iron-rich foods than South South states (94%) were most likely to consume such food.

INFECTIONS AND MALNUTRITION

In Nigeria, Kenya, Tanzania, India and other countries^(29,30), measles is associated with malnutrition up to stages II and III with reduced levels of serum retinol and vitamin A deficiency which predisposes to corneal ulceration, ulceration-keratomalacia, xerophthalmia and outright corneal blindness. Measles leads to profound depression of cell mediated immunity, protein losing enteropathy and malabsorption in the acute measles^(31,32) stage. Malnourished children also develop cancrum oris/noma as described by Enweonwu and coworkers⁽³³⁾ in impoverished Nigerian children who also had reduced plasma concentrations of zinc (<10.8umol/L), retinol (<1.05umol/L, ascorbate (<11 umol/L), essential amino acids (Threonine, valine, leucine etc) with increased serum levels of cortisol. They postulated that in the evolution of oral mucosal ulcers through acute necrotising gingivitis to noma, triggered after infections by *measles* and *Herpes viridae*, that a consortium of microorganisms led by *Fusobacterium necrophorum* and *Prevotella intermedia* elaborate dermonecrotic toxic metabolites.

UNICEF press release in April 2010⁽³⁴⁾, revealed that sixteen West African and Central Africa nations - had measles epidemic as a result of insufficient immunisation. Reported were Benin (85 cases), Burkina Faso (1258), Central African Republic (31), Cote d'Ivoire (491), Cameroon (1338), Chad (5832), DR Congo (3976), Guinea Bissau (1013), Mauritania (863), Liberia (1341), Mali (774), Niger (352), Nigeria (3804), Senegal (560), Sierra Leone (351), Togo (295) with various deaths and malnutrition. Routine immunisation recommendation of 95% coverage for each vaccine including measles in children under one year of age is not achieved in these nations. In 2005, Medecins Sans Frontiers⁽³⁵⁾ conducted emergency intervention in Borno State, screening 2500 children in different villages and found 1-2% of them suffering with severe acute malnutrition contributed to by multiple factors such as young mothers who stop breastfeeding too early and are unable to give their babies a healthy varied diet. Chronic food insecurity in Northern Nigeria and sub-Saharan zone and food stocks depleted by scanty rains and locust swarms as well as measles epidemic were other determinant factors.

Intestinal parasites lead to micronutrient deficiency. Iron stores are depleted by severe hookworm infections and diarrhoeal diseases (acute and chronic) lead to loss of protein micronutrients, aminoacids and protein losing enteropathy, while intestinal tuberculosis may cause

malabsorption. Parasitic agents in children lead to shorter heights and lower weights and the work of Adelakan in Oyo State ⁽³⁶⁾ and Ighogboja and Ikeh ⁽³⁷⁾ in Jos showed that parasites - *Ascaris lumbricoides*, *Trichuris trichiura*, *Ancylostoma duodenale*, *Strongyloides stercoralis*, *Taenia saginata*, *Enterobius vermicularis*, *Schistosoma mansoni* and other protozoa are contributory in this regard.

Tumour Necrosis Factor (TNF) is increased and released in children with infections including, malaria and bronchopneumonia and which induces fever and mobilizes amino acid and trace elements from muscles leading to acute weight loss. Deleterious effect of TNF on the brain is ameliorated by polyunsaturated fatty acids which adequate breast feeding provides. Shanker ⁽³⁸⁾ in 2000 clearly showed that protein-energy malnutrition is associated with malaria and that vitamin A and Zinc supplements tend to reduce severity of clinical attacks of malaria.

Aflatoxins and Malnutrition in Nigeria

Hendrickse had made studies in Sudanese children ⁽³⁹⁾ with regards to aflatoxins which are metabolites of the fungi *Aspergillus flavus* and *Aspergillus parasiticus* -moulds which are common contaminants of food. Aflatoxins B₁, B₂, G₁, G₂, and their metabolites have been linked to hepatitis, immunodepression, fertility impairment, cancer and malnutrition ^(40,41,42). Research in Benin and Togo on humans ⁽⁴³⁾ showed a close response relationship between exposure to aflatoxin and degree of stunting and underweight in children under five years with 99% of children having serum aflatoxin adducts. Studies in Zaria show ⁽⁴⁴⁾ significant aflatoxins level in the food and blood of kwashiorkor and marasmus children in Nigeria.

