



## **Globalization, Stress and Metabolic Syndrome. A Selected Focus on Sub-Saharan Africa**

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## Introduction

This paper explores the connection between the inherent forces associated with globalization and their contribution to stressful experiences (Livingston et al., 2012). It is further posited that these stresses, in turn, have the potential to further contribute to and/or exacerbate the constellation of diseases referred to collectively as metabolic syndrome or MetS. Given the enormity of the task, the focus of the paper primarily focuses on the relationship between stress and selected risk factors contributing to MetS, primarily within the countries that comprise Sub-Saharan Africa (SSA)(see Figure 1). SSA consists of those countries that are fully or partially located south of the Sahara Desert. As a related matter, and with some exceptions, the focus of the paper is on the general territory that comprises SSA, even though at times specific countries in the region are highlighted.

The forces of globalization have produced many changes in the world. These forces have contributed to cultural and ethnic conflicts, political changes, and changes in health standards and conditions (Woodward et al., 2001). Nowhere are these health changes (e.g., infectious and chronic diseases) more prevalent than in the lives of people living in the relatively poor countries of SSA. Using a derived conceptual model, the main focus of this paper is to underscore the



impact globalization has made, mainly through urbanization and, subsequently, stress, over time, on the contribution to a cluster of disease outcomes called collectively, metabolic syndrome, on people living primarily in SSA.

It is argued in the paper that the above mentioned factors, along with other factors in society that space constraints do not allow for them to be fully addressed in this paper (e.g., failure of needed governmental assistance, health care, financial constraints), over a period of time, place people at risk to develop MetS through the



relentless and sustained exposure to chronic stress, which has been referred to as the “allostatic load.” The allostatic load, which will be elaborated on more in a later section of the paper, helps to better explain how responses to stress (over time) may become maladaptive and damaging (McEwan, 1998), as is the case with MetS.

### ***Background Information on Sub-Saharan Africa***

Sub-Saharan Africa is in the middle of one of the most rapid demographic and epidemiologic transitions in world history. Additionally, all countries of SSA are experiencing severe (stress-related) problems of poverty, increasing urbanization Westernization of lifestyle, and in some cases, the disruption of their social fabric (Motala et al., 2009). The global prevalence of non-communicable diseases (NCDs) is on the rise, with the majority of the growth occurring among populations in developing countries (BeLue et al., 2009). In SSA, NCDs are projected to surpass infectious diseases (IFDs) (which are typically endemic to developing countries) by 2030 (BeLue et al., 2009).). In this paper, and as illustrated in the derived conceptual model (see Figure 2), while there may be several paths to explain MetS, the main path taken is that globalization contributes to stressful experiences, which in turn have the further potential to contribute to the etiology and/or exacerbation of risk factors (e.g., obesity, high blood pressure, insulin resistance) that have the potential to cause a constellation of diseases collectively referred to as MetS. As seen in Figure 2, and for purposes of this paper, while an appreciation is made for the potential impact government, health care systems, health education, etc. can have on MS, the focus is on the parameters to the left of the figure in bold boxes and with bold directional arrows.

Notwithstanding some positive effects of globalization, it is argued in the paper that in the SSA experience, it has contributed to negative stressful experiences, such as increased urbanization, poverty and the Western-style disruption of the sustaining social fabric of developing countries, like those of Sub-Saharan Africa. It is estimated that by 2020 the total population in Sub-Saharan Africa will double, so that 487 million individuals will be living in urban areas (UN-HABITAT, 2004).

Based on globalization, and from a health perspective, it has been reported that urbanization in Sub-Saharan Africa is strongly associated with increased levels of



obesity, diabetes and cardiovascular disease (Young et al., 2010), all of which are associated with MetS. Additionally, the production of processed foods, which have high profit margins for transnational food corporations, are among the largest sources of foreign direct investment in many countries of Sub-Saharan Africa (Young et al, 2010). This scenario signals an impending crisis for the healthcare systems and economies of Africa (Chukwudebe, 2010). The World Health Organization (WHO) projects in the next ten years Africans will

experience the largest increase in death rates from cardiovascular, cancer, respiratory diseases and diabetes (WHO, 2005).

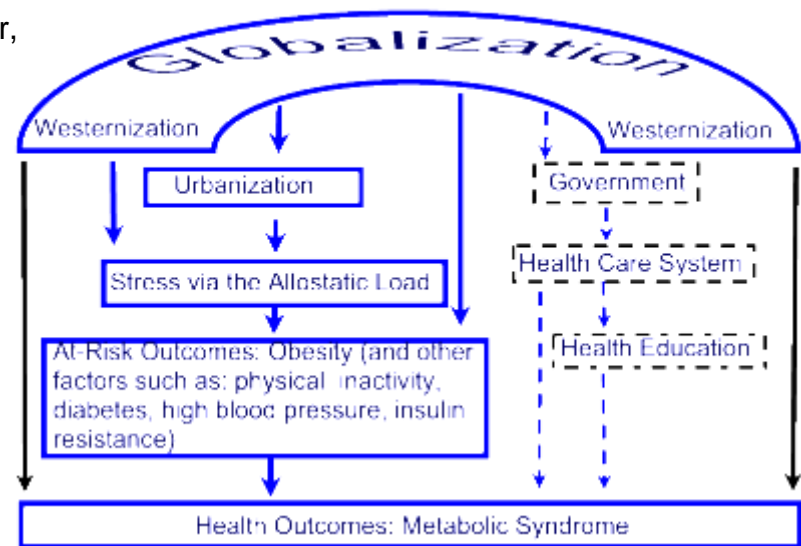
*The Health of the People* (WHO, 2006) is the first report to focus on the health of the 738 million people living in the African Region of the World Health Organization. While acknowledging that Africa

confronts the world's most dramatic public health crisis, the report offers hope that over time the region can address the health challenges it faces, given sufficient international support. All of the SSA countries are experiencing a multifaceted array of problems including: increased life expectancy poverty, increasing urbanization, Westernization of lifestyle, globalization and, in some cases, the disruption of the social fabric (WHO, 2005; Motala et al., 2009).

### **The Impact of Globalization on Sub-Saharan Africa and the Health of its People**

According to Chapman (2009), while globalization has resulted in many positive outcomes for SSA, which include increase access to technology, it also has contributed to various negative outcomes. For example, there is a blurring of geographic boundaries; urbanization; increasing the divisions between the rich and the poor; improved transportation, thereby, moving people closer to urban centers and, in turn, decreasing their physical activity; importation of other countries failures (i.e.,

Figure 2: A Conceptual Model of the Relationship Between Globalization, Stress, Metabolic Syndrome and its Health-Related Risk Factors





Western/fast foods); and increasing cost of health care goods, such as pharmaceuticals, which have had a negative impact on the health of people in SSA.

### ***Globalization, Societal and Economic Changes***

Globalization, which can be defined as a process in which regions are becoming more interconnected, as a result of the increasing movements of goods, people, capital and ideas, has both positive and negative impacts on health (Unwin & Alberti, 2007). According to the United Nations (2008), one of the major outcomes of globalization currently seen in SSA is urbanization, which results from a combination of natural population increase, reclassification of areas originally seen as rural, and rural to urban migration. It is estimated that by the year 2020, the total population of SSA will double, so that approximately 487 million people will be living in urban areas (UN-HABITAT, 2004).

According to Azevedo & Johnson (2011), the impact of globalization on social services and employment has been negative, especially in the areas of health and access to quality health care for most people in the world, when unemployment increases. The resulting unemployment in “micro-enterprises” has been steadily increasing over the years. For example, in Latin America, unemployment increased by 50 percent during the 1990s, and in SSA, North Africa and Asia, by 74 percent, 43 percent, and 62 percent, respectively, even though overall GDP social service budgets remained the same (World Bank, 1995). While in some cases there have been temporary economic growths, in most cases these growths are not sustainable. One of the countries in SSA, Zambia, is a good example, where liberalization policies led to unemployment and further poverty. As a result of loans made to the country by the World Bank and the International Monetary Fund, Zambia was encouraged to open its borders to cheap textile imports (Azevedo, 2003). Because Zambia was unable to compete, it lost 30,000 jobs and 132 of 140 textile mills, all of which resulted in a 40 percent loss of manufacturing jobs within eight years (Azevedo & Johnson, 2011). It is reasoned in this paper that these and other similar changes, which result from the forces of globalization, bring with them potential sources of stress for the people of SSA countries (Livingston et al. 2010).