Antioxidants and Micronutrients

WHO has prescribed that all humans should take fresh vegetables and fruits daily because of their contents of micronutrients and antioxidants.

Antioxidants prevent cancer, cardiovascular diseases, osteoporosis and other non-communicable diseases ^(45,46,47,48,49). People who eat fruits and vegetables have lower risk of heart disease, cancers, while people who eat only small amounts have increased risk of developing cancer and evidence shows that vitamin and mineral deficiencies can lead to DNA damages.

The National Expert Committee on Non-Communicable disease undertook a survey in 2003 in Lagos zone to assess use of vegetables and fruits with the following findings in table below ⁽⁵⁰⁾.

In 2003, survey in Lagos Zone, 15% of respondents consume fresh fruit daily in Lagos Zone while

Micronutrient/Vitamin	Source
Vitamin C (ascorbic acid)	Fresh fruits, vegetables
Vitamin E (tocopherols, tocotrienols)	Vegetable oils
Phenolic antioxidants (resveratrol, Flavonoids)	Tea, coffee, soy, fruits, olive oil, chocolate Red wine.
Carotenoids (lycopene, carotenes, Lutein)	Fruits, vegetables, egg

20% consume fresh fruits at least five times daily as recommended by WHO. Furthermore, fresh vegetables were not consumed daily by 36.5% of rural respondents compared to 29.6% of urban respondents. These findings indicate the need to massive nutritional education in Nigeria.

Table 6: Distribution of Respondents - Consumption of Fresh Fruits Lagos Survey, 2003 NCD Expert Committee

No. of days of Daily consumption	Respondents	Percentage (%)
None	144	13.7
1-2	460	43.7
3-4	238	22.6
5-7	211	20.0

Table 7: Distribution of Respondents -Consumption of fresh vegetables Lagos Survey, 2003 NCD Expert Committee

No. of days of daily consumption	Urban	Rural	Total
None	161(29.6%)	160(36.5%)	321(32.7%)
1-2	280(51.6%)	202(46.1%)	482(49.1%)
3-4	63(11.6%)	54(12.3%)	117(11.9%)
5-7	39(7.2%)	22(5.0%)	61(6.2%)
Total	543(100%)	438(100%)	981(100%)

Trace Elements, - Hypertension, Cancers, Non-communicable Diseases

Approximately 40 micronutrients are required in human diet⁽⁵¹⁾. Deficiency of vitamin B₁₂, folic acid, B₆, niacin, C, or E, or iron, zinc appear to mimic radiation in damaging DNA with single or double stranded breaks. Folate deficiency, vitamin B₁₂ and B6 deficiencies, lead to extensive incorporation of uracil into human DNA leading to chromosomal breaks^(52,53,54).

Aging appears to be due in part to oxidants produced by mitochondria⁽⁵²⁾ and their metabolism are restored normal with nutrients and lipoic acid in diets. A negative relationship between water hardness and cardiovascular mortality rate *has* fuelled interest regarding minerals and trace elements in pathogenesis of atherosclerosis, cardiovascular diseases and hypertension, as higher incidencies have been reported in soft water areas. These elements are obtained through water and food chains. Calcium, magnesium, cobalt, lithium, vanadium, manganese, copper have been, considered potentially beneficial while cadmium, lead, silver, zinc and antimony are considered harmful with cobalt and zinc attributed both roles. Chromium exerts beneficial effect in preventing formation of atheromatous lesions and by decreasing blood cholesterol levels. Deficiency of copper and zinc or their imbalance is associated with increased risk of hypertension as these are co-factors of enzymes^(55,56).

With regard to cancer, the currently available evidence supports inverse relationship between selenium exposure and prostate cancer risk and reduction in lung cancer risk. There is limited evidence for inverse relationship between zinc and breast cancer.

The qualitative and quantitative content of these trace elements in water and environment need to be studied and determined in all age groups in both urban and rural areas of Nigeria.