### ***Globalization, Urbanization and Health Outcomes***

Growth of the urban population in SSA countries is presently occurring at a rate of 4.5 percent yearly (UN-HABITAT, 2004). Urbanization in SSA, as in other developing countries, is strongly associated with increased levels of obesity, diabetes, and cardiovascular disease (Unwin & Alberti, 2006). According to Kengne et al. (2005), in the urban regions of SSA obesity levels now equal those of the west. Although it is primarily argued in this paper that a major contribution to obesity in SSA is stress (Livingston et al. 2010), because of globalization, a host of other factors have been mentioned as contributors.

Lower levels of physical activity and an increasing calorie rich diets are important contributors of the increased obesity rates seen in SSA countries (Sobngwi et al, 2004). The increased production of processed foods has high profit margins and transnational food companies constitute the largest sources of foreign direct investment in many countries of SSA (Hawkes, 2005). It is a well known and appreciated fact that the global availability and marketing of cheap vegetable oils has led to increasing fat consumption in less developing countries (as those in SSA)(Drewnowski & Popkin, 2005).

Of main importance to the position espoused in this paper is that the availability and high fat content of the foods mentioned above have, in part, contributed to an array of health outcomes and risk factors that ultimately can contribute to the metabolic syndrome (MetS). For example, obesity is the major risk factor for Type-2 diabetes, which accounts for over 90 percent of all diabetes (International Diabetes Federation, 2006). Furthermore, rural-urban comparisons of diabetes in SSA indicate a 2 to 5 fold higher prevalence in urban areas (Mbanya et al. 1997; Aspray et al. 2000).

Countries of SSA are currently experiencing one of the most rapid epidemiological transitions characterized by increasing urbanization and changing lifestyles (Fezeu et al. 2006). These changes have increased the rates on non-communicable diseases (NCDs), especially cardiovascular diseases (CVD) (Kadiri & Salako, 1997). In countries like Nigeria, Ghana and South Africa, the prevalence of chronic diseases is increasing, while the threat of communicable and poverty-related diseases (e.g., malaria, infant mortality, cholera, malnutrition) still remains (Yach & Hawkes, 2004; Kengne & Awah, 2009). In South Africa, CVD is the second leading



cause of death after HIV accounting for up to 40 percent of deaths among adults (Peer et al. 2008). Globally, which includes the countries of SSA, certain risk factors have been found to account for up to 90 percent of all myocardial infarctions (heart attacks), as well as other poor CVD outcomes, e.g., stroke. Of importance for the premise and direction of this paper, some of the more salient risk factors include smoking, alcohol consumption, obesity, diet, low physical activity, psychosocial factors (stress), diabetes, hypertension and high lipid levels (Steyn et al. 2005).

### ***Hypertension***

Once rare in West Africa, hypertension has emerged as a serious endemic threat (BeLue et al. 2009). It has been identified as a major risk factor for CVD, which has emerged as an important medical and public health issue in SSA despite the endemic ravages of HIV, tuberculosis and malaria (Agyemang & Owusu-Dabo, 2008). Increasing migration from rural to urban areas also suggests worsening prevalence of hypertension as migrants adopt lifestyle changes in physical activity, dietary habits and stress level (BeLue et al. 2009).

### ***Diabetes***

In the past (i.e., prior to the 1990s) diabetes was regarded as a rare disease in SSA (Mbanya & Ramiaya, 2006). However, since the 1990s with the advent of many demographic and epidemiologic transitions, as well as rapid challenges associated with urbanization, diabetes has become one of the non-communicable disease (NCD) burdens in SSA. Currently, there are approximately 10.4 million individuals with diabetes in SSA, which represents approximately 4.2 percent of the global population with diabetes (International Diabetes Foundation, 2006). It is projected that by the year 2025 this figure will increase by 80 percent to reach 18.8 million in this region. Studies indicate that an aging population, plus rapid urbanization, are major contributors to the increasing prevalence of diabetes in SSA (Kengne, Amoah & Mbanya, 2005).