Glycaemic Indices of Nigerian Foods and Non-communicable diseases

Glycaemic index (GI) proposed by Jenkins and colleagues⁽⁵⁷⁾ to characterise rate of absorption of carbohydrate after meal is defined as area under the glucose response curve after consumption of the 50g carbohydrate from a test food divided by the area under the curve after consumption of 50g carbohydrate from a control food, either white bread or glucose. By 2005⁽⁵⁸⁾, up to 1300 GI food entries worldwide have been made and factors which determine GI include carbohydrate type, fibre, protein, and fat content; food form and method of preparation. High GI foods⁽⁵⁹⁾ elicit higher insulin and C peptide levels and reductions in dietary GI have been shown to lower risks for various conditions associated with hyperinsulinaemia such as diabetes mellitus, dyslipidemia, cardiovascular diseases; obesity, and cancer. It is important that the GI of various Nigerian foods be determined in the raw and processed forms to determine the best practices for recommendation for prevention of chronic diseases.

The work of Omoregie and Osagie⁽⁶⁰⁾ on ten common Nigerian foods cassava tuber, yam, maize, millet, sorghum rice, wheat show that their processing into fine powders leads to their having higher glycaemic indexes and should be discouraged. Processing seeds removes⁽⁶¹⁾ fibre-rich outer bran and the vitamin and mineral rich inner germ leaving endosperm.

It should also be noted that even when these processed foods are used as basis for making sweetened cakes (with addition of simple sugars like sucrose or table sugar), the glycaemic indices are further increased⁽⁶²⁾. Furthermore, when they are consumed with soft drinks which contain significant amounts of sucrose in Nigeria⁽⁶³⁾ or its components (glucose and fructose), the risks are magnified. It has been shown in rats that chronic feeding with fructose leads to diabetes mellitus⁽⁶⁴⁾.

TRANSITIONS AND DETERMINANTS

Rapid shifts in diet and body composition are occurring in the world, and these changes are currently more rapid in low and moderate income countries. Broad shifts in population size and its age structure and composition are called demographic transition, while shifts in dietary and physical activity patterns are called epidemiological transition leading to double jeopardies of communicable and non-communicable diseases as currently occurring in Nigeria. Dietary and physical activity changes (sedentary life style) as reflected in nutritional outcomes such as changes in average stature and body composition are referred to as nutrition transition. The geriatric age in Nigeria has not yet deleted the traditional pyramidal structure with younger people at the base.

Evidence from many developing countries shows that nutrition related chronic-diseases prematurely disable and even kill a large number of economically productive people as four out of five deaths are beginning to occur in such countries and 40% of global burden of disease measured as disability adjusted life years (DALYs) is attributed to non-communicable diseases like diabetes mellitus, cancers, stroke, and cardiovascular disease.

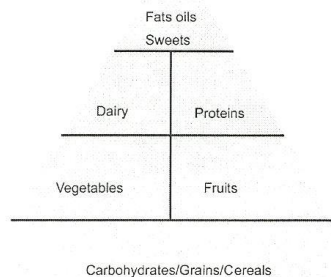
A diet high in total fat, cholesterol, simple sugar, and other refined carbohydrate and low in polyunsaturated fatty acids and fiber; often accompanied by increasingly sedentary life has become the characteristic determinant of most rich societies and increasing proportions of the population of poorer countries.

Effect of fetal, infant and childhood insult. This constitutes another important driving determinant of latter NCDs in adult life. Shifts toward obesity occur among those who earlier faced (a) higher levels of low birth weight in the population, (b) intrauterine growth retardation and stress and fetal programming (c) intrauterine malnutrition (d) nutrition insult on infants (e) stunting in childhood. This effect of earlier malnutrition on latter development of non-communicable diseases in adult life is an exceedingly important determinant that must be appreciated in policy and public health intervention^(65,66,67) as researches on the effect of previous stunting in Brazil and elsewhere⁽⁶⁸⁾ had demonstrated. Nigeria has an important prevalence of stunting as described earlier.

FOOD PYRAMIDS

Nigeria has a variety of traditional foods amongst the more than 400 ethnic groups but evolutionarily some foods and soups are becoming accepted universally and nationally. The vegetable rich soup from Akwa Ibom as well as bitter leaf soup from South East areas are rich in vegetable and fibre. The food pyramid was developed in the USA and many nations adopted it to their own application. It consists of base of carbohydrates and grains with progressive rise to the peak of oils, fats/sweets. It recommends caloric requirement for children, adults, pregnant women or breast feeding women.

Fig. 3: Food Pyramid Structure



Fats and sweets should be taken sparingly, dairy products can provide calcium; vegetables and fruits are sources of vitamins, fibre and antioxidants and minerals, protein from meat and fish. The details need to be worked out and taught in schools, communities and nationally. The Ministries of Education, Agriculture, Health, Labour and Environment should be concurrently be engaged with nutrition issues in Nigeria.

CONCLUSION

1. The nutrition intervention programme in Nigeria has evolved through household food security and nutrition to the conceptually clearer position of nutrition as an outcome of all sectors. In the early 90s, outcome goals such as the reduction in infant and under-5 malnutrition (protein energy malnutrition) were addressed through household food security, breastfeeding, and growth monitoring and promotion. Lack of linkages and weak inter-sectoral collaboration, including the undervalued role of the community, has resulted in the failure to achieve an overall reduction in malnutrition and its attendant debilitating effects on child survival and development. Therefore, there is a need to strengthen the many interventions in the health, agriculture and education sectors.
2. Politicians and health and agricultural policy makers are timidly recognising that investing in people's health is a necessary condition for economic development but energetic, bold and committed actions and decisions are needed for the adoption of urgent and consequent strategies. The need for such strategies is enhanced by the fact that risk factors like cholesterol, tobacco, blood pressure, and obesity are no more a specificity of industrialized countries as they are becoming more prevalent in developing nations, where they compound the burden of infectious diseases that have always afflicted poorer countries. An intersectoral, integrative approach must be the sine qua non.
3. Sustained investment in nutrition in Nigeria would avoid millions of deaths of children and women and the entire population; a tragic lowering of intellectual capacity, and enormous losses in economic productivity. The conditions for attaining these benefits includes the recognition of nutrition as a key factor for the socio-economic development of Nigeria; politically committing to improve the nutritional situation of the population; and the optimisation of the impact of the national nutrition strategy by targeting the most vulnerable groups through cost-effective interventions. The sustained investment in nutrition will bring about enormous benefits for the health of Nigeria population, the education of children and consequently the economy in order to make success of the MDGs programme which is stalling the nation in the face as Nigerian lags behind in the implementation.

RECOMMENDATIONS

1. Ensuring breastfeeding policy continues as also a way to prevent Type 1 diabetes in addition to its nutrition source and support for immunity.
2. Expanded immunisation to cover 95% recommended by UNICEF/WHO, especially with regard to measles by NPHCDA.
3. Regular massive community deworming of children.
4. School based nutrition and physical activity intervention like the Healthkick programme of South Africa. LGAs, States, communities should spearhead this.
5. Better food handling and storage to eliminate fungal contamination and aflatoxins which NAFDAC should ensure.

-
6. Iodisation of salt, vitamin A and other plus programmes of immunisation programmes to continue and be extended.
 7. Massive cultivation of fruits and vegetables and national and community education to consume prescribed amounts.
 8. Make nutrition activities integration a priority in resource allocation for poverty reduction and economic development.
 9. Strengthen the effective coordination of national nutrition activities by supporting the national food and nutrition policy and the national nutrition programs arising from the policy.
 10. Support, as a matter of priority, the integrated implementation of the national nutrition programme (multisectorally and multidisciplinary) arising from the national food and nutrition policy through the provision of adequate financial, human and material resources for line ministries and NGOs.
 11. Incorporate nutrition considerations into development policies and programmes of all relevant ministries for poverty reduction, food security, employment, productivity and nutrition improvement.
 12. Institute a mechanism for nutrition improvement in pregnancy and early childhood to promote increased life expectancy and quality of life.
 13. There is a need for further research to improve data on risk factor exposure and to extend the analysis from the selected group of risk factors currently in use to other important risks e.g. non-breastfeeding and salt and fat intake and to estimate trends in exposure to risk factors.
 14. There is a need to radically transform the medical paradigm of the last 50 years, with its apparent reliance on pills to the healthy-lifestyle model, with its core focus on exercise, healthy eating, positive social values, and strategies targeting the general population.
 15. Researchers must monitor knowledge, attitudes, and practices; risk factors; and outcomes, ongoing, comprehensive risk factor surveillance is an essential component of public health strategies, to provide baselines and to examine needs and the effects of interventions.
 16. Multidisciplinary science and multisectorial programmes, beyond the confines of food and nutrition, must be integrated into efforts to control the increase in NCDs.
 17. Construct food pyramids for communities and Ministries of Labour, Agriculture, Health, Education, Environment and Women Affairs to address nutrition, obesity and exercise.