## **Obesity**

Until recently, obesity was a public health problem only in Western countries. However, in the past two decades it has become a global problem sometimes referred to as a “globesity epidemic” (Misra & Khurana, 2008). Many low- and middle-income countries struggle with the so-called “dual burden” of obesity and underweight; but although malnutrition persists in many places, overweight is rapidly becoming a more common problem than underweight (Mendez et al. 2005). Being overweight means excessive body weight relative to height and is described as a body mass index (BMI) of 25-29.9 kg/m<sup>2</sup>. In contrast, obesity is defined as excessive accumulation of body fat associated with increased cell mass and number, and described as a BMI of 30 kg/m<sup>2</sup> or more (Flegal et al. 1998).

According to Voster et al. (1999), the prevalence of overweight and obesity has increased in Sub-Saharan Africa because many countries are moving away from societies characterized by subsistence agriculture to increased urbanization (and its accompanying stressors mentioned before) and industrialization. As mentioned before, this transition is typically accompanied by changes in food supply, type and level of physical activity and access to health care. In a related manner, Caballero (2005) reported that 1 in 6 people worldwide is already obese or overweight, and it is not uncommon, even in SSA, to find overweight adults in the same household with underweight children. Psychological stress, which is a risk factor for obesity in Western countries (Bennett et al., 2008), may also contribute to obesity (as it is reasoned in this paper) to low- and middle-income countries. It is also suggested (Bennett et al. 2008) that when people move or migrate to new urban areas, they could face more stress, since they have left behind traditional village support in addition to possibly earning lower wages and/or struggling to find work.

## **Insulin Resistance**

Insulin resistance is the term used to describe an impaired biological response to insulin (Hunter & Garvey, 2008). In the early stages of insulin resistance, hyperinsulinaemia occurs, and compensates for resistance to certain biological actions of insulin. According to Chukwunonso et al. (2008), insulin release, when sustained as a