REFERENCES

1. Gardner G. and Halwell B (2000). Overfed and Underfed: the Global Epidemic of Malnutrition. Peterson JA ed. World Watch Paper 150.
2. World Health Organisation Expert Committee: Physical status; The use and interpretation of anthropometry. Report of a WHO Expert Committee. Technical report series 854, WHO Geneva.
3. Senbanjo I.O.; Adejuyigbe E.A.: Prevalence of overweight and obesity in Nigerian preschool children. *Journal of Nutrition and Health*, 2007, vol. 18, no4, pp. 391-399.
4. Bakari A.G., Onyemelukwe G.C., Sani B.G., Aliyu I.S., Hassan S.S. and Aliyu T.M.: Obesity, overweight and under weight in suburban northern Nigeria. *Int. J. Diabetes & Metabolism* (2007), 15: 68-69.
5. Akesode F.A., Ajibode H.A.: Prevalence of obesity among Nigerian school children. *Social Science and Medicine*, 1983; 17(2): 107-11.
6. Senbanjo I.O.; Adejuyigbe E.A.: Prevalence of overweight and obesity in Nigerian preschool children. *Journal of Nutrition and Health*, 2007, vol. 18, no4, pp. 391-399.
7. Rotimi C.N., Cooper R.S., Ataman S.L., Osotimehin B., Kadiri S., Muna W. et al. Distribution of anthropometric variables and the prevalence of obesity in population of West African origin: the International Collaborative Study on Hypertension in Blacks (ICSHIB). *Obes. Res.* 1995; 3 Suppl. 2:95s-105s.
8. Forrester F., Wilks R., Bennett F., McFarlane-Anderson N., McGee D., Cooper R. et al. Obesity in the Caribbean. In: Derek J., Chadwick D.J., Cardew G. eds. *The origins and consequences of obesity*. CIBA Foundation Symposium 201. Chichester, United Kingdom: John Wiley and Sons; 1996. Pp. 17-31.
9. Kelishadi R.: Childhood overweight, obesity, and the metabolic syndrome in developing country. *Epidemiologic Reviews* Advance Access, May 3, 2007.
10. Olalekan A. Uthman: Effect of low birth weight on infant mortality: Analysis Using Weibull Hazard Model. *The Internet Journal of Epidemiology*. 2008. Volume 6.
11. United Nations Children's Fund, World Health Organisation: *Low Birthweight: Country, regional and global estimates*. New York: UNICEF; 2004.
12. Puska P. Nutrition and mortality: the Finish experience. *Arta Cardie* 2000; 55: 213-220.
13. Puska P.: Nutrition and the global prevention on non-communicable diseases. *Asia Pacific. J. Clin. Nutr.* 2002. 11 (suppl): S755-S758.
14. Solomons N.W. Global strategies to prevent non-communicable diseases: A view for the low-income societies. *South African Journal of Clinical Nutrition* 2005; September Vol. 18, No. 2, pg 182-185
15. Patil A.V., Somasundaram K.V., Goyal R.C.: Current health scenario in rural India. *Aust. J.*

Rural Health 10: 129-135, 2002.

16. Popkin BM, Horton S, Kim S, Mahal A, Shuigao J: Trends in diet, nutritional status, and diet-related non-communicable diseases in China and India: the economic costs of the nutrition transition. *Nutr Rev* 59:379-90, 2001.
17. Sheity P: Diet and Life-style and Chronic Non-communicable diseases: The Determinants of the Emerging epidemic in Developing Societies. In a Report of the seminar 27 April 2001 on Non-communicable Diseases with special focus on Cardiovascular Diseases and Diabetes in the Developing World. By the Danish Society of Tropical Medicine & International Health The ENRECA Health Research Network, and Danida the ENRECA Health Research Network 2001.
18. John JH, Ziebland S, Yudkin P, Roe LS, Neil HA: Oxford Fruit and Vegetable Study Group: Effects of fruit and vegetable consumption on plasma antioxidant concentrations and blood pressure: a randomised controlled trial. *Lancet* 359:1969-1974, 2002.
19. Sacks FM, Svetkey LP, Vollmer WM, Appel LJ, Bray GA, Harsha D, Obarzanek E, Conlin PR, Miller 3rd ER, Simons-Morton DG, Karanja N, Lin PH; DASH-Sodium Collaborative Research Group: Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. *DASH Sodium Collaborative Research Group. N Engl J Med* 344:3-10, 2001,
20. Shashi A. Chiplonkar, Valshali V. Agte, Kirtan V. Tarwadi, Kishor M. Paknikar, and Uma P. Diwate. Micronutrient Deficiencies as Predisposing Factors for Hypertension in Lacto-Vegetarian Indian Adults. *Journal of the American College of Nutrition*, Vol. 23, No. 3, 239-247 (2004).
21. FGN/NPC and USAID. Nigeria Demographic and Health Survey -NDHS 2003
22. Barker DJP. Mothers, and diseases in later life babies London: BMJ Publishing 1994.
23. WHO Global strategy for non-communicable disease prevention and control (draft). Geneva, Switzerland: World Health Organisation, 1997. (Publication no. WHO/NCD/GS/97.1).
24. UN/SCN. Fourth Report on the World Nutrition Situation. New York 1999.
25. Maziya-Dixon B, Akinyele I.O., Oguntona E.B., Nokoe S., Sanusi R.A. and Harris E. (2004). Nigeria Food Consumption and Nutrition Survey (NFCNS 2001-2003). International Institute of Tropical Agriculture (IITA), 2004. Ibadan, Nigeria.
26. Draper C.E., de Villiers A., Lambert E.V., Fourie J., Hill J., Dalais L., Abrahams Z., Steyn N.P.: Healthkick: a nutrition and physical activity intervention for primary schools in low-income settings. *BMC Public Health* 2010, 10: 398-405.
27. Nation Population Commission: Nigeria Demographic Health Survey (2008).
28. AbouZahr C., Wardlaw T.: Maternal mortality at the end of a decade: Signs of progress: *Bulletin of the World Health Organisation*, 2001, 79, 561-568.
29. ReddyV.: Interaction between nutrition and measles. *India J. Pediatr.*, 1987; 54:55-57.

30. Inua M, Duggan M.B, West C.H. et al.: Post-measles corneal ulceration in children in Northern Nigeria: the role of vitamin A, malnutrition and measles. *Ann Trop. Pediatr.* 1983; 3:181-91.
31. Dossetor J.F.B., Whittle H.C.: Protein losing enteropathy and malabsorption in acute measles. *Br. Med. J.* 1975; 2: 592-3.
32. West C.E.: Vitamin A and measles. *Nutrition Reviews*, 2000; 58(2) S46-S54
33. Enweonwu C., Falker W.A., Idigbe E.O., Afolabi L.M., Ibrahim M., Onwujekwe D., Savage O., Meeks V.I.: Pathogenesis of cancrum oris (NOMA): Confounding interaction of malnutrition with infection. *Amer. J. Trop. Med. Hyg.* 1999; 60:223-233.
34. UNICEF press centre: Measles outbreaks threaten progress in child mortality in West and Central Africa. April 2010. <https://www.unicef.org/media/media5339a.html>.
35. Medecins Sans Frontiers. Field news; Malnutrition in Northern Nigeria: Without medical support hundred of children might die. 2009. <http://www.dwb.org/news/article.cfm?id=1572&cat=field-news> http
36. Adelekan L.: Intestinal parasites and nutritional status of Nigerian children. *Afr. J. Biochem Res.* 2002; 5: 115-119.
37. Ighogboja I.S., Ikeh E.I.: Parasitic agents in childhood diarrhea and malnutrition. *West Afr. J. Med.* 1997; 16(1), 36-39.
38. Shanker A.H.: Nutritional modulation of malaria morbidity and mortality. *J. of Infectious Diseases* 2000, 18(Suppl 1): 537-53).
39. Hendrickse R.G.: The influence of aflatoxins on child health in the tropics with particular reference to kwashiorkor. *Trans Roy. Soc. Trop. Med. Hyg.* 1984; 78: 427-435.
40. Enweonwu C.O., Sreeby L.M.: Studies of hepatic lesions of experimental protein-calorie malnutrition in rats and effects of refeeding an adequate protein diet. *J. Nutr.* 1971; 101; 301-314.
41. Enweonwu C.O.: Aflatoxins and kwashiorkor. *Lancet*; 324(8412), 1133-1134.
42. Williams J.H., Philip J.D., Jolly P.R., Stiles J.K., Jolly C.M., Aggarwal I): Human aflatoxicosis in developing countries: a review of toxicology, exposure, potential health consequences and interventions. *Am. J. Clin. Nutr.* 2004; 80; 1106-1122.
43. Gong Y.Y., Cardwell K., Hounsa A., Egal S., Turner P.C., Hall A.J., Wild C.D.: Dietary aflatoxin exposure and impaired growth in young children from Benin and Togo: Cross-sectional study. *BMJ* 2002; 325; 20-21.
44. Onyemelukwe G.C., Ibiam G., Ogoina G., Ogbadu G: Aflatoxins in Nigerian Children with Kwashiorkor (In press).
45. Stanner S.A., Hughes J., Kelly C.N., Buttriss J.: A review of the epidemiological evidence for the "antioxidant hypothesis". *Public Health Nutr*, 2004; 7(3); 407-