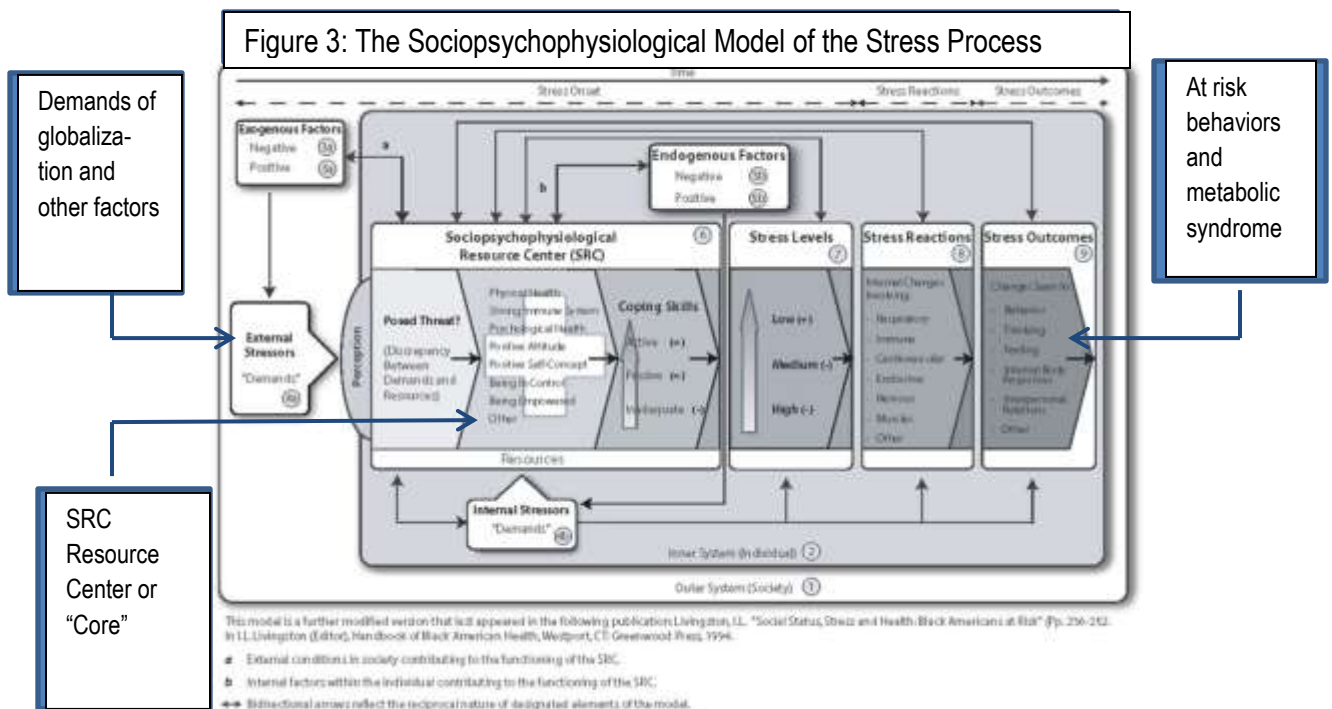




result of insulin resistance, results in hyperinsulinaemia and the attendant metabolic abnormalities. It is reasoned in this paper that these expressions will become more likely and frequent in SSA when the stresses of globalization and urbanization are experienced.

### Globalization and Stress

As indicated by the title of this paper, as well as how the parameters are labeled in Figure 2, stress is posited to play a very important role in an intervening capacity in contributing to the people in SSA countries potentially experiencing, over time, Metabolic Syndrome (MetS). However, whether stress is viewed as a stand-alone antecedent or intervening variable, any discussion involving this phenomenon can be both complex, dynamic and voluminous. This being the case, and because space does not allow for such an explanation at this time, only some cursory comments will be made with references made about the stress model presented in Figure 3 to other publications that provided more thorough explanations.



For purposes of this paper, stress is defined in an interactive manner, i.e., stress occurs as a result of the discrepancy between demands or stressors (e.g., resulting



from globalization, westernization, urbanization and cultural changes...) and the resource capabilities of the individuals living in the countries of SSA. As can be seen in Figure 3, the stress process takes place over sequential pathways from onset, through reactions and, over time, ending with outcomes (e.g., diseases, MetS). As illustrated in the SPPM, demands arising from globalization, urbanization, poverty, etc. are perceived and interpreted through individuals' Sociopsychophysiological Resource Center, or SRC, before any meaningful stress is experienced. Therefore, as seen in Figure 3, the SRC is the "core center" in the SPPM. Essentially, this is where "resiliency" and "coping skills" are cultivated and maintained in face of the multitude of personal and societal (e.g., urbanization) demands experienced. *Please see Livingston, 2012 for a greater explanation of the SPPM.*

One of the major contributing factors to the psychosocial stressors of people living in SSA is urbanization (see Figure 2). Exploding growth of cities often lead to mega slums, which lead to the deterioration in health (e.g., cardiovascular disease) and well-being of people due to poor quality of urban housing, sanitation issues, and limited access to efficient health care systems, as well as mobility/transportation stress (Olufemi & Oluseyi, 2007). Studies in South Africa, as well as in West Africa found that hypertension prevalence increased across the gradient from rural farmer to urban poor to railway workers: 14, 25, and 29 percent, respectively. Various studies in South Africa reported that participants who spent a longer period of their lives in urban areas were more likely to be hypertensive (Steyn, Norman & Laubscher, 2008) and, women in particular, were more likely to smoke (Malan, Wissing & Seedat, 2008).

### **Metabolic Syndrome**

Metabolic abnormalities, such as: glucose intolerance, insulin resistance, abdominal adiposity, high blood pressure (BP), low HDL cholesterol and raised triglycerides tend to cluster as risk factors. When there is a clustering of three or more of these risk factors individuals are thought of as having Metabolic Syndrome (MetS) or Syndrome X (Grundy et al., 2004). As seen from Figure 4, MetS, in turn, through further insulin resistance, can lead to type 2 diabetes. Additionally, Type 2 diabetes through, vascular effects, can, in time, lead to cardiovascular disease (Grundy et al., 2004;



Young et al. 2009). By way of emphasis, metabolic syndrome increases the risk of cardiovascular disease (CVD) by 2-fold and the risk of developing type 2 diabetes mellitus by 3-fold. It has been said that the underlying pathophysiology is thought to be related to abdominal obesity and insulin resistance (Motala et al., 2009). While there is no universally accepted definition for MetS, the three most often used are those set out by the World Health

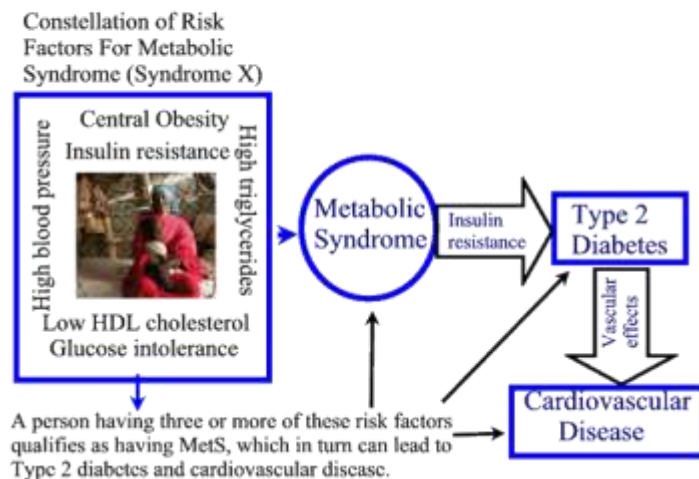
Organization (WHO), International Diabetes Federation (IDF) and National Cholesterol Education Program Adult Treatment Panel 3 (NCEPATPIII) (Albert, Zimet & Shaw, 2006, Young et al., 2009).

As mentioned before, all of the SSA countries are

experiencing the problems of poverty, increasing urbanization, Westernization of lifestyle, and in some cases the disruption of the social fabric (see Figure 2). As a result of these changes, SSA is experiencing multiple burdens of disease, both communicable and non-communicable (Motala et al. 2009). It is reasoned in this paper that these shifting non-communicable disease burdens, e.g., lack of physical activity, elevated blood pressure are the precursor risk factors that will contribute to eventual rises in MetS and, subsequently, the disease outcomes, e.g., CVD, diabetes that result from MetS.

Modern society imposes demands on many (e.g., in SSA) that lead to difficulties in coping with their situations and more chronic “stress.” In this paper, it is reasoned that these “difficulties” contribute to both the constellation of risk factors that comprise and are a result of the MetS. Once activated, stress engages the central nervous system and activates behavioral and physiological response patterns (see Figure 2 of the SPPM under stress reactions, where the stress process is internal), such as the “defense” and “defeat” reactions, which have been beneficial for the survival of the

Figure 4: Constellation of Risk Factors For Metabolic Syndrome and Disease Outcomes





individual and the species, but may become maladaptive when stress is chronic (McEwen, 1998, Folkow, 1997). The concepts of “allostasis,” i.e. adaptation to physiological states and the environment, and “allostatic load,” which is essentially the cumulative impact of chronic stress, are helpful in understanding how responses to stress may become maladaptive and damaging (McEwen, 1998).

As an internal process, which is illustrated in the SPPM seen in Figure 3, when initiated (through the SRC), stress activates the sympathoadrenal system and the hypothalamic-pituitary-adrenocortical (HPA) axis. Defense reactions involve catecholamine release, vagal withdrawal, cortisol secretion, and activation of the renin-angiotensin system; the less well characterized defeat reaction is a stimulus for cortisol production (Folkow, 1997; Henry & Grim, 1990). These mediators sub-serve functions that help the individual during short-term stress. When stress is frequent, adaptation (coping) is lacking, the ability to shut off the stress response is deficient, or the responses to stress are inadequate and compensatory mechanisms are activated, the allostatic load may become overwhelming and the adaptive processes become maladaptive (McEwen, 1998).

According to Motala et al. (2009), global estimates have confirmed an epidemic of chronic lifestyle disorders, such as diabetes. The largest proportion of these increases are expected to occur in the developing countries of the world including those found in SSA. Recent estimates from the International Diabetes Federation (IDF) project that for Africa, which makes up 22 percent of the world’s total land area, in adults aged 20-79 years, the regional prevalence of diabetes is expected to increase from 3.1 percent in 2007 to 3.5 percent in the year 2025. This would bring a corresponding 80 percent increase in numbers, from 10.4 million to 18.7 million (IDF, 2006).