46. Halliwell B.: Free radicals, antioxidants and human disease: curiosity, cause or consequences. *Lancet* 1994; 334: 721-724.
47. Food, Nutrition, Physical Activity and the prevention of cancer: Global perspective. <http://www.dietandcancerreport/?p=ER>. World Cancer Research Fund (2007) ISBN, 978-0-9722522-2-5.
48. New SA, Robin S.P, Campel M.K. et al Dietary influences on bone mass and bone metabolism: further evidence of a positive link between fruit and vegetable consumption and bone health? *Am J Clin Nutr*; 2000; 71: 142-151.
49. Tucker KT, Hannan MT, Chen H et al: Potassium, magnesium and fruit and vegetable intakes are associated with bone mineral density in older men and women. *Am J Clin Nutr*. 1999.
50. Onyemelukwe G.C.: National Survey Report of NCD Expert Committee 2003: Lagos Survey www.gconyelukwe.com
51. Hajjar L., Kotchen T.: Regional variations in blood pressure in the United States are associated with regional variations in dietary intake. The NHANES-III data. *J.Nutr*. 2003; 133:211-214.
52. Ames B.N.: Micronutrients prevent cancer and delay aging. *Toxicology letters*; 1998; 102-103,5-18.
53. Silvera S.A.N., Rohan T.F.: Trace elements and cancer risk: a review of the epidemiologic evidence. *Cancer Causes Control*. 2007; 18: 7-27.
54. Ames B.N., Wakimoto P.: Are vitamin and mineral deficiencies a major cancer risk. *Nature Reviews Cancer*. 2002. 2. 694-704.
55. Golembiewska E., Kwiatkowska E., Nocen I., Dutkiewicz G., Chlubek D.: Trace elements modify the activity of sodium transporting systems in erythrocyte membrane in patients with essential hypertension - preliminary study. *Nephrol Dial Transplant* 2005, 20: 409-470.
56. Tubek S.: Role of Trace elements in primary hypertension. Is mineral water style or prophylaxis? *Biological Trace Elements Res*. 2006, 114, 1-12.
57. Wolever T.M.C., Jenkins D.T.A., Jenkins A.L., Josse R.G.: The glycaemic index: methodology and clinical implications. *Am. J. Clin. Nutr.* (1991), 54: 846-854.
58. Foster-Powell K., Hoh S.H.A., Brand-Miller International tables of glycaemic index and glycaemic load. *Am. J. Clin. Nutr.*, 2002, 76; 5-56.
59. Salmeron J., Aschevio A., Rionm E.: Dietary fibre, glycaemic load and rise of NIDDM in men. *Diabetes Care* 1997, 47: 1244-1251.
60. Omoregie E.S., Osagie A.N.: Glycemic indices and glycaemic load of some Nigerian foods. *Pakistan Journal of Nutrition* 2008, 7(3); 710-716.
61. Jimoh A.K., Adediran O.S., Adebisi S.A., Biliaminu S.A., Okesina A.B.: Effect of food processing on glycaemic response to white yam (*Dioscorea rotunda*) meals. *Diabetologia*

Croatia, 2008, 37-3, 67-72.