Although the prevalence of CVD risk factors and some of the individual components of the MetS have been reported in SSA, such as type-2 diabetes, obesity and hypertension, it should be said, however, that the available literature on MetS in SSA is fairly limited. The chief reports of MetS in SSA refer to mainly single epidemiological studies from the Cameroon (Motala et al. 2009). A study conducted recently examined the independent associations between objectively measured free-living physical activity energy expenditure (PAEE) and the metabolic syndrome in adults



in rural and urban Cameroon. The results of the study showed that urban dwellers had a significantly lower PAEE than rural dwellers ( $44.2 \pm 21.0$  vs.  $59.6 \pm 23.7$  kJ/kg/day,  $P < 0.001$ ) and a higher prevalence of the MetS (17.7 vs. 3.5%,  $P < 0.001$ ) (Assah *et al.*, 2011).

### **Conclusion: Future Activities to Better Address the Impact of Globalization on Metabolic Syndrome (MetS)**

Although ultimately controlling MetS via the dynamic and complex macro experiences of globalization operating through the selected parameters mentioned in the paper (e.g., urbanization, stress and MetS risk factors) is seemingly impossible task, a list of suggested strategies are offered that should be followed. These strategies include the use of health education and related techniques that involve all relevant sectors of SSA societies, which, at the end, will impact and change prevailing public policy and serve to improve the quality and quantity of residents' lives in SSA.

- i) Acknowledge at all levels, especially at the governmental and policy levels, that globalization has a complex influence on health in general with a particular focus on the risk factors associated with the MetS (e.g., stress, physical inactivity, hypertension...) and its resulting diseases (e.g., CVD, diabetes). See earlier conceptual model in Figure 2.
- ii) In the case of stress, use a conceptual model (see earlier SPPM in Figure 3) to address and guide appropriate health education and other appropriate intervention strategies. After better understanding the nature of the “allostatic load,” which implies the cumulative and toxic nature of stress that has the potential to disrupt the functioning of the cardiovascular, immune, nervous and metabolic systems, targeted intervention strategies must be used at both the macro and micro levels, especially in those more urbanized and Westernized countries in SSA.
- iii) More attention must be placed on chronic hypersecretion of stress mediators, such as cortisol, in individuals with a genetic predisposition exposed to a permissive environment, may lead to visceral fat accumulation as a result of chronic hypercortisolism. Once again, in this regard, the SPPM, presented



- before, can be used as a guide for any health education and/or intervention that is planned in urban communities in SSA.
- iv) Because of the increasing burden of obesity, the metabolic syndrome, T2DM, and CVD in the developing countries of SSA, there should be a more urgent need of all “major players” to strategize health policies and mass intervention programs to tackle the influx of poor (inappropriate, Western fast-food) nutrition, as well and continue efforts to manage undernutrition.
  - v) In view of the context of SSA countries, a review must be made to address the following: a) curtail the “preventable or modifiable factors” implicated in the epidemiology of obesity and the metabolic syndrome; and b) modify and/or change lifestyle and nutritional transitions experiences, especially for urban dwellers in SSA.
  - vi) The foregoing peculiarities and challenges notwithstanding, there is a clear need to recognize that “holistic management” of multiple metabolic abnormalities in people with hypertension, diabetes, obesity, or dyslipidemia, requires insight into the tendencies of these abnormalities to cluster (hence the reason why MetS is viewed as a clustering of these abnormal risk factors),
  - vii) Concurrently, massive screening for elevated blood pressure, elevated blood glucose, obesity, and plasma lipid abnormalities (all of which are contributing risk factors for MetS) should be encouraged.
  - viii) Again, at the macro or population level, healthy lifestyle measures should be vigorously promoted. These should include culture-specific and region (i.e., SSA) specific stress management activities using the SPPM as a guide.

If these screenings are done routinely, and appropriate interventions instituted in a timely manner, utilizing the models (as guides) presented in this paper, it is reasoned that they will assist in controlling the risk factors associated with MetS. In a like manner, these efforts will also help in controlling the incidence of the primary MetS-related diseases of type 2 diabetes and CVD (especially stroke) that are increasingly affecting the people and economies of the developing countries in Sub-Saharan Africa.



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