62. Fasanmade A.A., Anyakudo M.C.: Glycemic indices of selected Nigerian flour meal products in male type 2 diabetic subjects. *Diabetologia Croatia* 2007, 36-2, 33-38.
63. Onyemelukwe G.C., Bakari A., Ogbadu G.: Sugar and caloric contents of selected soft drinks marketed in Nigeria. *Int. J. Diabetes & Metab.* 2006.
64. Cohen A.M., Teitelbaum A., Roseman A.: Diabetes induced by a high fructose diet. *Metabolism*: 1977, 26: 17-24.
65. Adair L.S., Kusawa C.W., Borja. : Maternal energy stores and diet composition during pregnancy program adolescent blood pressure. *Circulation* 104 (2001) 1034-1039.
66. Adair L., Dahly D.: Developmental determination of blood pressure *Ann Rev. Nutr* 2005, 25: 407-434.
67. Baker D.J.P.: Fetal origins of cardiovascular and lung disease New York: Marcel Dekker 2001.
68. Popkin B.M.: An overview of the nutrition transition and its health implication. The Bellagio meeting, *Public Health Nutrition*; 5(2002):93-103.

ABSTRACT

Four families of venomous snakes are found in Nigeria Viperidae, Elapidae, Colubridae and Actraspidae, but three species of carpet viper (*Echis ocellatus*), black-necked spitting cobra (*Naja nigricollis*) and puff adder (*Bitis arietans*), belonging to the Viperidae and Elapidae families, are the most important snakes associated with envenoming in Nigeria. The incidence of bites has been reported as 497 per 100,000 population per year with a 12 percent natural mortality, with *Echis ocellatus* accounting for at least 66 percent in certain foci. Bites occur more often while victims are farming, herding or walking mostly among agricultural workers, the economically productive members of society. Carpet viper venom contains a prothrombin activating procoagulant, haemorrhagin and cytolytic fractions which cause haemorrhage, incoagulable blood, shock and local reactions/ necrosis. The spitting cobra bite manifests with local tissue reaction and occasionally with bleeding from the site of bite, but no classic neurotoxic feature has been observed except following Egyptian cobra (*N. haje*) bites. Cardiotoxicity and renal failure may occasionally occur following bites by the carpet viper and the puff adder. In the laboratory, haematological and other features are noted; immunodiagnosis has a role in species identification. Immobilisation of the bitten limb is probably the single most important first aid measure. Antivenom should be used cautiously when indicated. Effective anti-venoms remain the only proven remedy for snake bite poisoning but they are scarce and often inappropriate and ineffective. However, two new s raised against venoms of Nigerian snakes have proved very promising. As only 8.5 percent of snake-bite victims attend hospitals in Nigeria, health education and use of boots among workers should be the main preventive measures. Appropriate steps for solving the crisis of antivenom supplies and snake bite control and management are recommended.

INTRODUCTION

Snakebite is an important but often overlooked medical problem in Nigeria and many health institutions in the country are yet to become aware of the magnitude of the problem. The Federal Ministry of Health inaugurated a *National Task Force on Snakebite Control in Nigeria* that focuses on its epidemiology, management, control and prevention. This article seeks to update on the problems and solutions to the snakebite menace in the country.

SNAKES IN NIGERIA

There are more than 3000 species of snakes in the world, but in Africa, only about 25 of these are known to cause mortality and these belong to four main families, Viperidae (*Vipers and Adders*), Elapidae (*Cobras and Mambas*), Colubridae (*Boomslang*) and Hydrophiidae (*Sea Snakes found in Coastal East and South Africa*). The Hydrophiidae, now grouped by some taxonomists with Elapidae, have not been reported from Nigeria. The subfamily Crotalinae is not found in Africa¹. The vipers are relatively shorter, thicker snakes with long hinged front fangs. The main example in Nigeria is the saw-scaled or carpet viper (*Echis* spp) of which there are two main species in West Africa *Echis ocellatus* and *Echis leucogaster*. Its world distribution stretches from Senegal to Bengal, a range perhaps second only to that of the European Viper, *Vipera berus*. *Echis ocellatus* has an average length of 35 40cm and resides in the semi arid rocky terrain. It is the most prevalent cause of bites in the middle belt and the northern states of Nigeria^{2,3}. Roman's carpet viper (*E. Leucogaster*) lives in the sahel belt of Nigeria and is probably under recognised as cause of human bites⁴. *Echis ocellatus* has also been seen as far South, as the Shaki/Kishi area of Oyo state and in Enugu and Udi hills⁵. The snake is mainly nocturnal entering human dwellings only rarely unlike the spitting cobra. *Echis ocellatus* may be confused with at least four other snakes in West Africa *Dasypeltis scabra*, *Telescopus variegatus*, *Bitis arietans* (juvenile type) and *Causus maculatus* the former two lack fangs while the latter two are also